



International symposium on Combating Climate in C40 Megacities

Kolkata • Guwahati • Patna



Recommendation Report



Symposium Programme

“International Symposium on Combating Climate Change in C40 Mega Cities”

Date : April 22, 2015

Venue : Hotel Kenilworth, 1 & 2, Little Russel Street, Kolkata, West Bengal
American Corner at Guwahati, Assam
American Corner at Patna, Bihar

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South Asian Forum for Environment

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Foreword...



Helen La Fave
US Consul General
US Consulate, Kolkata

The vulnerabilities due to climate change are affecting everybody in the world. According to the Secretary of State USA, John Kerry, climate change is a crisis that waits for no one and it respects no borders. No one nation acting alone can lead this challenge. That is the reason why USA is committed to working with other countries as a climate partner towards a global solution to this urgent problem. The science for climate change is beyond doubt, it is loud, it is clear, it is warning us, and it is compelling us to act. If we continue down the same path as we are doing, the world as we know it will change, likely for the worse. All actions against fighting climate change need to be partnered together. There is much to do in the climate change scenario. There are many changes that need to be made, some of them ambitious. Climate change cannot be mitigated miraculously by one country. There has to be partnerships between cumulative nations to mitigate climate change. It affects health, agriculture, marine life, water resources, and displacement of people around the world. Climate change disrupts normal life and the issue transcends several different areas.

The three part Climate Action Plan by President Obama aims to cut urban carbon pollution by affecting stringent long term standards for carbon emission and increasing building appliances energy efficiency as well as standards to cut carbon pollution from power plants. These standards can make a difference piece by piece in every household around the world. In this regard an example would be the barely visible skyline of New York from New Jersey in the 1960s and 1970s. However recently one can observe the clear skyline once again; this has been made possible by the stringent regulations regarding emissions that are being implemented. The global change initiative has been elevated to a presidential initiative and the USA is providing US foreign assistance as an incentive to people working on climate change issue. The Asian Development Bank in 2014 talked about risk to Indian economy due to climate change at the rate of 1.8% of the total GDP by the year 2050. It is a significant issue that cannot be ignored.

The big cities like Kolkata, Guwahati and Patna are going through rapid urbanization and there will be a resource crunch in the future that needs to be addressed. The 3 cities are connected with cities worldwide having shared interest. The cities of the world can learn from the cumulative experience in mitigating the adversities or the solutions undertaken by these three cities in the fight against climate change.

This conference is a part of the U.S. government's commitment in addressing the challenges of climate change. To have this conference when the world commemorates Earth Day today is all the more significant. I am also delighted that we have been able to connect via video conference with Guwahati and Patna to open up the very important agenda of combating climate change and addressing this urgent and complex global challenge. Knowledge and preparation are the keys to survival. The US government is committed to address the challenges of climate change in India.

Foreword...

Dr. Govind Hariharan
Professor of Economics
Kennesaw State University
University System of Georgia
Georgia, USA.



Cities worldwide have evolved rapidly to become the principal hub of economic activity and population congregation. Today over half the population of the world lives in cities and contribute to 80% of the world GDP. In India likewise the urban population of around 300 million contributes to two third of India's economic output. With the growth in their importance, when a city sneezes wouldn't the whole country be expected to cough? Chinese cities such as Beijing have been among the most polluted cities in the world over the last two decades with tremendous economic impact. A study conducted by the Massachusetts Institute of Technology estimated the economic cost of pollution in China from lost labor productivity and health care costs in 2005 at \$112 billion. Delhi was recently ranked as the top city in the world for air pollution by the World Health Organization followed by the much smaller Indian cities of Patna and Gwalior. The economic cost primarily from sea water encroachment of a Category 3 Hurricane Katrina in the US has been estimated to be over \$150 billion with thousands of deaths and even the more muted post-tropical cyclone which affected the major metropolis of New York City has been estimated to have cost in excess of \$70 billion with over 200 resultant deaths. Kolkata is now ranked seventh and Mumbai eighth in Maplecroft's ranking of cities with the highest risk levels from extreme weather, rising sea levels and other possible effects of climate change. One dreads to think of the likely human and economic toll if a storm such as Katrina were to arrive in Dhaka, Mumbai or Kolkata.

These are issues in which these three distinct cities of Kolkata, Patna and Guwahati with different population mass, different altitudes and risks and at different stages toward becoming a mega city can create the template that cities like them can emulate and adapt. South Asian Forum for Environment (SAFE) has been a leader in developing innovative and practical solutions to address many of these issues. It is with this as the backdrop that a high level international summit was organized by Kennesaw State University, USA, South Asian Forum for Environment and the National Council for Climate Change and Sustainable Development (NCCSD) under the auspices of the US Consulate in Kolkata. The conference was concurrently held in the cities of Guwahati, Kolkata and Patna on Earth Day, April 22nd, to create best practices and a path forward. Perhaps at a time in the near future, when it rains people will imagine the fresh blossoms that will follow and not the dreaded walk through puddles and potholes. We will have organizations like SAFE to thank for when that happens.



Foreword...



Dr. Kirit N Shelat

IAS (RTD)

Executive Chairman

National Council for Climate Change and sustainable Development
and Public Leadership (NCCSD)

The policy framework requires a base to establish a foundation for developing countries with cities under pressure and economies in transition. We are pleased to inform you that National Council for Climate Change and Sustainable Development (NCCSD), the South Asian Forum for Environment (SAFE) and Kennesaw State University, in collaboration with the U.S. Consulate, Kolkata, delivered a high level "International Symposium on Combating Climate Change in C40 Mega Cities" in Kolkata, Guwahati and Patna, on April 22, 2015. The deliberations in three cities were video streamed with localized moderated panels and discussions.

We congratulate the success of this partnership and we gratefully thank the panelists and participants for your active participation and contribution.

The session's explored policy initiatives needed to facilitate the sustainable development plans along with the challenges. At the symposium, we experienced an explosion of ideas and innovations as the masterminds gathered to brainstorm, discuss new and innovative ways as means of achieving climate smart cities. The ways for sustainable solutions is essential for the development of sustainable economies as it strengthens productive capacities.

Furthermore, in the context of climate change and emission reduction concerns, it is imperative that we specifically set the agenda and strengthen the partnership towards C40 network. The symposium successfully focused on key issues stressed on concrete strategies in combating climate change, particularly in view of continuing population growth in cities.

The Symposium brought together urban stakeholders from India, the United States, Bangladesh and Sri Lanka to address issues of climate change and formulate plans to mitigate environmental concerns in an urban setting with special focus on the role of C40 cities.

The recommendation summary is the outcome of the symposium and creates reference frame for the strategies and policies towards sustainability goal.

Foreword...

Dr. Dipayan Dey
Chair

South Asian Forum for Environment (SAFE)



The impacts of climate change are expected to create numerous challenges for cities. This conference on combating climate change in C40 Megacities synthesizes key points raised in a series of discussions among "adaptation leaders" from three cities of India viz. Kolkata, Patna and Guwahati, facing the utmost pressure of urbanization. Critical issues for urban adaptation that emerged from the discussions include the need for political commitment at multiple levels of government, information and data as a basis for understanding potential risks and vulnerabilities, meaningful and effective stakeholder engagement shaped by local contexts, and sustained financial and staff resources that are sensitive to urban variability. Although there is growing recognition that cities need to make concerted efforts to prepare for climate impacts, many city officials are finding that advancing an adaptation agenda is challenging. They may encounter skepticism or find that adaptation is not viewed as a priority issue. Further, those that are taking action find that they have no tested models to follow. As a result, there continues to be a need for information, resources and institutional support that will enable cities to develop robust adaptation programs. The recommendations of this forum are therefore relevant to city leaders who wish to understand the scope for acting to address climate change, local and national policy-makers who intend to support or facilitate this process, and international organizations that work with cities on issues of adaptation and resilience. A critical issue that emerged from the discussions is that adaptation in cities requires commitment from political leadership at multiple levels of government. International and national policies foster regional and local action, including providing avenues for finance and ensuring that plans are developed and implemented. Absent national mandates, committed and visionary municipal leaders have also provided the impetus for action and a foundation for promoting engagement and coordination across city departments. However, participants noted that national political and financial support is critical for the long-term stability and success of programs, and the widespread adoption of adaptation initiatives. To date, this support continues to be lacking in many cities represented at the meeting. The participant cities emphasized that understanding risks and vulnerabilities is integral to adaptation planning. While traditional approaches to planning focus on historical trends, adaptation must draw on climate projections to anticipate future conditions, impacts, and vulnerabilities. Some cities are producing dedicated risk assessments while others are drawing on regional data to understand general trends in high priority sectors. No matter what approach they are taking, various actors from these cities understand that they need information as a basis for understanding potential risks and vulnerabilities. Further, the deliberations do highlight how policy-makers, corporate and organizations working with these cities on issues of adaptation and resilience must support and facilitate processes of testing ideas to get empirical evidences, adaptive management, and recalibrating as new information is obtained and lessons are learned.

Expert speakers on topics



Kolkata

Inauguration session

1. **Welcome remarks** – Dr. Dipayan Dey, *Chair, South Asian Forum for Environment (SAFE)*.
2. **Address of the Chief Guest** – US Consul General Helen La Fave, *US Consulate, Kolkata*.
3. **Address of the Guest of Honour** – Justice B P Singh, *Formerly Judge, Supreme Court of India*.
4. Inaugural Lecture on **Framing the Economics of Climate Change and Mega Cities** – Dr. Govind Hariharan, *Professor of Economics, Kennesaw State University, University System of Georgia, Georgia, USA*.
5. Speech by **Air pollution and its Health and Climate Benefits** – Samuel Kotis, *Deputy Minister Counsellor (Energy, Environment, and Climate Science), US Embassy in New Delhi*.

Technical session I & II

6. **Urban challenges in the present climate context** – Prof. Joyashree Roy, *IPCC Author and Economist, Coordinator-Global Change Programme-JU, Jadavpur University, Kolkata*.
7. **The C40 Experiences of Dhaka : Life and Livelihood in the Climate Perspective** – Dr. Kawser Ahmed, *Prof. & Chairman, Ecology, Environment & Climate Change. University of Dhaka* & Prof. Towhida Rashid, *Dept. of Geography, University of Dhaka, Dhaka, Bangladesh*.
8. **Energy Smart Cities : The Kolkata Context** – Dr. S P Gonchoudhuri, *Ex-Director of West Bengal Renewable Energy Development Authority and winner of Ashden Award for his expertise in Solar Power*.
9. **Ecosystem Services in Urban Wetlands towards Climate Resilience : A case Study of Kolkata Metropolis** – Dr. Priyanie Amersinghe, *IWMI, Colombo, Sri Lanka*.
10. **Kolkata Meteorology : Past and Present; A Climate Change Perspective** – Dr. G C Debnath, *Sr. Scientist, Indian Meteorological Department, Kolkata*.
11. **Innovations for Change : A Step towards Climate Resilient Kolkata** – Mr. Rupayan Dutta, *Programme Manager, UK, Kolkata Municipal Collaboration on Low Carbon & Climate Resilience, British Deputy High Commission, India*.
12. **Municipal Solid Waste Management, Local Situations and Perspective** – Mr. Debashish Jana, *Chairman in Council, Bidhannagar Municipality, (Urban Local body)*.
13. **Sustainable Transportation in Rapidly Urbanizing Kolkata** – Dr. Joy Dasgupta, *Behavioral Anthropologist & Planner, Consultant UNDP-GEF Programme*.
14. **Way forward for developing Smart Cities: Recommendations and Regulations** – Dr. R. Gopichandran, *Director, Vigyan Prasar, Dept. of Science & Technology, Govt. of India, New Delhi*.

Moderator

- Dr. Govind Hariharan, *Professor of Economics, Kennesaw State University, University System of Georgia, Georgia, USA*.
- Dr. Dipayan Dey, *Chair, South Asian Forum for Environment (SAFE)*.



Guwahati

Technical session I & II

15. **Opening remarks** – Greg Pardo, *Deputy Director, American Center, Kolkata.*
16. **Role of Public Leadership both Elected and Non-elected : Climate Smart City Management** – Dr. V V Sadamate, *Former Advisor, Planning Commission of India.*
17. **Local Situations and Perspective** – Mr. Rajbanshi, *Addl. Commissioner, Guwahati Municipal Corporation, Guwahati.*
18. **Management of agro-biodiversity and urban agriculture** – Dr. Anup Das, *Sr. Scientist, Indian Institute of Agricultural Research, ICAR, Assam.*
19. **Solid Waste & Waste Water Management** – Mr. Hazarika, *Excel Industries Ltd. Guwahati, Assam*
20. **Rain Roof Water Harvesting in Cities & Agro food Waste utilization for Urban Plantation** – Dr. A A Ahmed, *Principal Scientist, Assam Agricultural University, Assam.*
21. **Role of Citizen's in Climate Smart Cities : Gender Inclusive Perspective** – Dr. Kinkini Dasgupta, *Scientist, Vigyan Prasar, Department of Science & Technology, Govt. of India, New Delhi.*
22. **Way forward developing smart cities** – Mr. S V Nagachan, *Head, Barapani Research Center, Shillong, Meghalaya.*
23. **Perspective of Climate Smart City : C40 by local Expert** – Dr. Arup Misra, *Associate Professor, Chemical Engineering Department, Assam Engineering College, Director, Department of Science & Technology Council, Assam.*
24. **Energy Efficiency & Consumer Behavior patterns** – Mr. N. M. Patel, *Environmental, NCCSD*

Moderator

- Dr. V V Sadamate, *Former Advisor, Planning Commission of India.*
- Amrita Chatterjee, *Director, Communication & Research, SAFE.*

Patna

Technical session I & II

25. **Role of Citizen's in Climate Smart Cities : Gender Inclusive Perspective** – Prof. K V Raju, *Director, Development Management Institute, Patna, Bihar.*
26. **Role of Public Leadership both Elected and Non-elected : Climate Smart City Management** – Dr. Kirit N Shelat, *Rtd. IAS, Executive Chairman, NCCSD.*
27. **The Climate Vulnerability of Patna City and its Disaster Preparedness** – Dr. M Sen, *Director, Indian Meteorological Department, Bihar*
28. **Energy Efficiency** – Mr. Anshu Kumar, *Environment Consultant, Chandigarh*
29. **Recycling of Water and Agro : Food Waste for Urban Agro Forestry** – Dr. R K Mittal, *Vice Chancellor, Rajendra Agriculture University, Bihar.*
30. **Solid Waste Management & Waste Water management** – Dr. Mandar Prabhune, *Transpek Industries Ltd. Patna, Bihar*
31. **Local Situations and Perspective** – Mr. Kapil Ashok, *Commissioner, Patna Municipal Corporation, Patna.*
32. **Disaster Management** – Mr. Jai Singh, *IAS, Joint Secretary cum Director, UD & HD, Bihar*
33. **Climate Smart City Initiative** – Mr. Amrit Lal Meena, *Principal Secretary, Urban Development Department, Government of Behar.*
34. **Way Forward for developing Smart Cities** – Shri Anup Mukherji, *Rtd. IAS, Chairman, Development Management Institute*

Moderator

- Dr. Kirit N Shelat, *Executive Chairman, NCCSD*
- Prof. K V Raju, *Director, Development Management Institute, Patna, Bihar*



International symposium on Combating Climate in C40 Megacities



The C40 cities initiative which started in 2005 has the pertinent motto 'Cities have the power to change the world'. The world we are living in now has a predominantly urban population. The galloping momentum of urbanization brings with it environmental and social stress which can exacerbate the climate change scenario. The C40 advances climate action agendas of the world's megacities in order to achieve meaningful reductions of greenhouse gas emissions and climate risks. On this premise the "International symposium on Combating Climate in C40 Megacities", was conducted in Kolkata, Guwahati and Patna with array of experts panelists to brainstorm on ideas and recommendations, questions and answers, problems and solutions taking action to address climate change by developing and implementing policies and programs that generate measurable reductions in both greenhouse gas emissions and climate risks. The work of the growing city is critical for reducing greenhouse gas emissions worldwide. The symposium has been funded by the US Consulate, Kolkata with collaborative partner Kennesaw State University, USA, organized by South Asian forum for Environment, SAFE and National Council for Climate Change and Sustainable Development, NCCSD.

The symposium conducted simultaneously in 3 cities, Kolkata, Patna and Guwahati, was electronically connected, and each city showcased actions that can effectively address local environmental issues. The publication is the compilation of the recommendations as an upshot result of the event, which also helps facilitate the policy as a reference document.

Core Elements of C40

1. Framing the economics of climate change in Mega cities
2. Observed impacts of climate change on urban health
3. Risk based planning, disaster preparedness in urban context
4. Energy efficiency, recognition and role of renewable energy
5. Urban wetland conservation and urban biodiversity
6. Sustainable water solutions and potentials of harvesting

Expected outcomes

- Provide access to stakeholders and develop a status report and recommendations on addressing climate change in Kolkata, Patna, Guwahati, and present it to key policy makers.
- Initiate an Urban Public Leadership group identified during the conference for developing regulatory frameworks.



- Highlighting best practice models, and initiatives to document for solution reference
- Foster collaboration and partnership from India and the US to address issues of climate change and formulate plans for Urban Public Leadership.

Key words: Energy, Water, Transport, Health, Infrastructure, Waste, Future, Economy, Environment

What Makes a Climate-Smart City and How Can We Build Them?

Highlights :

The urban challenges in the present climate change context emphasized that the largest opportunities for future urban GHG emissions reduction might be in rapidly urbanizing countries where urban form and infrastructure are not fully utilized, however there are limitations in governance, technical, financial, and institutional capacities. The major challenges are in the form of holistic sustainable development in environmental, social and economic scenarios. Another issue is that green growth is a 'niche' compared to (GDP) or social goal (HDI) growth agenda. The Low Carbon Growth (LCG) concept has little or no space in city urban planning. The major areas of concern in a city are air and water pollution and health problems along with social problems like crime against women and children. The vulnerable sections of the society are most susceptible to water borne diseases. In the context of climate change, residual impacts under high adaptation with rise of 2oC temperature, increases the risk of heat related mortality in Asia. As adaptations heat health warning system, sustainable urban planning and new work practices to avoid heat stress among outdoor workers would mitigate climate impacts tremendously in the long run. In a megacity like Kolkata where invested capital need is a priority area for sustainable development, scope for enhanced investment through LCG can be expected to provide a positive incentive for acceptance and support by the city development planners. There is a need to champion the climate change agenda and change general behavior towards climate change adaptations. This can be done by striking a balance between social and market norms.

The importance of non renewable energy in the sphere of megacities, especially solar, was stressed. India's power forecast and plans for 2030 would leave a gap of around 1,50,000mw after investments in thermal, hydel and nuclear energy. This would have to be met from renewable energy sources like solar, wind and biomass. 2% of the total power purchased by the power utilities has to be from renewable energy (RE) sources. Without India's energy freedom and security, the country's growth cannot be achieved and generation of more and more energy from the non-conventional sources will help to curb carbon emission and restrict rising pollution.

The importance of urban/peri-urban wetland ecosystem services and climate resilience was highlighted as a case study of Kolkata which has a number of wetlands with unique ecosystem services. It was emphasized that 28 types of ecosystem services are associated with wetlands under TEEB. They are categorized under provisioning, regulating, supporting and cultural. The wetlands provide food, raw material, as well as water for domestic and drinking purposes. They regulate the local climate, carbon sequestration and act as buffer for extreme events. They maintain genetic diversity and are habitats for different kind of animals and plant. Additionally they also have recreational and aesthetic value. The wetland system meets the needs of poor people and alleviates poverty. People use, modify, and care for nature which provides material and immaterial benefits to their livelihoods. However there are many kinds of anthropogenic activities that have altered ecosystem services e.g. city development and people. The cross-scale and cross-level interactions of ecosystem services in landscapes can be managed to positively impact development outcomes. There is a need for city planning at a regional scale (smart cities concept that covers peri-urban areas and economic implications and provisioning; by-laws and policies; watershed and basin scale – hydrological cycles). There is a need to share the information collected with multiple stakeholders that can bring about change e.g. city authorities, development cells, NGOs. Finally, there has to be a comprehensive integration of ecosystem services in local and regional policy making.



C40 Megacity Conference

Consolidated Report and Recommendations

KOLKATA, West Bengal



Kolkata is a wondrous city with its colossal heritage steeped both in history and modernity. It is a quintessential example of conurbation comprising a number of large towns, and other urban areas that, through population growth and physical expansion, have merged to form one continuous urban and industrially developed area. It is the principal commercial, cultural, and educational centre of East India, while the Port of Kolkata is India's oldest operating port as well as its sole major riverine port. The city went through



two phases of pre independence and post independence development. Being the capital under the East India Company and later under the British Raj, Kolkata served as the capital of British held territories in India until 1911. The colonial planners built the city on the east bank of the Hooghly River. Later during the 1960s through the 1970s due to population explosion and immigrant influx the city started expanding on all sides. The Kolkata metropolitan area was spread over 1,886.67 sq km as of 2011. With a metropolitan population of over 14.38 million, Kolkata is one of the densely populated cities in India.

Much of the city was originally a wetland that was reclaimed over the decades to accommodate a burgeoning population. The remaining undeveloped areas, known as the East Kolkata Wetlands, were designated a "wetland of international importance" by the Ramsar Convention (1975). As with most of the Indo-Gangetic Plain, the soil and water are predominantly alluvial in origin. According to the Bureau of Indian Standards, on a scale ranging from I to V in order of increasing susceptibility to earthquakes, the city lies inside seismic zone III; according to a United Nations Development Programme report, its wind and cyclone zone is "very high damage risk".

According to a 2013 survey conducted by International Association of Public Transport, Kolkata ranks the top among the six cities surveyed in India, in terms of public transport system. The Kolkata Metro, in operation since 1984, is the oldest underground mass transit system in India. Kolkata has four long-distance railway stations, located at Howrah (the largest railway complex in India), Sealdah, Chitpur and Shalimar, which connect Kolkata by rail to most cities in West Bengal and to other major cities in India. The city serves as the headquarters of three railway Zone out of Seventeen of the Indian Railways regional divisions—the Kolkata

Metro Railways, Eastern Railway and the South-Eastern Railway. Kolkata has rail and road connectivity with Dhaka, capital of Bangladesh.

As of 2011, the city had 4.5 million residents; the urban agglomeration, which comprises the city and its suburbs, was home to approximately 14.1 million, making it the third-most populous metropolitan area in India. It has a population density of 24760/ sq.km. The city is one of the most ethnically diverse cities in the country. Bengali people comprise the majority of Kolkata's population; Rajasthanis and Biharis compose large minorities. Among Kolkata's smaller communities are Chinese, Tamils, Nepalis, Oriyas, Telugus, Assamese, Gujaratis, Anglo-Indians, Armenians, Greeks, Tibetans, Maharashtrians, Konkanis, Malayalees, Punjabis, and Parsis.



The slums of Kolkata can be divided into three groups: the older ones, up to 150 years' old, in the heart of the city, are associated with early urbanization. The second group dates from the 1940s and 1950s and emerged as an outcome of industrialization-based rural–urban migration, locating themselves around industrial sites and near infra-structural arteries. The third group came into being after the independence of India and took vacant urban lands and areas along roads, canals and on

marginal lands. In 2001, 1.5 million people, or one third of Kolkata's population, lived in 2011 registered and 3500 unregistered slums. As of 2003, the majority of households in slums were engaged in occupations belonging to the informal sector; 36.5% were involved in servicing the urban middle class (as maids, drivers, etc.), and 22.2% were casual labourers. About 34% of the available labour force in Kolkata slums was unemployed. As a growing metropolitan city in a developing country, Kolkata faces substantial urban pollution, traffic congestion, poverty, overpopulation, and other logistic and socioeconomic problems.

As a growing metropolitan city in a developing country, Kolkata faces substantial urban pollution, traffic congestion, poverty, overpopulation, and other logistic and socioeconomic problems.



Recommendations

1. The city of Kolkata having its roots in the medieval era has a complex urban ecology while its location and developmental needs makes it very vulnerable to climate change issues. Having said that the panel of authors opined on the climate resilient actions and development goals from lessons learnt in New Jersey and New York.
2. In suggesting the climate resilient model few concerns that were prioritized includes water resource, solid waste, drainage and disposal, rapid transport and traffic congestion along with loss of urban biodiversity and habitat. The concerns mainly focused on the emission footprints of urban Kolkata, pollution and health security, loss of natural habitat etc and recommended an increase of ecological handprints through effective partnership of public and private organizations in consortium.
3. Allied issues of urban poor, increasing energy demands, vanishing wetlands and waterbodies, urban encroachment on water resources and lack of institutional remedies were highlighted. The forum recommended integrated efforts on small scale interventions in cities waste management, use of harvested water and renewable energy in maintaining basic civic facilities, resource budgeting and utilization.
4. The forum strongly recommended integrated planning on urban landscape, equitable distribution of traffic load and communication network. Partnership endeavours in energy management and entrepreneurial efforts for poverty alleviation in the peri-urban fringes of Kolkata, received an emphasis to recommend anthropogenic pressure on the cities socio-ecological metabolism.
5. Community governance of natural resources and climate smart policy implications in developing municipal guidelines to mitigate climate impacts where debated in the forum. In the milieu of COP 21, where negotiations on climate financing are due, a policy preparedness for achieving co benefits of favorable negotiations in planning the city of Kolkata as climate smart city was highly recommended.



6. The platform encouraged discussions on cross-sectoral overlapping issues, mutually conflicting and benefitting areas, policy gaps and implementation bottlenecks were discussed.
7. Few recommendations in specific included, adaptive research for reality check and demonstrated feasibility options, innovations and up-scaling of successful interventions and apportionment. It also included enhancement of market opportunities. Community engagement and communications at science-society interface.



8. The forum advised for a bottom up approach with immediate, medium and long-term goals for a time-bound delivery of climate smart adaptive action plan.
9. The forum identified some glaring challenges in the process of ensuing climate adaptive development, those are the feasibility gap between awareness and action, synergies between actors and planners, limitations and limits of incremental and program linked activities, sustainability in financing transitions, less than optimal use of resources, etc.
10. The consolidated way forward of recommended by a forum was enthusiastic in providing major needs in 14 city sectors and recognizing the need for integrated approaches in regulations, institutional mechanisms, plans and policies and empirical evidences. The recommendations were safeguarded with 20 action points that essentially includes the spread and depth of information for decision support system, leap frog, peoples perspective for innovations, local relevance of climate change and its immediate impacts and awareness for a long-term action.

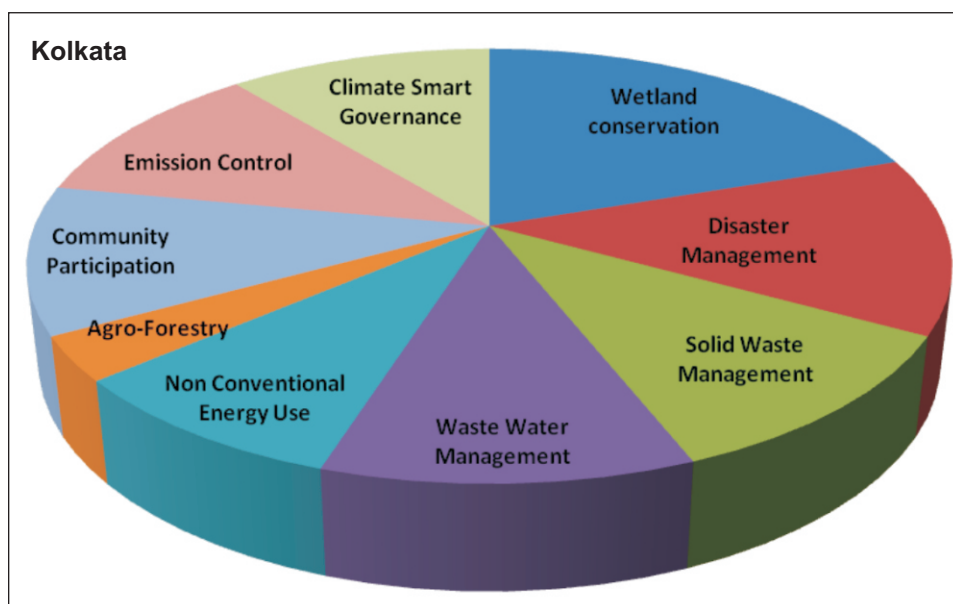


Figure Graphical representation of recommendations on interventions to combat climate change



C40 Megacity Conference

Consolidated Report and Recommendations

GUWAHATI, Assam



Guwahati is the leading commercial and educational nucleus of Assam and Northeast India. The city is the foremost center for cultural activities and sporting events, as well as a center for administrative and political activities of Assam. It is home to premier institutions such as the Indian Institute of Technology Guwahati and Gauhati University where scholars from all over the nation come to study different disciplines. It is an important regional hub for transportation. The National Highway 37 that runs from Panchratna (near Goalpara) across Assam state to Roing in Arunachal Pradesh passes through the city. In



terms of population it is the fastest growing city in North East India, with a population of 8.04 lakh and a growth rate of 38.6 percent according to 2001 census. The population density in Guwahati is 2695.43 persons per sq km. The rapid growth in population has resulted in the state proposing a rapid transit system having 3 corridors in the city.

Guwahati bestrides the valley of the river Bharalu, a small tributary of the river Brahmaputra. It is surrounded by hills, except where the Bharalu discharges into the Brahmaputra. Guwahati's urban morphology spreads out from the core city area towards Narengi in the north east and Dispur in the southern part of the city. Dispur is the seat of Government of Assam. The Assam Secretariat building is located in Dispur along with the Assam Assembly House and the State Emergency Operations Centre. Dispur has become a very important sub centre of the city surrounding which residential and commercial habitats have developed. The most important corridor in Assam is along the Guwahati-Shillong (GS) Road towards the south (almost 15 km from the city-center). The GS Road is an important commercial area with retail, wholesale and offices developed along the main road; it is a densely built residential area in the inner parts.

The city is a major wholesale distribution center, a marketing hub, and also a retail hub of the region. The Guwahati Tea Auction Centre is one of the largest and busiest tea trading centres in the world, where the major commodity under the hammer is Assam tea. The Tea Auction Centre has emerged as the second largest

CTC tea auction market in the world and second largest overall next only to Colombo auction centre in Sri Lanka. Manufacturing is an important activity. The most important manufacturing industry in the city is the petroleum refinery of IOCL at Noonmati, which is known as Guwahati Refinery.



The random urbanization and the phenomenal growth of population over the past few decades – beginning from the shifting of the State capital to

Guwahati from Shillong in the early 1970s – have resulted in continuous and large-scale conversion of land from non-urban use to urban use, leading to rampant encroachment in the hills and shrinkage of forest cover. Artificial flood has always been a major dilemma for Guwahati. The underlying causes of this seasonal problem are careless human activities like disposal of refuse in Bharalu river, including indiscriminate habitation alongside it, unsystematic invasion of the hilly stretches etc., which are outcomes of over-

population in the city. The problems are likely to become even more pronounced as the city continue to grow rapidly causing a strain on municipal infrastructures like water supply, sewage and solid waste disposal causing grave environmental as well as health problem.



The city is the cauldron where all the hopes, aspiration and dreams of North East of the country foregather and diverge into different directions like education, transport, commerce, and politics. Guwahati is precariously positioned such that an increased awareness and adoption of sustainable practices would go a long way in combating climate change whereas

an indifference to sustainable livelihood adoption would degrade quality of life for its ever growing population. An urban agglomeration like Guwahati with its multi ethnic population, unique geography and a voracious appetite for development is ideally suited to be a canvas for climate change adaptation programs such as the C40 megacities initiative.

Recommendations

1. It was decided to obtain the Guwahati Municipal Corporation's concurrence on the resolutions and to move a proposal for developing master trainer in collaboration with Dr. Sarad Saikia, Dr.A. Misra, Arya Vidyapith College, Dr. A.K.Tripathi, Mr. Ngachang & SAFE.
2. Emphasis was placed upon three water diversion in Guwahati for



enhancing water resources for the city. Increase of water harvest potential is important for the city and importance to waste water problem must be given priority.

3. Periurban wetlands need to be conserved through community based interventions. Makhna as alternative agricultural cultivation crop in or around Deepor Beel is recommended addressing marginal farmers' financial security issues, who are often found to be migrating to urban slums as casual laborers being displaced from their trade owing to anthropogenic pressure.
4. There is a need for segregating waste at household level at source and segregating bio-degradable waste. The recycling of municipal waste materials for production of compost, preparation for urban agriculture or entrepreneurship development, rainwater harvesting for utilization in terrace cultivation and domestic utilization, recycling of marginal water produced in household or family level, utilization of dug well already abandoned for ground water recharging and tackling the rainwater in household level needs to be addressed in participatory mode. This will check the inundation problem in city area. The Renovation of Drainage System is to be undertaken under the expert opinion and action plan from Mr. Ranjan Baruah.
5. There should be stress on cutting urban demands and logical revision of daily needs (consumption footprints) attempting to lower the carbon footprints and as well giving a second thought while paying extra amount for non biodegradable carry bags because unplanned disposal of this kind of products are causing tantrums to nature.
6. There should be an association with 30 NGO'S who are already active but playing the hands on role and the focus should be on their capacity building.



The capacity building of hoteliers, cab driver is imperative in promoting eco tourism.

7. The support of Assam Agricultural University is required for promoting green cover in the city. The universities may be approached for developing some workforce to do a pilot survey relating to waste harvesting. Importance needs to be directed at promotion of vertical gardens for ornamental roof top for reducing 'Heat Island Effects' and Green building concept for energy budgeting and resource saving.
8. The present state of greenhouse gas emission in and around Guwahati needs to be assessed along with present carbon sequestration potential of Guwahati. There can be an intensive plantation program including bio-remedial plantation for pollution control.
9. The use of high end instruments for service providing and monitoring, creating linkages among data sets and adopting new kinds of computing models for city services should be initiated.
10. A Perspective development plan for Guwahati was also proposed in the forum that needs to be masterminded by Guwahati Metropolitan Development Authority. There needs to be an alliance of the Government, the city administration, the investors and most importantly the citizens through a civil society interface for better delivery and compliance with the C40 mandates. The emphasis on lateral thinking like giving permission to the buildings which have rainwater harvesting facilities, compulsory uses of public transport etc need to be taken up as a public awareness campaign and city sensitization module.
11. There is a lacuna between energy need and supply which can be bridged by efficient use of energy and its conservation with the least-cost option. The Bureau of Energy efficiency was set up in 2002 to motivate in various ways to improve energy efficiency & launches schemes like Energy Efficiency Labelling of Equipment etc, though this is often flouted in urban areas where temperature of air conditioners are set to the body comfort zone temperature which is 22.1 - 26.7°C. The use of energy efficient electrical gazettes to reduce the power consumption while receiving the same level of activity needs to be adopted by all. It is important to follow the standards and labeling of the electronic products to get a guidance of energy efficient electrical devices. Also, city centric awareness campaigns regarding energy efficiency need to be launched.
12. Last but not the least, women from slum area should be mainstreamed through pilot projects for their training, capacity building, environmental education for awareness etc. In urban areas women are suffering from poor home condition, scarce economy, lack of awareness, disgraceful health, hygiene and sanitation. Women health care and child care are the issues that need to be addressed separately. Policy makers should include these affairs into mainstream policy schemes for appropriate women empowerment.

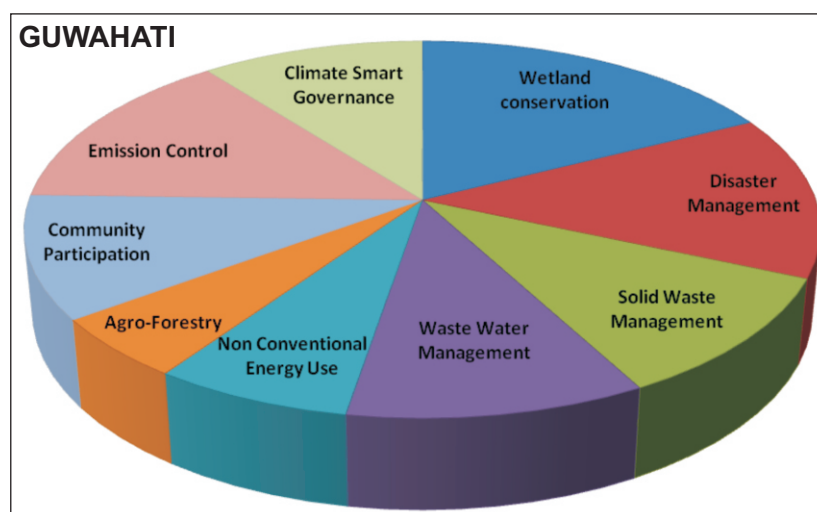


Figure Graphical representation of recommendations on interventions to combat climate change



C40 Megacity Conference

Consolidated Report and Recommendations

PATNA, Bihar



Patna is one of the most ancient continuously inhabited places in the world. It is the capital as well as the largest city of Bihar. The rich cultural heritage of the city goes back millennia. It had its genesis during the time of the Mahajanapadas (earliest city centers). Even during the Maurya period (around 300 BCE) its population was about 400,000. The Buddhist, Hindu, and Jain pilgrim centres of Vaishali, Rajgir, Nalanda, Bodh Gaya, and Pawapuri are nearby. Historically it had attracted scholars from all around



the world to Nalanda, a monastery university which was a centre of learning from the fifth century CE to c.1200 CE . Recently the government embarked on the creation of Nalanda University (also known as Nalanda International University) located in Rajgir, around 100 kilometres from Patna. The University was created as a revival of an ancient center of learning at Nalanda. This university along with the very old Patna University draws a huge population of students from Eastern India.

A characteristic of the geography of Patna is its confluence of rivers. Patna is located on the south bank of the Ganges River in Eastern India. It has an entirely alluvial and flat region. The land in the district is too fertile to be left for wild growth. The district is devoid of any forest wealth of consequences. The alluvial land yields rice, sugarcane and other foodgrains. The area under cultivation is studded with mango orchards and bamboo clumps. In the fields adjoining the Ganges weeds such as ammannia, citriculari, hygrophile and sesbania grow. But palmyra and date palm and mango orchards are found near habitations. It is no wonder that Patna had allured humans through the ages to settle and build communities on its rich and fetid grounds.

Patna has emerged as the second largest city in eastern India with an estimated population of 1.68 million in 2011. It is considered to be one of the fastest-growing cities in the country. Patna has long been a major agricultural center of trade, its most active exports being grain, sugarcane, sesame, and medium-grained Patna rice. There are multiple sugar mills still in existence in and around the city. It is an important business and luxury brand center of eastern India. As with all transitioning city in the throes of rapid urbanization Patna presents a peculiar assortment of opportunities and limitations. The demographics indicate that the social

indicators like crude birth rate, crude death rate and infant mortality rate have improved in the city well above the state average. Still other figures like the sex ratio indicate that there is a massive room for amelioration which can be brought about by meticulous planning and a bottom-up philosophy.

One of the main objectives of the C40 initiative is welcoming the concept of human centered design which believes in the rather time-worn but cardinal expression 'Nothing is Impossible'. The seemingly complex problems like poverty, gender equality, clean water, waste disposal are solvable. The way to doing so is involving the very people who face these problems in their day to day existence. The problems faced by an evolving city like Patna are myriad. The waste generated per day is 510 metric tonne per day, there is no practice of storing the waste at source in a scientifically segregated way, the municipal laws governing the urban local bodies do not have adequate provisions to deal effectively with the ever growing problem of solid waste management or haphazard growth of infrastructure. The C40 megacities initiatives offers problem solvers a chance to design with communities, to understand the people they are going to serve, to create innovations that would bring about a holistic sustainable way of existence for all.

Recommendations

1. The recycling of municipal solid wastes in developing megacities is imperative to reduce urban landfill emissions. The city generates solid and liquid waste products which need to be recycled for conversion into secondary materials with modification. Also segregation of municipal solid waste at source can help reduce the landfill emissions in the cities. This is to be done to save energy, to mitigate waste disposal problems, to create employment opportunities and also to generate organic fertilizer, bio-organic fertilizer and soil conditioner. It would also produce bio-gas, ethanol, to extract Phosphorus and Calcium, to produce pulp and paper.
2. The recycling of waste water is to be done through several technologies like bioremediation, coagulation, filtration, oxidation, encapsulation and evaporation to a quality high enough to use in irrigation, flushing and washing purpose. For this very purpose public education and involvement is required.
3. The urban issues like water scarcity, lack of planning of proper sewage and waste water management treatment etc. was impressed upon. The enterprise Transchem Agritech industry has come up with an environmentally sustainable, economically viable and socially acceptable concept to solve the problems. The basics of the concept engage Bio-filter technology by the use of waste-eater earthworms. It is a synthetic process, which



harnesses the energy from carbon and other elements of the solid waste & wastewater and converts them to precious "Bio-nutritional" products like humus and nutrient rich water.

4. There needs to be more agro-forestry enterprises. Agro-Forestry is a sustainable production system integrating trees on farms and in the agricultural landscape. Urban agro forestry is defined as the planting, protection or preservation of trees for their economic, social and ecological value as part of agricultural and horticultural systems in urban areas.
5. The pros and cons of a smart city were deliberated on. The city should be competitive; socially, financially and environmentally sustainable, and of course capital rich.
6. The administrators and policy planners must have a clear and practical vision for taking the city forward for a 'Smart City' nomenclature. There must be clear identification of economic drivers in attaining the 'Smart City' status city planners and public welfare departments must plan for 24X7 utility services on health, sanitation, education, entertainment, non formal sectors, and also have to monitor them perpetually.
7. The city must adopt green technologies for less pollution and less power consumption and recycling of municipal solid waste products has to happen. The promotion of urban green cover should be prioritised. There is a need for creating green spaces for citizens and concepts of terrace gardening, urban agriculture etc. The systemic discipline in every sector, starting from garbage disposal to car parking will help in implementation of the plans.
8. There is a need for smart leadership for effective urban governance and mitigating challenges like providing transparent administration and strict monitoring of contracts raising resources etc. The capacity building



programs for elected and non elected members of urban governance should be a core component of the planning program.

9. It is imperative to identify gaps within existing city net work and bridge gaps in line of Climate Smart City concept. He also highlighted few challenges to build a smart city that includes equity in service providing to all levels of society, a special focus on road side residents, slum dwellers and non formal sectors and responsible leadership



10. On the issue of gender inclusion in relation to climate smart cities a number of viable suggestions were conceived. It fell under the category of citizen participation, good governance and resource planning for climate smart cities as well as public transportation, traffic management and civic administration function. To reduce stress there is an urgent need to invest in women farmers for food security. There should be use of unique biodiversity and natural resources knowledge by women for proper management. The improvement in preparedness for disaster risk management can only be achieved through greater women participation.

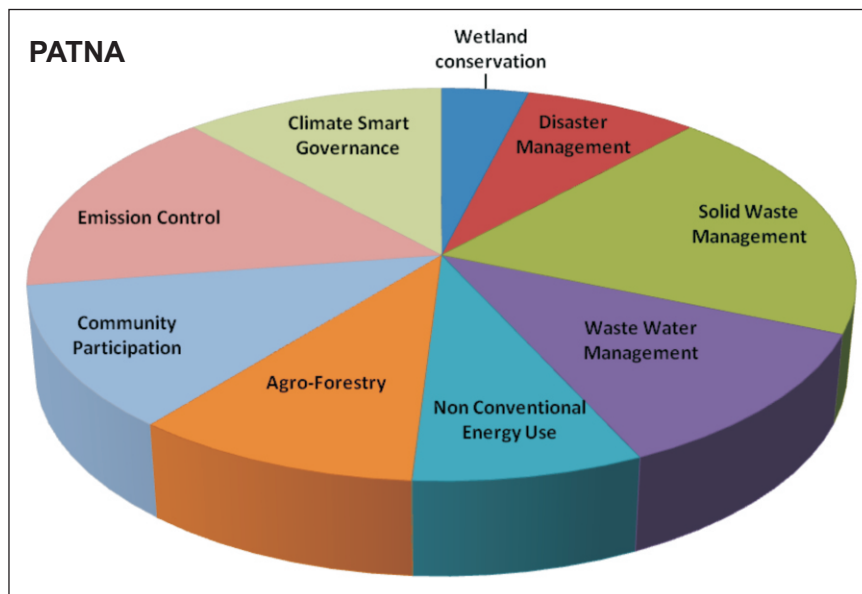


Figure Graphical representation of recommendations on interventions to combat climate change

Conclusion



How can the developing cities of today become the smart cities of tomorrow?

To help cities do so, this international symposium went beyond discussion opportunities to explore concrete and integrated actions for cities in developing countries. Specifically, the symposium examined innovations and solutions that can contribute to sustainable solutions while being integrated into the everyday complexities of a city.

Both panelists and participants shared their insights on the most effective “smart city” and “smart climate” approaches for cities at different stages of development and showcased innovations that have effectively worked creating a win-win situation for environmental conservation and poverty alleviation.

Through the relay of discussions, the scientists, researchers, climate experts, officials, and policy makers focused on identifying the main challenges and opportunities for firm collaboration that more sustainable programs can be incorporated.

More than half of the world's population lives in cities, up to 70% of all carbon emissions can be attributed to urban consumption. The city planners and governors/governance are yet to equip and plan for disaster preparedness to face the eventualities due to Climate Change. In the developing countries the megacities are facing unique challenges like migration, high population density, diseases and degradation of unique ecosystems.

A well worked out science-society based response to climate change now must include action to both reduce the carbon pollution and preparation and adaptation. Cities are uniquely positioned to act quickly and innovatively and many city leaders around the world have already displayed a commitment to action.

Urban development has long been incompatible with natural areas and has exploited the environment. However, proven technologies and management practices are now available, for example renewable energy (RE) systems and ecosystem based adaptation (EBA). We know that to thrive in any urban future, especially a future with climate change, we must get our energy from renewable sources and develop in a way that sustains ecosystems and the services they provide.



The symposium was held in Kolkata, Guwahati and Patna aiming to encourage these cities towards a policy shift directed towards sustainable urban development and find a place among the C40 group of cities. The recommendations made for these three cities would be available to policymakers of these cities as a road map for effective policy making directed towards climate change adaptations in the urban scenario. However it should be seen as a common platform for all cities aspiring to be a part of the C40 cities movement. A sustainable city should meet the needs of the present without sacrificing the ability of future generations to meet their own needs. Urban sustainability is the idea that a city can be structured without unnecessary reliance on the surrounding countryside and be able to power itself with renewable sources of energy.

The aim of this is to create the smallest possible ecological footprint and to produce the lowest quantity of pollution possible, to efficiently use land, compost used materials, recycle it or convert waste-to-energy, and to make the city's overall contribution to climate change minimal. This is the most crucial agenda for all aspiring C40 megacities.

This recommendation report is a consolidated list of accomplishments, long-term and short term actions and strategic solutions for sustainable cities. These recommendations will help the policy planners to develop a CSS, City Sustainability Strategy. This report can be used as a reference point, but should be read within the context of C40 cities theme.

The recommendation report of the symposium serves as a template to assist the next symposium or conference to start the discussion from where it had ended.

And, more importantly the stakeholder and citizens have to work meticulously to translate the recommendations into actions.

