

# *Urban Green Growth Strategies for Indian Cites*

VOLUME 1

Urban Green Growth Strategies For Indian Cities





# Urban Green Growth Strategies for Indian Cities

○ Volume 1



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## Message



India's vibrant and rapidly growing cities offer ample opportunities to its population and are accelerating its economic growth. Considerations of equity, social inclusion and environmental conservation have ranked high in our traditional growth approach. However, the sheer pace of India's urban development has led to unplanned growth and threatens our valuable natural resources and the quality of life of our citizens.

The Government of India's recent initiatives such as the Smart Cities programme, the Heritage Rejuvenation and Development (HRIDAY) Scheme, the Urban Renewal Mission, and the Swachh Bharat Mission look to address these challenges. It is necessary that we look at a new urban development paradigm with greener solutions which help us realize positive social, economic and environmental impacts.

We appreciate the work undertaken by the project team from GGGI, ICLEI South Asia and NIUA towards successfully developing and applying the Green Growth approach in the Indian urban context. The outcomes of the project hold high relevance in the manner in which we envisage India's growth and will be helpful to orient urban transformation onto the green path.

Sd/-  
Shankar Aggarwal

# Foreword

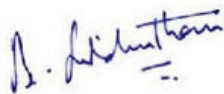
India has undergone unprecedented population growth and urbanization in the recent decades, propelling the country to become the second largest urban system globally. With urban areas expected to contribute to 75% of the country's GDP and house 590 million of its people, emerging cities of India are truly the engines of her future growth.

Local governments in particular, face a key challenge in ensuring that urban infrastructure and services keep pace with this rapid urban transformation. There has been an increased focus on following a responsible growth path which takes into consideration impacts on the environment while ensuring optimum economic and social prosperity for urban dwellers.

In light of the recent thrust by Government of India on Smart Cities, 'Urban Green Growth' is a very relevant but relatively new approach which integrates economic and social objectives with environmental goals. ICLEI South Asia and the National Institute of Urban Affairs (NIUA), with support from the Global Green Growth Institute (GGGI), have undertaken this project to enable Indian cities to better understand the Green Growth process and communicate its potential benefits to India's urban growth story. To this end, the project entails developing a framework to pilot the Green Growth approach in Indian cities. An assessment of ten tier-two Indian cities of geographically diverse regions and compilation of fifteen good practices of urban India in the context of Green Growth Principles were carried to test the applicability of the framework. The idea is to demonstrate the imperative of long term integrated planning and investment that would yield multiple development benefits.

The project team would like to thank the local governments and the stakeholders in the cities for their enthusiastic response and support. Going forward, we hope that the outcomes of this initial exercise will help Indian cities to develop and implement the Green Growth theory and practice, to meet their development objectives in a holistic manner. We also believe the analysis and recommendations would be useful to design the national and state policies on smart cities.

With best regards,



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# *Introduction*

○ Volume 1



# Introduction

## 1.1 Purpose of this project and report

In recent decades, India has seen unprecedented population growth and urbanization. In the period between 2001 and 2011, the total population increased by 17.64%, along with an annual economic growth rate of approximately 6%. From having 5,161 classified towns and 384 urban agglomerations in 2001, India's urban centres grew to 7,935 classified towns and 475 urban agglomerations in 2011, making India the second largest urban system in the world.

However, the current urban growth is far exceeding the capacity of infrastructure and services. While many are attracted to cities because of the potential opportunities for better livelihoods (concentration of services, availability of jobs, improved lifestyle etc.), local governments are facing the daunting challenge of meeting the needs of all citizens - with a special focus on the urban poor, providing housing and basic services, and building the infrastructure required to keep pace with the growing population.

Traditional urban planning and management tools must be reoriented to meet the fundamental challenges for managing urban growth and development. For this growth to be sustainable, policies, strategies and actions must be guided by an approach that aims at positive social, environmental and overall economic impacts: Green Growth. 'Green Growth' is still a new concept in India, as it is around the world. Indian cities need to better understand what a Green Growth process entails - and the benefits that can be derived from it - before they can effectively start their transition towards a Green Growth path.

To bridge this knowledge and awareness gap, the Global Green Growth Institute in India has set up the '**Urban Green Growth Strategies for Indian Cities Program**', to support municipal and state governments by providing technical and strategic expertise to better meet their development objectives and offering implementation support for green and inclusive growth.

This report represents the first project under this program. The work detailed in this report focuses on communicating and telling the story of the potential benefits of green growth in Indian urban development. The report also aims to hypothesize an initial set of Green Growth strategies that Indian cities can follow.

### ***The objectives of the project are to:***

- Define 'Urban Green Growth' in the context of urbanizing India.
- Develop a framework for applying the Green Growth approach for Indian cities and test it in a representative sample of cities.
- Identify and communicate the benefits and the potential of Green Growth strategies across a range of Indian cities; and inform national policy conversations on urban development.
- Compile a detailed set of good practices relevant to the urban development needs and challenges of Indian cities (including: green technologies, policies, business models, standards, systems, partnership models, etc.)
- Describe and explain what these good practices can potentially bring to Indian cities (including: economic growth, job creation, investment opportunities, poverty alleviation, etc.)

*The project was organized into two work streams:*

- **Work stream #1** - Green Growth Framework Development for Cities and Cross-City Analysis.
- **Work stream #2** - Green Growth Good Practices from Indian cities.

**Work Stream 1** focused on developing a definition and framework for mapping 'Green Growth Potential'. As part of Work Stream 1, visits to ten cities in India provided concrete data and information to better assess their potential and enabled the development of a number of recommended strategies for urban green growth.

In **Work Stream 2**, good practices relevant to urban green growth were identified and analysed. In total, 15 practices across key urban sectors were short-listed; and the project team made visits to those project sites. The storyline and analysis of the good practices are presented in this report as examples of approaches to Green Growth.

This report is divided into three volumes; and it brings together the information collected and analysed during the "Defining Urban Green Growth Potential for Indian Cities" project:

- **Volume 1:** Urban Green Growth Strategies for Indian Cities.
- **Volume 2:** Green Growth Profiles of Ten Indian Cities.
- **Volume 3:** Good Practices for Green Growth in Indian cities

### **Volume 1: Urban Green Growth Strategies for Indian Cities**

Volume 1 summarises the main findings of the project, based on the conceptual work done and an analysis of the ten cities and fifteen good urban practices visited during the project. This volume synthesizes the insights from the project visits and analysis; and articulates the observed opportunities and barriers for Green Growth in Indian cities. The volume also presents certain elements of sector-specific strategies for urban Green Growth. Volume 1 is further organized into five sections:

**Section 1** (this section) introduces the project, the partners, and the structure of the report.

**Section 2** sets the context for the study, by describing the existing potential for Green Growth in Indian cities, based on the current state and foreseen urbanization trends, as well as the challenges and barriers that are currently hindering - or could hinder in the future - such Green Growth processes.

**Section 3** introduces the Green Growth Framework that has been developed within the project. This framework has been used to analyse relevant urban sectors and to assess the Green Growth potential in each of the ten cities visited in the project.

**Section 4** goes into more detail and explains the main findings from the city visits. Analysis of green growth potential has been done according to eight relevant urban infrastructure/ service sectors: **Land Use and Density; Ecosystem and Biodiversity; Energy; Economy and Business; Housing and Buildings; Transport; Water and Sanitation; Solid Waste Management.** Synthesis of insights from the analysis of the good practices is also included in Section 4.

**Section 5** summarises the main conclusions of the study, and the possible strategies to fully unlock the Green Growth potential of Indian cities. This section suggests a way forward and looks towards a greener, economically viable, and socially inclusive future for Indian cities.

## **Volume 2: Green Growth Profiles of Ten Indian Cities**

Volume 2 includes detailed profiles for all of the ten cities visited. Each city profile looks at the city's growth story from a sectorial perspective and concludes with a number of recommended strategies to help the city to make use of their untapped Green Growth potential.

## **Volume 3: Good Practices for Green Growth in Indian cities**

Volume 3 presents the 15 good practices that have been collected during the project. Each good practice refers back to the developed Framework (presented in Volume 1, Section 3) and highlights how that particular urban project example helps cities to achieve the visions of Green Growth described in this report.

## **1.2 Partners**

The implementation of the project relied heavily on the expertise on green growth and urban issues of the partners involved. Considering that the concept of Green Growth is entirely new to India and Indian cities, the experience and knowledge brought by the partners contributed to lay a strong foundation on which the further analysis and recommendations were built and developed. The project also helped build capacity within the partners, preparing them to further take forward the issue of urban Green Growth in India.

### **Global Green Growth Institute**

The Global Green Growth Institute (GGGI) is dedicated to supporting developing and emerging countries on exploring the potential for Green Growth to achieve their development objectives. The Green Growth approach integrates economic aims such as poverty reduction, job creation and social development, with environmental goals such as sustainability, resource productivity, climate response, and energy security.

GGGI supports governments in their efforts to create and implement national and sub-national Green Growth strategies. GGGI's country programs consist of green growth planning, analysis and design; domestic capacity building; and identifying public/private partnerships to support green growth implementation. GGGI operates a tailored but consistent program for each country, typically comprised of three phases: Scoping Green Growth Plan (GGP); Performing analysis and design of institutional frameworks and capacity building; and Supporting implementation and investments in the green growth plans.

In addition, GGGI seeks to stimulate a South-South dynamic of mutual learning and collective refinement of a Green Growth planning methodology. GGGI facilitates the exchange of knowledge acquired by governments and experts around the world that are developing and implementing such plans.

### **ICLEI South Asia**

ICLEI - Local Governments for Sustainability is the world's leading association of more than 1,000 metropolises, cities, urban regions and towns that have made a commitment to sustainable development, representing over 660 million people in 85 countries. ICLEI is dedicated to building and supporting a worldwide movement of local governments to achieve tangible improvement in global environmental conditions through the cumulative impact of local governments.

## National Institute of Urban Affairs

NIUA is a premier institute for research, training, capacity building and information dissemination in urban development and management. The Institute has the support and commitment of the Indian Ministry of Urban Development (MoUD), the Government of India, state governments, urban and regional development authorities and other agencies working on urban issues in India. Over the years, NIUA has distinguished itself through its involvement at the national, state and local levels in urban policy development, municipal finance and financial management reforms, decentralisation and governance, inclusive service delivery, and most importantly effective programme management on behalf of the Government of India.

Over the 36 years of its existence, NIUA has undertaken research, evaluation and consultancy assignments of a wide range of issues for the Government of India and some of its Ministries, the Planning Commission, state governments, development corporations, and urban local bodies. Projects have also been taken up with the support of international organizations. NIUA has been involved in the conception and implementation of NURM, carrying out the appraisal of city development plans, preparing primers for each of the reforms monitoring the urban reforms agenda, coordinating PEARL network and institutional strengthening of municipalities through capacity building programmes and by providing hand holding services, among others. As the nodal coordinating agency of the Indo-USAID FIRE-D project, a joint initiative of the United States Agency for International Development (USAID) and the Government of India, NIUA assisted municipal and state governments in India to develop sustainable urban environmental services (water, sewerage, and solid waste) and to ensure that the poor have access to them.



# *Green Growth in Indian Cities: Potential and Barriers*

○ Volume 1



# Green Growth in Indian Cities: Potential and Barriers

## Urbanization and Growth in India

Indian cities are key elements of the economic transformation that is being envisaged by the Government of India. The challenge before the country is to make a drastic shift from an agriculture-based economy towards a manufacturing and services economy that can provide sustainable livelihoods for the Indian population. About 632 million Indians (52 percent of the total population) are below the age of 25, with 260 million (21 percent) being between the ages of 15 to 25. The pressure of this young and mobile population, which is no longer satisfied with inherited livelihoods and traditional occupations, is being felt in the entire urban sector, comprising 4,041 statutory towns and 3,894 census towns – the magnet that offers opportunities and improved quality of life. After two decades of globalization, accompanied by the dramatic effect of communications and media, the Indian population is demanding access and equity to an unprecedented degree.

India has to leverage its cities despite the fact that an overwhelming majority of them are deficient in basic services, financially weak and lacking the capacity required to plan and implement change. Growing at a decadal rate of 31.76% (2001-2011), these urban areas house almost 377 million people and are expected to accommodate 590 million people by 2030. Urban growth is far exceeding the capacity of infrastructure and services, and inadequate environmental management measures have contributed to a significant degradation of valuable natural resources, adversely affecting the quality of life of urban dwellers. Conventional urban planning and management tools have become barriers in their development and in order for this growth to be sustainable, there is a desperate need for new policies and implementation strategies that can generate positive social, environmental and economic impact. Without a radical change in 'business as usual' paradigms, Indian cities will continue to achieve limited growth at the cost of very high resource consumption, which is unsustainable.

In order to squarely address the challenges of urbanisation, the Government of India has launched a number of new initiatives. The Swacch Bharat Mission aims to make India litter-free and open-defecation-free by 2019. The Urban Renewal Mission for 500 cities targets the provision of drinking water, sewerage, waste management and other infrastructure to at least the established benchmark levels. The 'Housing for All' scheme promises that every Indian will have an adequately serviced shelter by 2022. The HRIDAY (Heritage Rejuvenation and Development) Scheme will revitalize heritage cities. The programme for Smart Cities targets the transformation of 100 mid-sized cities and satellite towns through effective planning, financial management, mobility and widespread use of information & communication technologies (ICT).

The ambition and scale of the urban transformation in India will only be sustainable if the path chosen to achieve targeted objectives is essentially a 'green' path. The nature and extent of the environmental pressures and damages being caused by India's cities are yet to be fully measured; however, there is sufficient evidence in the levels of air and water pollution



alone that these cities are producing externalities that are likely to severely impede the productivity of the indigent populations and are contributing to global phenomena like climate change to unprecedented levels. In this scenario, the developmental impetus needs to be steered towards greener solutions and a new approach to the economy of cities.

It was pointed out by UN-Habitat in 2010 that environmental sustainability, equity and social inclusion, availability of infrastructure, productivity and quality of life are necessary for creating prosperity. Systemic distortions and inefficiencies are anathema to prosperity, as they breed inefficiency and accelerated higher levels of consumption of resources. While economies of scale are one of the chief drivers of the wealth of cities, these economies can easily become dis-economies and produce the accumulation of gaps and barriers that hamper sustainable development.

The Global Commission on the Economy and Climate has published the New Climate Economy Report titled 'Better Growth Better Climate' in September 2014. The report concludes that growth and climate change need not be seen as contradictory because it is now possible and desirable to leverage the "deep structural transformation" in the global economy and technological changes and innovations that can be enabled through strong political leadership and credible, consistent policies. It is expected that the "business as usual" scenarios that are prevailing in most economies of the globe will become outmoded and will be completely replaced by around the year 2030. As the Report states, "future economic growth does not have to copy the high-carbon, unevenly distributed model of the past."

The Commission observes that the most significant structural and technological changes will be seen in three key systems of the economy:

- (i) Cities, which generate around 80% of global economic output, and around 70% of global energy use and energy-related GHG emissions;
- (ii) Land use productivity, which is presently low due to the sprawling urban expansions and negative impacts on natural environments; and
- (iii) Energy systems, which power the growth of all economies and which are being affected by the strong trend of preference for clean energy.

Indian cities provide live examples of the key systems of the new climate economy. Urban growth in India is predominantly unplanned and unstructured and this has a negative effect on productivity of land and creates energy intensive patterns of growth. It is expected that the per capita availability of land, which was 0.37 hectare in 1991 – at the commencement of economic liberalization in India – will become almost halved by 2035 -- that is, 0.20 hectare. While this has resulted in smaller land holdings for farmers, and making them more dependent on urban food prices, it is also creating alienation from agriculture and 'distress migration'. This phenomenon has a drastic effect in cities, by creating unsustainable sprawl and huge energy costs to the municipal administrations. Land-related distress is particularly critical in the rain-fed regions that comprise 60 percent of India's cultivated area and are home to more than 200 million of the rural poor.

Despite these distortions, urban areas in India are now contributing to more than 60% of the national GDP (compared to 47% in 1980-81); and this figure is expected to increase to 75% by 2020 , creating a greater potential for sustaining innovation and adoption of new technologies. It is imperative that better planning, technology and management become the cornerstones of India's urban strategy. Getting a grip on the gaps and barriers to the sustainable growth of Indian cities should therefore be a high priority<sup>1</sup>.

<sup>1</sup>Ministry of Housing and Urban Poverty Alleviation, Government of India, 'Report of the Working Group on Urban Strategic Planning: 12th Five Year Plan', October 2011.

## Local Governments As Drivers Of Green Growth

As engines of growth of the country's economy, Indian cities can become crucial actors in promoting 'green' prospects and pathways. A number of enablers are already in place – albeit at different stages of implementation – that provide a framework for greater functional and financial autonomy for local governments. The 74th Constitution Amendment Act (1992) recognized urban local bodies (ULBs) as the third tier of Government by assigning them specific civic functions. It required state governments to amend their municipal laws in order to empower ULBs “with such powers and authority as may be necessary to enable them to function as institutions of self-governance”. Building further on this legal basis, the Government of India drafted a Model Municipal Law in 2003 to assist the states in framing their urban decentralization strategies. The next step was taken in 2005, when the Government of India launched the Jawaharlal Nehru National Urban Renewal Mission (JnNURM), which funded the development of infrastructure and service-delivery mechanisms as an incentive for the state and the ULB to undertake a systematic reform programme for planning their growth and provide services in a financially sustainable manner. The JnNURM pushed an agenda of urban transformation that would result in greater independence and robust economic performance for India's cities. The mantra of self-government and the ethos of responsible governance was instituted through the Mission and set the stage for the new programmes and schemes being envisaged by the Government of India today.

Given the experiences of the past decade, it is not difficult for ULBs in India to opt for adoption of green growth strategies, such that they can benefit from innovations and drivers of the new global economy based on the production of value-added goods and knowledge-based services which do not have a negative environmental impact. However, serious deficiencies prevail in many cities and there are formidable barriers to the adoption of innovation and sustainability pathways. Most Indian cities suffer from a legacy of shortages and endemic distortions in their policy and regulatory frameworks. Most cities are grappling with issues related to the urban poor, who need housing and basic services. Overcrowding, environmental decay, inefficient systems of municipal service delivery, lack of funds and inefficient administrations are a combination of factors that are commonplace and that compound the challenges being faced by the cities. Faced with the burden of legacy and the demand to build infrastructure to keep pace with the growing population, cities are rendered helpless.

With the renewed focus and greater ambition being directed at the urban sector in India, there is a unique opportunity for articulating and adopting green growth strategies that can profoundly change the somewhat bleak prospects perceived by Indian cities and trigger new enthusiasm for sustainable trajectories for achieving prosperity. A Green Growth planning approach applied to Indian cities will allow them to refocus and reorient their current development pathways, based on a realistic assessment of opportunities and barriers. By developing a vision for green growth, cities can integrate social, economic, and environmental objectives in their plans and projects as well as prioritize investments that can enable the sustained achievement of outcomes. Cities can adopt a pragmatic approach whereby they choose to identify efficiencies that can be achieved in the short term so that these efficiencies can further support a broader transformation.

## Potential for Green Growth in Indian Cities

A Green Growth approach integrates economic aims such as poverty reduction, job creation and social development, with environmental goals such as sustainability, resource productivity, climate response, and energy security.

The Government of India's urban strategy mandates an integrated approach to dealing with the challenges of urban growth, enabled by the convergence of efforts across various Ministries and Departments of the government. This approach is articulated in the form of a number of missions, programmes and schemes, which are presently under formulation. The first commitment is towards total sanitation by 2019, which targets the provision of solid waste management and sanitation. This would be backed by the urban renewal mission, which will fill the infrastructure gaps that create the lack of sanitation and the inefficient collection and management of waste in addition to bridging the gaps in coverage, both spatially as well as in terms of frequency and duration of service. The commitment towards the cleaning of all Indian rivers, starting with the Ganges, which is impacted by the waste from over 130 towns along its banks, is also related to the sanitation mission. The provision of housing for all, with the stipulation that all dwelling units should have direct access to a toilet, will further support the achievement of the total sanitation goal. The extension of 'Corporate Social Responsibility' commitments to include slum redevelopment will encourage private sector participation in dealing with a national problem and a major barrier to sustainable growth.

The development of mid-sized towns and satellite towns as 'smart cities' is a programme that targets the improvement of management of city functions, especially with the use of the E-governance platforms that are enabled by ICT (information & communication technology). Smart cities would also generate new jobs through manufacturing and other economic activities like trade & commerce and the services sector.

While the national plan for fiber connectivity will provide high-speed internet connectivity to all parts of the country, the Ministry of Power is working on a national plan for ensuring 24X7 supply of electricity to cities, supplementing the dependence on hydroelectric energy with the development of renewables like solar, biomass and wind energy.

The Government has also committed to support and develop the SME (small & medium enterprises) sector in order to address the artisanal base of the Indian economy. The development of heritage cities addresses the need to promote the urban heritages of India as an economic driver, which is expected to combine with the creation of jobs in the various services attached to tourism and culture.

The national programme for skill development, which is being spearheaded by a new Ministry of Skills Development, will form the basis of a comprehensive campaign to enhance the livelihoods of Indian workers and new entrants to the workforce. This would be coupled with the capacity building mission of the Ministry of Urban Development, which aims at developing the necessary municipal cadres and the in-service training of all municipal staff and officials such that they can sustain the city economy and manage the funds and functions of the ULBs more efficiently, with transparency and responsibility.

The formulation of the 'R-urban' mission will impact the growth of cities by provisioning for urban infrastructure and services in rural areas. Peri-urban areas already support 9% of the country's population and provide 18% of the employment on 1 per cent of the country's land area (12th FYP), and these areas need specific policy initiatives. This will significantly address the phenomenon of haphazard growth in the peri-urban areas of cities, where land tends to be cheaper than within the municipal boundaries and speculative and unplanned development is rampant. Innovations like the use of recycled water from cities for growing organic fruits and vegetables in their hinterland will create a sustainable symbiosis between city and countryside.

The smaller towns of India will be able to avail of the provision for the 'Pooled Municipal Debt Obligation Facility', which has been increased by ten times from its previous allocation,

such that smaller ULBs that do not have the capacity to leverage funds from the finance market are able to offset the risk by pooling their resources with other small ULBs in their immediate vicinity. This would enable sustainable management of such phenomena as solid waste management and transportation connectivity, which have a regional footprint.

The investment of funds by the Government of India is expected to be driven by the logic of convergence, such that there is maximum impact achieved with every rupee of investment. The principle of integrated planning – a fundamental aspect of green growth – will therefore assume primacy. The emphasis on public-private-partnership (PPP) as a mode of funding the urban sector will be an important factor for promoting green growth, as environmental management costs and risks will have to be mitigated before private investments can be leveraged by ULBs. Greater fiscal responsibility will have to be a cornerstone of the new urban order and will enable to uptake of green growth strategies.

The renewed emphasis on planning will provide a fillip to the acceptance of green growth as a paradigm in India. Combined with the use of ICT and the focus on efficient land use, supported by public transportation, the green growth of Indian cities can become a reality sooner than expected.

In the study report entitled 'Planning, Connecting, and Financing Cities - Now: Priorities for City Leaders' (2013) the World Bank created an urbanization policy framework in which planning was given foremost importance, promoting the coordination of land use with infrastructure, especially transport, natural resources, and hazard risk. The report encourages the tapping of all resources and assets in a city – built assets, contextual advantages, natural features, natural and built heritage – for its economic development. Improving the regulatory and financial apparatus in the city would be the enabler for such integrated planning and management.

### **Barriers To Green Growth In India**

The barriers to the articulation and achievement of green growth pathways have been revealed by the experience of the JnNURM. A number of audits and evaluations of the first urban renewal mission in the country have shown that the main bottlenecks in the achievement of sustainability are the lack of capacity for city management, the absence of integrated and comprehensive spatial and physical plans, and the financial weakness of ULBs. ULBs are overly dependent on grants from the Central and State governments and have limited capacity for generating own sources of revenues and their inability to collect user charges that can sustain the operations and maintenance of the assets created by the ULBs.

The lack of financial independence creates a vicious cycle in the ULBs, as it prevents them from controlling their own budgets, and the lack of funds prevents them from filling the infrastructure and service gaps that could bolster confidence within the finance market and attract private investment through the PPP mode. Rigid systems of procurement, coupled with weak finances, prevent the adoption of new technologies and innovations in the use of existing ones.

Another barrier is the lack of public participation in the visioning and conceptualization of plans and projects. This creates a rift between 'public interest' and private interests, with a perceived conflict between the two that gets reinforced by the ULB's inability to fully satisfy the public's infrastructure and service needs. Alienation from the governance process discourages the public from accepting the initiatives of the ULBs and would be a barrier to making the kind of behavioural changes and lifestyle choices that would actively promote

sustainability. The establishment of common ground and consensus between the public and the ULB would also vitiate the communications that are bedrocks of building trust and confidence.

The lack of reliable and complete data on the urban sector is a significant barrier to identifying green growth potentials and envisioning 'green' interventions. This is likely to be addressed through the creation of paperless processes for management of schemes and programmes and a big push to the E-governance of Indian cities. However, the definition of data needs is incomplete and needs constant attention.

Based on the knowledge and understanding of this context, the project set out to describe a **Green Growth Framework** that is most appropriate and relevant for Indian cities.



# *Green Growth Framework for Indian Cities*

○ Volume 1



# Green Growth Framework for Indian Cities

The 'Defining Urban Green Growth Strategies for Indian Cities' project developed a Framework that aims to support cities in achieving their Green Growth vision, assisting them in assessing and correspondingly unlocking their Green Growth potential. This methodology is briefly presented below and was used by the project team to assess the Green Growth potential of the ten cities visited and to select and analyse the 15 good practices described later.

## Green Growth Framework

The potential for Green Growth in a city is a function of a target condition, based on the knowledge of future growth trends (the city's Green Growth vision), a current condition (the city's current state), the resulting gap, the ability to close this gap (leveraging existing or emerging options and opportunities), and the barriers that come in the way.

Assessing the **current state** of a city is the starting point in a Green Growth process. This is done looking into the city's **past growth trends**, as well as its **current policies and practices**, from legal and regulatory frameworks, to governance systems, financial mechanisms and informal practices. The main **actors** (e.g., Government leaders and employees, local institutions and organizations, businesses and private sector, citizens and community organizations) in the city need to be identified and examined, as they play a crucial role in influencing and steering the fulfilment of the city's Green Growth potential. Understanding their nature enables the city to develop correspondingly appropriate relationships, incentives and motivations to gain their support.

Unless conscious changes are made, past and current growth trends are bound to substantially affect the future of the city. Analyzing expected **future growth trends** is thus imperative to assess the projected growth trajectory and identify the interventions needed to change it. The growth trends will be outlined by looking at **demographic and economic information** (from population growth patterns, to literacy/work participation/health and slums data and so on), **legal and institutional structure in the city** (e.g., existing and planned/upcoming plans and governance structure, prominent NGOs/civil society organizations/business associations in the city etc.) and, of course, the **current state** of the relevant sectors in the city described above.

The status of the city, based on the analysis of the current state and future growth trends, needs to be examined against the **city's objectives**. Indian cities have already included environment protection, equity and inclusiveness and economic growth in their development objectives, but are currently struggling to achieve them. A Green Growth approach enables cities to meet and even exceed these objectives, achieving a more ambitious Green Growth **vision** that represents the ideal scenario of how a city would look in a hypothetical but probable future. This future scenario becomes the target the city aims to achieve and that guides the Green Growth process.



*Illustrative table of possible objectives for Indian cities*

Economic Objectives	Social Objectives	Environmental Objectives
Growth (GDP)	Equity and Inclusiveness	Clean Air
Employment	Quality of Life	Clean water
City Competitiveness - Attracting companies - Attracting industries - Attracting talent	Basic services - Education - Health and Activity - Enjoyment and Entertainment - Clean and beautiful city - Green spaces and parks	Green and open spaces
Better infrastructure	Participation	Biodiversity
	Resilience and Reduced Vulnerability	Low energy footprint

*From the current state of being, cities have three possible scenarios ahead of them:*

**A. Business as usual:** where no change is applied to the existing situation and consumption of resources/production of waste etc. grow exponentially with time and with an increasing population.

**B. Efficient Green Growth:** efficiency measures are applied to the different sectors in the city, in an incremental and gradual way. While the consumption of resources and the production of waste will be slowed down thanks to improved efficiency, such ad-hoc, isolated and incremental approach will not be sustainable in the long-run.

**C. Transformative Green Growth:** this goes beyond the mere implementation of efficiency measures and is based on an integrated approach where the principle of a socially inclusive, economically viable and environmentally sound growth is the driving force of all decisions and actions (policies, strategies, technologies, infrastructure, planning, community involvement, etc.), resulting in a long-term and sustainable reduction of the potential negative effects of an unplanned growth.

The illustration below shows the three possible future growth scenarios and how they proportionally reduce their negative impact on the environment.

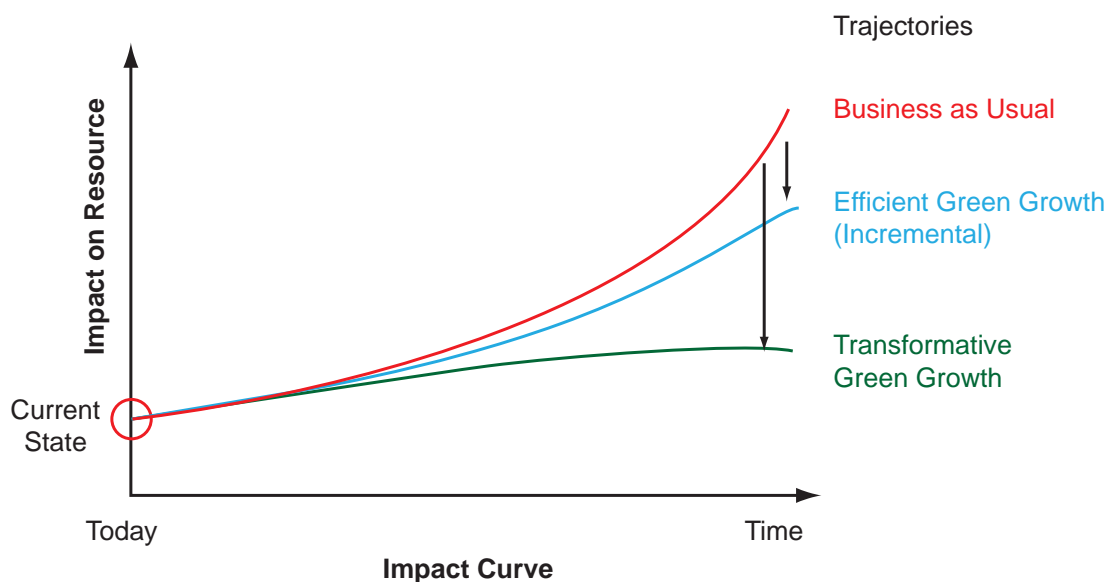


Figure 1: Impact Curve on Urban Environment

While ultimately all cities should aspire to achieve transformative growth, depending on their starting point and the existing opportunities and barriers an efficient vision might initially be the more realistic one. A shift to a more ambitious transformative vision can take place later in the process, when the city feels better equipped to aim at achieving higher targets.

Existing and emerging trends in the city present **opportunities** that can be leveraged to accelerate the achievement of the city’s Green Growth vision. Such trends include emerging technologies, financing models, policies and programs, capacities and resources, entrepreneurial solutions, etc. These opportunities can however be hindered by social, political or resource based **barriers** that may stand in the way and will require different approaches to be tackled.

The path that takes a city from its current state to its selected Green Growth vision, looking at the city’s ability to realize the opportunities and addressing the barriers, represents the city’s Green Growth **potential**. The potential will be tapped by developing and implementing Green Growth **strategies**, assisting the city in overcoming barriers and building on opportunities, thus enabling the city to achieve Green Growth **benefits**.

*The graph below (figure 2) gives a visual representation of the Framework.*

The graph below (figure 2) gives a visual representation of the Framework.



Figure 2 Framework for Green Growth



# *Unlocking Green Growth Potential in Indian cities*

○ Volume 1



# Unlocking Green Growth Potential in Indian cities

## 4.1 Project Methodology

The project combined the analysis of existing resources with on-ground research and direct engagement with cities.

*The process followed can be visualized here:*



The project team consisted of experts from ICLEI, NIUA and GGGI who worked together as a hybrid team on the project. Green Growth is a new concept and is not much known in India: the initial stages of the project were thus dedicated to arrive at a working definition of Green Growth for Indian cities, based on desktop research and knowledge of the Indian urban context: ***“Recognizing that growth is taking place in Indian cities, looking at the current state and trends, moving towards a triple bottom line (social, economic and environment) integrated solutions maximizing potential and addressing the barriers”***. This working definition was used as described in section 3 as a basis to develop a realistic framework for realizing the Green Growth potential in Indian cities, on the base of which corresponding strategies could be outlined.

The project teams then worked as two work streams to gather first-hand information and insights from Indian cities to test the applicability of the framework. For this purpose, eight sectors were identified, mirroring the organizations within municipal governments that most influence green growth in the city: ***Land Use and Density, Ecosystem and Biodiversity, Energy, Economy and Businesses, Buildings and Housing, Transportation, Water and Sanitation, and Solid Waste Management***.

**Work stream #1** worked to test the framework in ten 2nd tier and 3rd tier cities, to check its relevance in the Indian urban context.

***To ensure a balanced representation, the cities were selected based on the following criteria:***

- ***Population size and growth:*** fast-growing cities, with a population between 100,000 and 3,000,000 people (identified as the fastest growing cities in India and those with the highest potential for change)
- ***Geographical location:*** representing the 5 Indian geographical zones
- ***Functions:*** a mix of administrative, cultural, industrial, satellite cities etc...
- ***Geography, topology and climatology:*** including coastal, hilly, desert and inland cities
- ***Special factors:*** such as proximity to planned Industrial Corridors

The project team looked at the fastest growing Tier 2 and Tier 3 Indian cities and identified 32, based on the above criteria, to be invited to be part of the project through a written expression of interest. After having reached out to all of them, the following ten cities were ultimately selected: Agra, Agartala, Dehradun, Cochin, Kota, Ludhiana, Nadiad, Pimpri Chinchwad, Shimla and Vijayawada, based on a written response and commitment to support the project. The project team visited each of the ten cities for three days of data collection and interaction with key departments and officials, on the base of which a city profile was developed for each one.

**Work stream #2** worked to identify 15 accepted good practices from various Indian cities that would be documented as relevant examples of approaches to urban green growth. The good practices were selected from existing databases of NIUA and ICLEI, from award-winning urban initiatives, and from databases of other organizations such as CURE, DRONAH etc. The selection was made to match the eight identified sectors in the project; and favoring examples that included aspects of economic viability, environmental sustainability, social sustainability and improved governance.



## 4.2 Synthesis of City Profiles and Green Growth Potential

### 4.2.1 Introduction

Eight urban sectors have been identified as the most relevant in a city's Green Growth process: **Land Use and Density; Ecosystem and Biodiversity; Energy; Economy and Business; Housing and Buildings; Transport; Water and Sanitation; Solid Waste Management**. They have been selected based on the extent of infrastructure and services they cover - and that drive growth - and on their impacts on the local quality of life.

The Framework presented in Section 3 was used to analyze these eight sectors to assess their Green Growth potential and ways to unlock it. A first macro, national-level analysis of the eight urban sectors helped to develop hypothesis about the issues, challenges, and strategies for cities within each of them. These hypotheses were then tested in more specific assessments of the green growth potential in the ten cities visited, leading to the identification of similarities and common trends among them. Sector-specific strategies were ultimately outlined, providing recommendations on how to overcome the existing barriers and building on the current and emerging opportunities, to meet the targeted vision of Green Growth.

It is recommended that the sector analysis and strategies are read with the city profiles (Volume 2 of this report) that describe each city status and the Green Growth strategies in more detail.

### 4.2.2 Urban Land Use and Density Sector and Green Growth

#### Introduction

The land use pattern in a city is an outcome of natural and socio-economic factors that influence it, and of human interactions in time and space. Cities form their urban shape by making choices on the distribution of land use, density and the linkages between residential and work areas - with a particular focus on integration of land use and transport - through their urban planning processes.

With the rapid and steady growth of the urban population, the demand for land resource has increased as well. This is creating both horizontal and vertical pressure on all urban land uses. Considering that the Indian urban population is expected to increase up to 590 million by 2030, the per capita income is projected to grow four times and that land is a limited resource, the negative consequences of maintaining the current unsystematic approach could be tremendous for local environment and society: a Green Growth approach thus becomes imperative for urban planning.

#### Sector Growth Story

Analyzing the **current status** of the Land use and Density sector - including its present growth as well as prevailing policies and practices, evaluating the expected **future growth trends** and identifying the **main actors** who can support a transition to Green Growth helps develop an accurate picture of the starting point of a city's Green Growth process.

Human settlements in India, from hamlets and villages to towns and cities, have been in existence since centuries. The rapid urbanization of the recent decades has forced the





TO PROMOTE COMPACT DEVELOPMENT MASTER PLANS SHOULD FOCUS ON NEW DEVELOPMENT ALONG TRANSIT CORRIDOR

additional expansion to include agricultural lands, mountains, small water bodies and forests, which have been converted into human settlements; however, this development has often been carried out unsystematically, with poor control mechanisms, inadequate formal land distributions etc.

Urban land use is generally governed by statutory Master Plans prepared in line with the national Urban Development Plans Formulation & Implementation (UDPFI) guidelines<sup>2</sup>. The UDPFI guidelines classify urban land uses into residential, commercial, industrial, public and semi-public, parks/play grounds/open spaces (recreational), transport & communication, agriculture, water bodies and special activities (tourism or pilgrimage). As Land use is a state subject, town and country planning acts at the state level govern the Master Plans, which are developed as the long term perspective plans for guiding sustainable planned development of the city.

The density in the city is governed by Development Control Regulations that are locally revised in consultation with the state government from time to time.



**Table 1: Land Use Classification in Plain Areas according to UDPFI guidelines**

Land Use Category	Percentage of developed area			
	Small	Medium	Large	Metro Cities
Residential	45 - 50	40 - 45	35 - 40	35 - 40
Commercial	2 - 3	3 - 4	4 - 5	4 - 5
Industrial	8 - 10	8 - 10	10 - 12	12 - 14
Public & Semi-Public	6 - 8	10 - 12	12 - 14	14 - 16
Recreational	12 - 14	18 - 20	18 - 20	20 - 25
Transport & Communication	10 - 12	12 - 14	12 - 14	15 - 18
Agriculture & Water bodies	Balance	Balance	Balance	Balance

Source: UDPFI Guidelines

Originally the land procurement in the country was done either through private negotiations or land acquisition acts; as this process involves huge capital investments, land acquisition, planning and management<sup>3</sup> are currently regulated by *Guided land development for large areas* (called urbanizable blocks in Haryana); *Land Pooling and Reconstitution* (institutionalized as town planning schemes in Gujarat and other states); *Land Reconstitution/Redevelopment* (for in-situ upgrading in small parcels in core areas); *Acquisition for public purpose under the land acquisition act - 1984*; *Joint sector model of land assembly and development* (Greater Noida, CIDCO, New Mumbai, etc.); *Transferable Development Rights* (for built up areas); *Saleable FAR and mixed use concept* (for regeneration of inner city); and *Land Pooling and Redistribution Schemes* (Town Planning scheme, Gujarat and Maharashtra). In addition to land pooling, the recent developments are also based on the land banking scheme that includes strategic acquisition of land in advance of expanding urban development. This includes practices of buying and holding pre-development land for future use. It is best practiced in the states of Bihar, Gujarat, Kerala and Tamil Nadu.

Urban Master Planning processes are known to be tedious and long and - due to the limited local capacity - are often of poor quality.<sup>4</sup> Recognizing the fact that out of 5,161 urban centers, Master Plans were available for only 1,500 towns - of which most of them were outdated and not reviewed periodically - as per the provisions of the act, the 11th five year plan had proposed to update the Master Plans of all 441 Class I cities and 496 Class II towns. Aware of the time and resources needed to update a Master Plan, the National Urban Renewal Mission program introduced by the Ministry of Urban Development has mandated the city development plan as an infrastructure Master Plan, which has to be revised every five years and developed in sync with the existing statutory Master Plan of the city.

### Actors Involved

Master planning and land use planning are typically a responsibility of development authorities. In smaller cities this is carried out by the regional offices of the state department of Town and Country Planning. City Corporations, Development Authorities or Local Planning Authorities, District Administrations, etc. are the key agencies involved and responsible for

<sup>2</sup>UDPFI Guidelines are currently being revised as the *Urban and Regional Development Plans Formulation & Implementation*.

<sup>3</sup>The current land procurement practices in India are mentioned in the UDPFI guidelines, Jain, A.K., 'Urban Land Policy and Management Reforms', *ITPI Journal* 5:3, 2008.



planning and developing norms in an urban area. The development authority, or the local planning authority, is a parastatal body. Private consultants are hired to develop the Master Plans and the all active government departments are involved in the review/stakeholder committees chaired by the local district Collector/District Magistrate.

## **Green Growth Visions**

*The two visions below present an ideal scenario of how the Urban Land Use and Density sector would appear in the future, had the city fulfilled or even exceeded all its development objectives. These visions, achieved either through a gradual, incremental process (efficient) or a more radical paradigm shift (transformative) become the ultimate Urban Land Use and Density 'target' that cities should aim for.*

### **Efficient Green Growth Vision**

A vibrant and livable city that has integrated land use with minimum conflict between green spaces and built up areas, to satisfy all the social needs of the community. Statutory Master Plans minimize urban sprawl and guide desirable peri-urban development. Enforcement agencies use existing underutilized or unused land and promote transfer of development rights to retain traditional quarters and other conserved precincts. High density is encouraged through increase in floor space index in all areas with open land converted to community open spaces accessible for all. Organized agriculture is allowed as one of the urban functions to reduce land distortion from over predicted real estate demand, while involving communities in the planning process.

### **Transformative Green Growth Vision**

A compact city with reduced travel time and optimal utilization of local resources, with land use allocated for various uses that is self-sufficient for future generations without demand for additional land resources. Transit oriented mixed land use approach is in place with reliable public transport to eliminate private vehicle dependency. The Master Plan is mandatorily revised every 3 years with all the maps available on a GIS platform. Heritage and ecologically fragile areas development is regulated by clear guidelines, low rise development along transit corridors is discouraged and urban sprawl is reduced. Clear development guidelines exist and the private sector is actively engaged to help implement development in line with the Master Plan. The city has urban green spaces and forests to protect local biodiversity and a green economic policy that guides the city's economy.

<sup>4</sup>Planning Commission, Government of India, 'Draft paper: Working group on environmental sustainability of Indian cities for the formulation of the 12th Five Year Plan'.



## Green Growth Benefits

- **Personal benefits include:** reduced travel time and access to various services at walking or biking distance; affordable and accessible housing for all with sustainable public utilities; better access to drinking water through preservation of wetlands and efficient use of resources; access to services at lower costs.
- **Community benefits include:** improved existing road network and reduction of road based infrastructure demand; better control over conversion of green spaces to built-up areas resulting in better social infrastructure; reduced noise and air pollution; improved health; reduced traffic stress; safer communities.
- **National/Global benefits include:** reduced or better planned allocation of financial resources for future urban development; better economic conditions through optimal utilization of local resources; lower GHG emissions.

## Options and Opportunities

*Through the analysis of the Urban Land Use and Density sector, undertaken to assess its “Current Status” and “Growth Trends”, a number of existing or emerging options and opportunities have emerged. These can be used and leveraged by cities to accelerate the transition to their targeted Green Growth vision. These opportunities are listed below.*

By recognising planning and development control regulations as key requisites for a sustainable future and keeping in view the consequences of unplanned development, the High Powered Expert Committee and the McKinsey Global Institute have recommended several initiatives to be taken up for effective land use planning, such as upgrading planning technology (GIS maps and economic projections, transportation, and affordable housing, etc.) and preparation of effective 20 year Master Plans with integrated content; the Indian government is currently addressing this.

- Few metropolitan cities such as Delhi and Bangalore are in the process of developing their transit oriented policies and plans for the city to promote mixed use and increase densification in the cities. The URDPFI guidelines, currently being revised, recommend the same approach; other cities should learn from these examples.
- Emphasis should be increased on local development regulations and densification of land uses through ongoing efforts on Transit oriented development.
- Cities can utilize central government funding for the preparation of plans and the prioritization of long term infrastructure improvement; e.g. the Ministry of Urban Development provides funds under the National Urban Information Systems program to develop Master Plans on a GIS platform.
- Application of GIS in Master Planning processes can be used to record plot by plot data on land use, transportation, storm water system and solid waste management etc.
- The recently announced 100 Smart Cities program of the national government can be tapped as an opportunity for all cities to leverage innovative approaches for industrial development.



## Barriers

Evaluating the current and future trends of the Urban Land Use and Density sector led to the identification of barriers that already are or could in the future hinder or even prevent cities from seizing the opportunities listed above, thus precluding a transition to Green Growth. These barriers are listed below.

- Limited technical capacities of local agencies, that prevent Transferable Development Rights, PPPs and town planning schemes from being properly utilized as land management practices.
- Lack of monitoring of Master Plan violations, non-coordination of an excessive number of agencies involved, political interference etc.
- Non-functioning of Metropolitan Planning Committees and District Planning Committees, which have a major decision making role as per the 74th constitutional amendment. The non-implementation of the act is one of the major barriers for cities to take coordinated decisions for longer term development.



CHARACTERISED BY MIX LAND USE, MOST INNER CITY AREAS ARE MAJOR ECONOMIC CENTRES



## Review of the Cities Visited

The following sections present the results of the analysis of the 10 cities, carried out applying once again the Framework developed in chapter 3.

The table below provides a comparative overview of the status, barriers and opportunities for the Urban Land Use and Density sector across all the ten cities. The comparative analysis is done through relevant indicators, identified by the team (based on desk research and brainstorming sessions) and further developed to undertake the interviews and data collection during the city assessment visits. The analysis, driven by elements of the Framework, enables to test and validate the background (theoretical) sectoral hypotheses and develop sector specific green growth strategies on this basis.

Cities	Agartala	Agra	Dehradun	Cochin	Kota	Ludhiana	Nadiad	Pimpri Chinchwad	Shimla	Vijayawada
<b>Status and Trends</b>										
Existing Master Plan	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Existing City Development Plan	Yes	Yes	Yes	Yes	NA	Yes	NA	Yes	Yes	Yes
% of green cover to total land use	65.47	NA	29.4	26.35	NA	24.55	NA	64.40	85.17	25.17
% of built up area to total land use	33.93	NA	70.6	73.65	NA	75.45	NA	35.6	14.83	74.83
Total city area (Sq km) (2011)	62.06	188	96.98	94.88	527.03	159	NA	170.51	99.50	110
Total city area in 2001 (sq km)	16	141	31.08	94.88	221	159	28.48	170.51	35	61.88
Increase in density from last decade	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Any Attempt in last 10 years to carry out GIS mapping of city	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes



Cities	Agartala	Agra	Dehradun	Cochin	Kota	Ludhiana	Nadiad	Pimpri Chinchwad	Shimla	Vijayawada
<b>Barriers</b>										
Application of GIS in existing Master plan	No	No	No	No	No	No	No	No	No	No
Defining the roles clearly to implement the master plan	No	Partly	No	Partly	No	No	NA	Partly	No	Yes
Documented Information on Violations to DCRs and Master Plans	No	No	No	No	No	No	No	No	No	No
Review of Plan implementation process mid course	No	No	No	No	No	No	No	No	No	No
<b>Opportunities</b>										
Integrated plans for land use and other infrastructure	No	No	No	No	No	No	No	Partly through BRTS study	No	No
Cities meet the criteria of smart cities	No	No	No	No	No	No	No	Partly	No	Partly
Strategies to improve green coverage	No	No	No	No	No	No	No	No	No	No

Source: Compiled from city development plans and Master Plans of all cities



## Status and Trends in the Cities Visited

*The analysis of the current status and observed trends in the ten cities is needed to establish the initial benchmark from which the Green Growth process will be started.*

### **Existence and effectiveness of Master Plans**

Though all the ten cities have Master Plans and development plans in place, there is limited information available on the existing scenario of land use patterns. Majority of cities have little green coverage within their boundaries. None of the Master Plans kept pace with the cities' rapid urban growth and are hardly reviewed or updated mid-course. This has led to over utilization of land resources and overburdening of services such as drinking water provision, drainage, solid waste management etc. None of the cities maintained updated documented information on present status of land uses.

### **Attempts to modernize land use documentation and planning process**

Eight cities out of ten have tried to initiate GIS based land use mapping in the last ten years, indicating interest in modernizing the documentation process; the process has however never been completed, due to lack of technical capacity.

## Opportunities in the Cities Visited

*The existing and emerging opportunities identified at the national level (and previously described) have been tested in the ten cities visited, to assess their feasibility and applicability.*

### **Integrated plans**

Innovative mechanisms tested globally and nationally as well to improve land management can be applied by the ten cities to utilize and/or re-use encroached land for public infrastructures.

### **100 Smart Cities Program**

The recently announced 100 Smart Cities Program by the current national government is an encouraging opportunity for project cities to meet the benchmarks of providing efficient infrastructure with the optimal utilization of available local resources.

### **Green coverage strategies**

Recommendations in the URDPFI guidelines list percentages of coverage for various uses including green cover and open spaces. Most Master Plans follow these guidelines and should ensure reservation of land for these purposes.

- At the state level, state town and country planning departments fund the revision or preparation of Master Plans through in-house capacity or involving consultants. The city officials should approach them and avail of this opportunity.

## Barriers in the Cities Visited

*Many of the barriers previously outlined and potentially interfering with a Green Growth process at the national level have been encountered in the ten cities visited too.*





### ***Limited Technical Capacity***

The availability of information is critical for any plan or policy to be implemented and to be further revised; GIS (Geographical Information Systems) is one of the recommended tools for the collection and storage of such information. Very few cities have utilized the opportunity of setting up technical capacity through various central government programmes. Out of the ten cities visited, only Vijayawada, Pimpri Chinchwad and Cochin have technical capacity on GIS; however none of the cities' land use plans are currently interpreted in GIS.

### ***Lack of maintained records/documentation***

None of the cities have maintained documented accounts of the status of implementation of the Master Plan, variations, violations etc. None of the cities have attempted a review of the plan progress during the plan period.

### ***Lack of clarity of roles***

The majority of the cities' Master Plans do not clearly define roles and responsibilities, hindering its successful implementation.

## **Strategies for Green Growth in the Urban Land Use and Density Sector**

*Based on the analysis of the current state and future trends, and the assessment of the existing/emerging opportunities and corresponding barriers, a number of Green Growth strategies have been outlined, that will help cities overcome the barriers and fully leverage the existing opportunities. Cities can choose the combination of either of these strategies according to the applicability to the local context and to the target vision they are striving for. A prioritization of these strategies, for each city, can be found in Volume 2 of this report.*

### ***Undertake status analysis of existing development***

Cities should carry out a detailed status analysis of the current development within municipal limits and on the peripheries. This analysis should review the same against the plan and document violations or variations. Green Growth can only be planned on the basis of and with knowledge of the current status and emerging patterns.

### ***Map land use data on GIS platform***

Cities should document the current status of development and infrastructure provision on a GIS platform. The documentation should be at the property level and should map existing infrastructure lines and access points.

### ***Use advanced information systems for Master Planning and conduct periodic review***

Cities should develop a Master Plan in line with the URDPFI guidelines and state government town planning rules on a GIS platform, with a 20/25 year horizon and a 5 year phasing that is reviewed every 3 years and revised every 5 years, with the involvement of citizens. The plan should include green infrastructure planning based on future projections and financial feasibility information, and should be publicly available.



- **Promote compact and mixed use development:** Mixed used development using principles of transit oriented development should be promoted in cities to encourage high density along the major transit corridors, in order to minimize travel demand and reduce private vehicle ownership while promoting green growth based economic activities.

- **Identify strategic and important areas:** Cities should identify areas that need to be conserved for historical, environmental relevance and areas that need to be redeveloped, to promote green industries and employment opportunities in the city.

- **Ensure active participation of key private players and stakeholders with clearly defined roles and responsibilities:** Cities should partner with local builders, real estate companies and other private players to help implement the Master Plan. Roles and responsibilities for developing and enforcing the Master Plan should be clearly identified and agreed upon for all stakeholders such as local governments, institutions, private sector and citizens.



### 4.2.3 Urban Ecosystem and Biodiversity Sector and Green Growth

#### Introduction

An ecosystem includes all living things (plants, animals and organisms) in a given area, interacting with each other, and with their non-living environment. Biodiversity is the term used to describe the variety of life found on Earth and all of the natural processes. This includes ecosystems, genetic and cultural diversity, and the connections between these and all species. Urban ecosystems and biodiversity are important as a measure of quality of life in urban areas.

Even though the urban ecosystem and biodiversity is an overarching sector, there has been little focus on this until now. However, emerging trends in Indian cities show the need to change this approach, as rising urban pollution is reaching levels that severely impact human population. Applying Green Growth measures to this sector will make Indian cities more livable.



THERE HAS BEEN VERY LITTLE FOCUS ON BIODIVERSITY IN URBAN AREAS



## Sector Growth Story

Analyzing the **current status** of the urban Ecosystem and Biodiversity sector - including its present growth as well as prevailing policies and practices, evaluating the expected **future growth trends** and identifying the **main actors** who can support a transition to Green Growth - helps develop an accurate picture of the starting point of a city's Green Growth process.

India is one of the 17 identified mega diverse countries of the world with 7-8% of the recorded species, including 45,500 species of plants and 91,000 species of animals<sup>5</sup> ; the country is currently facing high rates of biodiversity loss because of uncontrolled urbanization, horizontal expansion of land, lack of urban planning framework, poor service delivery and high levels of air and water pollution from transport and industrial sectors. Noting such a great loss in urban biodiversity, the Government of India has initiated the State of the Environment (SoE) reporting in the 10th Five Year Plan to mainstream environmental monitoring in policy and decision making.

Over the years, observing that little is happening to protect biodiversity at the urban level - other than conserving wildlife sanctuaries, establishing bio-diversity parks and planting different species in and around the cities - the National Biodiversity Authority (NBA) was established in 2003 to implement India's Biological Diversity Act (2002)<sup>6</sup> . State Biodiversity Boards and Biodiversity Management Committees (BMCs) were formed later under NBA to guide the state governments and urban local bodies on matters relating to the conservation of biodiversity, sustainable use of its components and equitable sharing of the benefits arising out of the utilization of biological resources. The Government of India has formulated several schemes at the national level on pollution abatement and biodiversity conservation and habitat management during the 11th Five Year Plan - such as the National Ganga River Basin Authority, National Green Tribunal, and Wildlife Protection Act of 1972 - to be implemented with the support/involvement of State Biodiversity Boards and Urban Local Bodies<sup>7</sup>.



BANGALORE IS KNOWN AS THE GARDEN CITY OF THE COUNTRY FOR ITS WELL PRESERVED PARKS AND OPEN SPACES

<sup>5</sup>Ministry of Environment and Forests, Government of India, 'State of Environment Report-India 2009'.

<sup>6</sup>National Biodiversity Authority: <http://nbaindia.org/content/16/14/1/introduction.html>

<sup>7</sup>Ministry of Environment and Forests, Government of India, 'India's Fourth National Report to the Convention on Biological Diversity', 2009.



In addition to the above mentioned targets, the GoI has also taken up several initiatives during the 12th Five Year Plan, such as recasting the scheme of common effluent treatment plants (CETPs); Enhancement of Sewage Treatment Capacity; National Plan for Conservation of Aquatic Eco Systems (NPCA); National Environmental Monitoring Programme; National Forestry Information System; Invasive Species Management; Coastal and Marine Conservation; Valuation of Ecosystem Services and Biodiversity; Environmental Performance Index; Rangeland and Silvi Pasture Development Scheme; Satellite based Forest Resource Assessment; and Green India Mission.

India is also a party to the Convention on Biological Diversity (CBD), which calls upon all parties to prepare a national biodiversity strategy and action plans for the conservation and sustainable use of biological diversity. Accordingly, India has prepared its National Biodiversity Action Plan (NBAP) in consonance with the National Environment Policy, 2006.

### Actors Involved

At the central level the Ministry of Urban Development, Ministry of Environment and Forests, National Biodiversity Authority, National Horticulture Board, and Ministry of Agriculture are responsible for implementing Biodiversity Programmes and Schemes in India. No national policy covers urban ecosystems and biodiversity in India at present. The National Biodiversity Authority is an autonomous body that implements India's Biological Diversity Act (2002); the State Biodiversity Boards formed at the state level are responsible to advise state governments subject to guidelines issued by the Central Government. Other key responsible actors at the state level include State Agriculture Departments, and State Horticulture Departments.

There are no city-level biodiversity departments, but the district level Biodiversity Management Committees are being set up as per the Biological Diversity Act 2002. At the city level, the Environmental and Sanitation departments from city municipal corporations and municipalities are responsible for handling Urban Ecosystems and Biodiversity.

### Green Growth Visions

*The two visions below present an ideal scenario of how the Ecosystem and Biodiversity sector would appear in the future, had the city fulfilled or even exceeded all its development objectives. These visions, achieved either through a gradual, incremental process (efficient) or a more radical paradigm shift (transformative) become the ultimate Ecosystem and Biodiversity 'target' that cities should aim for.*

#### Efficient Green Growth Vision

A city where citizens are aware of the status and importance of local environment and biodiversity. With the involvement of citizens, the city maintains a documented status of the sector, has a plan in place and carries out a census and status review every three years. The city maintains greening guidelines and implements.

#### Transformative Green Growth Vision

A city with a local environment and biodiversity plan that has legal status and forms part of the Master Plan, and where the local environment is unpolluted and flora and fauna flourish in their natural surroundings with minimum disturbances; Maximum emission standards have been set up for vehicles and industries; local decentralized green energy generation is mandated for large consumers. The city has a green building code with minimum mandatory criteria for all buildings and maximum voluntary criteria.



## Green Growth Benefits

- Personal benefits include improved health and well-being, increase in sources of income generation from reserved crops, livestock and forestry.
- Community benefits include protection of water resources; healthy ecosystems; promotion of natural balance, decreased pollution; climate stability, etc.
- National/Global benefits include contribution to climate stability; controlled global warming; recovery from unpredictable events like floods and cyclones; pollution breakdown; promotion of economic development of the country; nutrient storage and recycling; protection of water resources; maintenance of ecosystems; protection of natural habitats; promotion of breeding stocks, promotion of recreation, tourism, cultural, spiritual and aesthetic values, etc.

## Options and Opportunities

*Through the analysis of the Ecosystem and Biodiversity sector, undertaken to assess its “Current Status” and “Growth Trends”, a number of existing or emerging options and opportunities have emerged. These can be used and leveraged by cities to accelerate the transition to their targeted Green Growth vision. These opportunities are listed below.*

- The Government of India has undertaken strong legal, policy and participatory measures to develop the sector in India, such as Biological Diversity Act, 2002, National Wildlife Action Plan (NWAP – 2002-2016), National Environment Policy (NEP – 2006), National Biodiversity Action Plan (NBAP – 2008), and National Action Plan on Climate Change (NAPCC – 2008)<sup>8</sup>.
- State governments and cities have several opportunities to strengthen the sector in their regions by availing and participating in projects and programs run by the Ministry of Environment and Forests (MoEF) every year as per the funds available. MoEF has been allocated an outlay of INR 1,787.4 million during the 12th Five Year Plan towards achieving 13 monitorable socio-economic targets for the ministry. The major initiatives taken with respect to Ecosystem and Biodiversity during the 12th Five Year Plan include restoring 0.1 million hectares of wetlands/inland lakes/water bodies by 2017 and mapping and preparing biodiversity management plans for deserts (both cold and arid), coastal areas, important core zones, wetlands, mangroves and so on to be completed by 2017.
- In addition to the budget allocated by MoEF, all states and union territories also allocate 1% to 13.5% of their budgets for expenditure on the environment every year.
- State governments and urban local bodies have several opportunities to participate in biodiversity programs run by different ministries/departments of the Central Government, in addition to MoEF, such as Ministry of Urban Development, Ministry of Earth Sciences, and Department of Agriculture, Department of Animal Husbandry, Department of Agricultural Research, Department of Ayurveda, Yoga, Unani, Siddha and Homeopathy. These departments also release funds for the development of the sector every year. The recent available information reveals that these departments have funded around INR. 10687.1 million on biodiversity during 2010-2011.
- Cities have the opportunity to avail the scheme “Environmental Education, Awareness and Training (EEAT)” initiated by MoEF that enhances and develops capabilities/skills among the public to improve and protect the environment.



- Cities can take advantage of Corporate Social Responsibility (CSR) obligations of businesses to develop biodiversity action plans with the support of private actors.
- State governments, urban local bodies and communities at large have the opportunity to leverage the Capacity 21 initiative being implemented by the Indira Gandhi Institute for Development Research (IGIDR) through the Ministry of Environment and Forests. The main objective of the programme is to build capacity on air quality, water quality and biodiversity.



*IN THE ABSENCE OF STRINGENT ENFORCEMENT, INDUSTRIES ARE POLLUTING WATER BODIES IN MOST CITIES*

<sup>8</sup>Report on Assessment of Funding support for Biodiversity Conservation in India: <https://www.cbd.int/financial/doc/india-assessment-funding-support-en.pdf>



## Barriers

*Evaluating the current and future trends of the Ecosystem and Biodiversity sector led to the identification of barriers that already are or could in the future hinder or even prevent cities from seizing the opportunities listed above, thus precluding a transition to Green Growth. These barriers are listed below.*

- Absence of national guidance on city action plans for improving urban biodiversity and ecology.
- Absence of effective policies, governance and institutional mechanisms at the national, state and city level for addressing urban biodiversity and climate change issues.
- No clarity of appropriate authority or official responsible for this sector; the horticulture department at the city level generally deals with urban greening but their responsibility is limited to plantation and maintenance of trees.
- Inefficient capacity of institutions that are directly involved in the implementation of the Biological Diversity Act at all levels, such as Biodiversity Management committees, State Biodiversity Boards, and the National Biodiversity Authority.
- Lack of documentation of the state of environment and biodiversity. Delhi is the only city in India that formally acknowledged the loss of house sparrow in the city and developed an action plan to protect it at the state level.
- Absence of city-level database that record the species name and provide information on the current utilization patterns of biodiversity, and its economic benefits to the local communities.
- Under-utilization of CSR measures as an instrument to protect biodiversity. In addition, very often for the corporate sector the idea of biodiversity conservation is limited to plantation of trees.
- Limited understanding about Indian biodiversity issues, inaccessibility of resources to acquire knowledge on the consequences of biodiversity loss, and unavailability of tools that foster community participation in biodiversity.





## Review of the Cities Visited

The following sections present the results of the analysis of the ten cities, carried out applying once again the Framework developed in chapter 3.

The table below provides a comparative overview of the status, barriers and opportunities for the Ecosystem and Biodiversity sector across all the ten cities. The comparative analysis is done through relevant indicators, identified by the team (based on desk research and brainstorming sessions) and further developed to undertake the interviews and data collection during the city assessment visits. The analysis, driven by elements of the Framework, enables to test and validate the background (theoretical) sectoral hypotheses and develop sector specific green growth strategies on this basis.

Cities	Agartala	Agra	Dehradun	Cochin	Kota	Ludhiana	Nadiad	Pimpri Chinchwad	Shimla	Vijayawada
<b>Status and Trends</b>										
Air pollution <sup>9</sup> (SO <sub>2</sub> , NO <sub>2</sub> , PM <sub>10</sub> )	NA	Low, Medium, Critical	Critical, Medium, Critical	Low, Low, Critical	Low, Medium, Critical	Low, Medium, Critical	NA	Low, Critical, Critical <sup>10</sup>	Low, Low, Moderate	Low, Low, Critical
Pollution of surface water bodies	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pollution of Ground water (GW quality) <sup>11,12</sup>	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Number of ambient air quality monitoring stations <sup>13</sup>	2	6	3	7	3	4	N.A.	2	2	3
Presence of surface water quality monitoring stations in the city	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

<sup>9</sup>Central Pollution Control Board, Ministry of Environment and Forest, Government of India, 'National ambient air quality status & trends in India-2010', 2012.

<sup>10</sup>Pimpri Chinchwad Municipal Corporation, 'Draft Copy-Environmental Status Report: 2012-2013', 2013

<sup>11</sup>Central Pollution Control Board, Ministry of Environment and Forest, Government of India, 'Status of Groundwater Quality in India: Part-I', Ground water quality series: GWQS/ 09/2006-2007, 2007.

<sup>12</sup>Central Ground Water Board, Ministry of Water Resource, Government of India, 'Ground Water Scenarios in Major Cities of India', 2011.

<sup>13</sup>National Ambient Air Quality Status & Trends in India-2010. Environmental Information System: <http://cpcbenviis.nic.in/airpollution/monetoring.htm>.



Cities	Agartala	Agra	Dehradun	Cochin	Kota	Ludhiana	Nadiad	Pimpri Chinchwad	Shimla	Vijayawada
<b>Opportunities</b>										
City specific Action Plan	No	No	No	No	No	No	No	Partial <sup>14</sup>	No	No
Establishing Biodiversity Management Committees	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Barriers</b>										
Presence of dedicated cell for Environment and Biodiversity in ULB	No	No	No	No	No	No	No	Partial <sup>16</sup>	No	No
Availability of city level biodiversity status report	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Availability of city level environment status report	No	No	No	No	No	No	No	Yes	No	No

<sup>14</sup>The Environmental status report recommends actions for improving urban environment and biodiversity but lacks a comprehensive action plan.

<sup>15</sup>Central Pollution Control Board, Ministry of Environment and Forest, 'Status of Groundwater Quality In India: Part -I', Ground water quality series: GWQS/09/2006-2007, 2007.

<sup>16</sup>The Environment engineering department present in the ULB focuses primarily on urban services such as wastewater treatment, municipal solid waste management and pollution impacts thereof and not as much on urban biodiversity.



## Status and Trends in the Cities Visited

*The analysis of the current status and observed trends in the ten cities is needed to establish the initial benchmark from which the Green Growth process will be started.*

- **Air pollution:** The existing air quality monitoring stations in the cities test and record air pollutants like SO<sub>2</sub>, NO<sub>2</sub>, PM<sub>10</sub>, etc. Air pollution is very high in all cities, with Deharadun and Pimpri Chinchwad having the worst air quality.
- **Surface water and ground water quality monitoring systems:** Data related to surface and ground water quality monitoring systems is not available for all cities.
- **Presence of ambient air quality monitoring stations:** Agra and Cochin have 6 and 7 air quality monitoring stations respectively; the other cities have between two and four stations.
- No biodiversity departments or BMC's exist in these cities though some of the project cities are looking at biodiversity through their climate change and environment projects.

## Opportunities in the Cities Visited

The existing and emerging opportunities identified at the national level (and previously described) have been tested in the ten cities visited, to assess their feasibility and applicability.

- **City specific action plan:** Cities have the opportunity to develop their city specific action plan on the protection and enhancement of biodiversity. Some of the initiatives taken up by the cities to strengthen their ecosystem and biodiversity include controlling land degradation, declaring protected areas, monitoring and controlling air quality, addressing issues related to water supply and quality, handling hazardous wastes from industries and hospitals, addressing strategically concerns related to climate change, integrating biodiversity concerns in the Master Plans, developing biodiversity parks and educating citizen's and NGO's to understand the impacts of urbanization on the biodiversity.
- **Establishment of Biodiversity Management Committees:** BMC's will conserve the urban biodiversity as per the instructions from the National Biodiversity Authority. The established BMC's can utilize funds from international and non-governmental organizations like Global Environment Facility (GEF) and World Wildlife Fund (WWF) for biodiversity conservation activities, as well as financial contributions from private companies as Corporate Social Responsibility (CSR) to document, plan and protect local ecosystem and biodiversity.

## Barriers in the Cities Visited

*Many of the barriers previously outlined and potentially interfering with a Green Growth process at the national level have been encountered in the ten cities visited too. Additional barriers, specific to some of the cities, have emerged as well.*

- **City level environment and biodiversity status report:** There is no city level environment and biodiversity status report and city level biodiversity action plan available in any of the project cities because of the lack of Biodiversity Departments and Biodiversity Management Committees. Pimpri Chinchwad has an environment status report that recommends actions for improving urban environment and biodiversity, but lacks a comprehensive action plan.



- **Dedicated cell for environment and biodiversity:** There is no dedicated cell for environment and biodiversity in the project cities that analyses the ground situation, monitors and initiates projects to overcome the barriers obstructing the growth of the sector. The environment engineering department present in Pimpri Chinchwad focuses primarily on urban services such as waste water treatment, municipal solid waste management and pollution impacts and not as much on urban biodiversity.

### Strategies for Green Growth in Urban Ecosystem and Biodiversity Sector

*Based on the analysis of the current state and future trends, and the assessment of the existing/emerging opportunities and corresponding barriers, a number of Green Growth strategies have been outlined, that will help cities overcome the barriers and fully leverage the existing opportunities. Cities can choose the combination of either of these strategies according to the applicability to the local context and to the target vision they are striving for. For each city, a prioritization of these strategies can be found in Volume 2 of this report.*

- **Document the existing status** of environment and biodiversity in the city. Involve schools, citizens and private parties in this exercise and carry out awareness activities.
- **Declare a local policy** and include in the Master Planning process a mandatory three year review of the status of environment and biodiversity. Introduce environmental resource budgeting tools such as Eco Budget, developed by ICLEI – Local governments for Sustainability.
- **Develop a plan for maintaining the quality of the environment** and conserving local biodiversity in the city by including conservation, greening, pollution reduction and treatment projects.
- **Involve the community** to protect local biodiversity as a part of the city plan. Seek national government funding through the biodiversity action plans for community engagement related initiatives.
- **Promote** urban agriculture, green public spaces, urban forestry, river and lake conservation, plantation drives, green roofs in the city by involving private partners and providing incentives to citizens.



## 4.2.4 Urban Energy Sector and Green Growth



RENEWABLE ENERGY HAS TO PLAY A LARGER ROLE IN THE URBAN ENERGY MIX

### Introduction

Energy is a vital component of urban infrastructure and lifestyles. While cities account for only 2.35% of India's land area they account for about 80% of the country's electricity consumption. Energy in the form of electricity, oil and gas is an inescapable necessity to enable urban infrastructure development, be it water supply, sewerage network, transportation, construction, manufacturing, information and communication technology (ICT) or provision of social infrastructure to enhance quality of life<sup>17</sup>. Electricity and fossil fuels are the dominant forms of energy used in urban areas in India, while renewable energy (RE) sources are still underutilized.

The energy sector in India is set to undergo significant expansion and investments, mainly to power future urbanization and rising urban energy demand. This presents a significant opportunity to intervene and amend existing trends to realign the sector's growth on a green growth pathway.

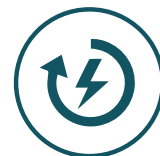
<sup>17</sup>Kalra P., Shekhar, R., 'Urban Energy Management', India Infrastructure Report, Oxford University Press, 2006.

<sup>18</sup>Primary energy comprises of commercially traded fuels including modern renewables used to generate electricity.

<sup>19</sup>British Petroleum, 'Statistical Review of World Energy', 2013.

<sup>20</sup>Badami, M., 'The Road Transport Energy Challenge in India 2010: <http://casi.sas.upenn.edu/iit/badami>.

<sup>21</sup>Ministry of Power, Government of India, 'Growth of Electricity Sector in India from 1947-2011', Central Electricity Authority (CEA), 2011.



## Sector Growth Story

Analyzing the **current status** of the Energy sector - including its present growth as well as prevailing policies and practices, evaluating the expected **future growth trends** and identifying the **main actors** who can support a transition to Green Growth helps develop an accurate picture of the starting point of a city's Green Growth process.

Energy demand in India has grown substantially over the years. Population rise, economic growth, increasing urbanization and higher electrification rates have led to a steep rise in primary energy consumption<sup>18</sup> in India, up from 200 million tonnes of oil equivalent (Mtoe) to 563 Mtoe over the last two decades<sup>19</sup>. Total power demand has grown three-fold, driven primarily by the residential, commercial and industrial sectors. The residential, industrial and road transportation sectors are the largest energy consumers in urban areas, accounting for over 80% of the total energy consumption<sup>20</sup>.

India's power supply has been traditionally dependent on fossil fuels. Although there has been an increasing emphasis on cleaner fuels in the last decade (such as natural gas and RE sources), coal continues to be the dominant energy source to meet energy requirements, accounting for nearly 55% of the country's energy supplies. To cater to the rising demand for energy, the electricity supply has been augmented substantially, up from 246,560 Giga watt hours (GWh) in 1990-91 to 788,355 GWh in 2010-11<sup>21</sup>. The augmentation in energy supply however has been unable to keep pace with the burgeoning energy demand, resulting in the country facing an overall power deficit of 8.7%. Power cuts are frequent, especially in smaller cities, necessitating the use of costly and polluting diesel powered generator sets. This is impacting industries and commercial establishments in particular by crippling business productivity.

The energy basket in Indian households is changing, with reduced dependence on traditional fuels such as firewood and kerosene. The share of urban households using LPG/PNG has more than doubled to 65% between 1993-94 and 2009-10. During the same time period, dependence on kerosene has plunged by 72%. Energy consumption and fuel choice in urban households are influenced by income, with preference for modern energy sources and higher energy consumption observed with increasing income levels<sup>22</sup>. A high urban electrification rate of 95% coupled with rising income has driven demand for energy to go beyond basic requirements such as lighting. Yet, India's per capita electricity consumption remains low at 780 kilowatt hour (kWh), a stark contrast to the per capita consumption figures of 12,000-15,000 kWh in developed countries<sup>23</sup>.

The Energy Conservation Act (2001), the Electricity Act (2003), New and Renewable Energy Policy (2005), Tariff Policy (2006), and the Petroleum and Natural Gas Regulatory Board Act (2006) are guiding policies at the national level. At the state level, policies, regulations, guidelines are formulated specific to the state context. No specific regulation or policies exist presently with regards to urban energy. There has been an increasing emphasis from the Government of India (GoI) towards initiatives such as the Solar Cities Programme, the National Mission on Enhanced Energy Efficiency (NMEEE) etc. along with efforts towards demand side management, RE implementation, green building schemes, and energy efficiency labelling and standards for products. Such efforts are however fragmented, falling well short of the potential and requiring considerable up-scaling.

With Indian cities estimated to contribute nearly 70% of the country's GDP by 2030, India is set to undergo massive urbanization with massive growth in urban population, infrastructure

<sup>22</sup>The World Bank, 'Energy Poverty in Rural and Urban India: Are the Energy Poor Also Poor?', Policy research working paper 5463, 2010

<sup>23</sup>FICCI, 'Lack of Affordable & Quality Power: Shackling India's Growth Story', 2012.

<sup>24</sup>McKinsey Global Institute, 'India's Urban Awakening: Building inclusive cities, sustaining economic growth', 2010.

<sup>25</sup>Office of the Scientific Adviser to the Government of India, TERI, 'National Energy Map for India: Technology Vision 2030', TERI Press, 2006.



and services, which in turn will propel demand for all types of energy in Indian cities<sup>24</sup>. Urban household energy requirement is projected to grow significantly across all key energy end-uses (see Table 2). Multi-fold rise in energy use is projected across all the major urban sectors viz. commercial, residential, industry and transport due to factors such as increased purchasing power, growing appliance sales for human comfort and entertainment, industrial expansion to cater to market demand, rising private vehicle ownership and urban sprawl<sup>25</sup>.

**Table 2: Projected Residential Energy Demand in Indian Urban Areas<sup>31</sup>**

End-use demand	2001	2011	2021	2031
Lighting (trillion lux hours)	33.8	57.6	89.0	118.0
Cooking energy (peta joules)	228.5	299.3	384.5	468.2
Water heating (peta joules)	5.8	14.5	40.3	75.8

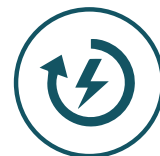
The targeted capacity addition in the power sector during the 12th and 13th Five Year Plan (FYP) (2012-22) is 218 GW. This requires a corresponding investment of INR 13,725 billion in the 12th FYP, with nearly 60% of this infrastructure expansion coming from fossil coal based power plants. The targeted additional RE based capacity is 48 GW, requiring an estimated investment of INR 3,500 billion.

### Actors Involved

The responsibilities in the Energy Sector in India are shared between Central and State Governments. Overall planning and decision-making rests with various ministries: Ministry of Power (MoP), Ministry of Petroleum and Natural Gas (MoPNG), Ministry of Coal and Ministry of New and Renewable Energy (MNRE). Institutions such as the Central Electricity Authority (CEA), Central Electricity Regulatory Commission (CERC), Power Finance Corporation Ltd. and Indian Renewable Energy Development Agency (IREDA) support specific aspects of planning, statutory technical standards, tariff regulation, financing with regards to power (electricity and RE). Institutions such as the Petroleum and Natural Gas Regulatory Board, the Directorate General of Hydrocarbons, and the Petroleum Planning and Analysis Cell support the MoPNG in various aspects of its functioning. The Bureau of Energy Efficiency (BEE) is a key institution driving energy conservation and efficiency in the sector.

At the state level, State Electricity Regulatory Commissions (SERCs) formulate retail tariffs and regulate operations of interstate electricity transmission. State nodal agencies and energy departments are responsible for planning, policy making and implementation of MNRE programmes for the states. State owned companies/utilities and private sector players are involved in generation, transmission and distribution of electricity. With regards to oil and gas products, public sector undertakings and private and joint venture companies are involved in activities of exploration, production, processing and distribution. Under the Solar Cities Programme, solar city cells have been established in a few cities to undertake planning and implementation of projects and promote RE and energy efficiency (EE)<sup>26</sup>.

<sup>26</sup>The Solar Cities Programme, initiated by the Ministry of New and RE (MNRE), GoI in 2008, intends to develop 60 Solar Cities across India, targeting a minimum of 10% reduction in fossil energy demand in each city through renewable energy and energy efficiency measures. The programme provides financial and technical support to cities for the preparation of detailed Master Plans, including assessing the current energy situation, future demand and action plans for implementation, setting up a solar city cell to oversee implementation and for promotional activities, building capacity in ULBs and creating awareness in the community.



## Green Growth Visions

*The two visions below present an ideal scenario of how the Energy sector would appear in the future, had the city fulfilled or even exceeded all its development objectives. These visions, achieved either through a gradual, incremental process (efficient) or a more radical paradigm shift (transformative) become the ultimate Energy 'target' that cities should aim for.*

### Efficient Green Growth

A city providing access to reliable power for all its citizens and having minimum energy losses. This is achieved through high quality power transmission and distribution infrastructure such as utility lines and poles, which are well designed and laid out to be in sync with the city's architectural design and aesthetics. High emphasis is placed on reducing energy use by residential, commercial, institutional and industrial users; achieved through policy mechanisms, energy efficiency programmes and financial incentive schemes. Mandatory energy performance standards/guidelines are in place to regulate energy use in commercial buildings (of a certain size) and in all public buildings, well complemented by fiscal incentives such as tax rebates for achieving low energy bills. All the local government facilities for urban services such as water supply, wastewater treatment and street lighting use highly energy efficient (EE) technologies and equipment. Voluntary programmes are in place for conducting energy audits and equipment retrofit across public and private sectors. Small scale RE systems such as solar public lighting, solar water heating systems, solar photovoltaic systems, family scale biogas plants and micro hybrid solar-wind systems exist at various locations in the city; triggered by fiscal incentives/financial assistance offered for RE applications above a certain size. Use of rooftop solar water heating systems is mandatory in the major building types within the city limits. Efficient cook stoves, disseminated through distribution programmes, are used in all the low income households and all heating requirements are met by CNG and LPG, with use of kerosene and fuel wood in a polluting manner near absent.

### Transformative Green Growth

A city with a stable uninterrupted 24x7 energy supply which maximizes the use of locally available clean energy sources (renewables as well as waste) leading to a high degree of self-sufficiency for energy supply. An extensive and well-designed decentralized energy network exists across the city, connecting multiple small scale decentralized RE based systems which supply power to neighbourhoods, industrial clusters, business districts and commercial centers in the city; triggered by fiscal incentives/financial assistance offered for RE applications of all commercially available sizes. This energy network uses smart grid technologies with intelligent communication, metering and control functions at the energy supply side and at the point of energy use. The smart technology optimizes the local energy supply through accurate weather and energy generation forecasting capabilities, giving priority to use of local RE sources before any power import from the national grid, and allowing for bidirectional energy flow to enable energy storage and its use during periods of high energy demand. Smart meters and controls are installed in homes and buildings to optimize energy use at the consumer end by turning off or regulating temperatures in appliances such as air conditioners, refrigerators to reduce peak load demand and high peak power costs to consumers while also enabling consumers to sell any excess renewable power generated in their premises to the local grid. Energy demand is offset further by city-wide uptake of EE technologies and micro scale RE systems and is well complemented by an energy conscious community. Energy cap and trade programmes regulate energy use in





large commercial buildings and industrial premises and allow for exchange and sale of stored energy between users. All the heating requirements in the city are met through a well laid out natural gas distribution network which ensures clean, safe, reliable, hassle-free gas supply for the community. A strong local green energy industry base exists in the city, spurred by well-designed fiscal incentive schemes and policies for promoting development of industries specializing in RE and EE technologies.

### Green Growth Benefits

Introducing green growth in the energy sector has numerous benefits that span the city community, individuals as well as at the national/global level.

- **Personal benefits include:** reduced indoor and outdoor air pollution; improved health and well-being; reduced expenditure on energy; increased disposable income.
- **Community benefits include:** increased productivity and competitiveness; improved public health; lower local environmental degradation; job creation; reliable and uninterrupted power supply.
- **National/global benefits include:** reduced public expenditure and energy import bill; minimized fossil fuel use; reduced energy losses; contribution to meeting millennium development goals; improved energy security; better climate resilience; lower GHG emission; natural resource conservation; climate change mitigation.



IMPROVED POWER TRANSMISSION AND DISTRIBUTION INFRASTRUCTURE CAN HELP TO MINIMISE POWER LOSSES



## Options and Opportunities

*Through the analysis of the Energy sector, undertaken to assess its “Current Status” and “Growth Trends”, a number of existing or emerging options and opportunities have emerged. These can be used and leveraged by cities to accelerate the transition to their targeted Green Growth vision. These opportunities are listed below.*

- The Solar Cities Programme aims to empower local governments in India to address energy challenges in urban areas by providing support to ULBs for the preparation and implementation of a detailed Master Plan to promote and implement RE and EE applications.
- The Bureau of Energy Efficiency (BEE) promotes roll out of state-wide municipal demand side management programmes in states such as Gujarat, targeting energy reduction in municipal services such as street lighting, water pumping, and sewage treatment facilities.
- Financial incentives and subsidies are offered by the MNRE and at the State level through various schemes for decentralized small scale RE applications, such as solar water heating systems, grid connected solar photovoltaic rooftop systems, solar cookers, solar home lighting systems, solar lanterns, solar street lights, biogas plants, small wind turbines etc.
- Financing schemes such as those provided by the Small Industries Development Bank of India (SIDBI) for micro/small industries or by the National Government for technology upgradation/modernization in textile, tanneries, and food processing sectors can support industrial RE/EE projects and help improve industrial energy performance. Mechanisms such as State Energy Conservation Funds can help access loans to implement RE/EE projects.
- Energy Service Companies (ESCOs) offer opportunities to implement energy efficiency projects in municipal services, buildings and industries by arranging for project financing and guaranteeing energy savings through performance based contracts.
- Many power supply companies offer EE appliances to consumers at discounted prices to help reduce the peak energy demand that they have to cater to.
- National policies such as the Industrial Policy in India promote private sector investment in the domestic RE industry through enabling incentives such as non-requirement of industrial clearance, tax holidays, soft loans, concessions custom/excise duty.

## Barriers

Evaluating the current and future trends of the Energy sector led to the identification of barriers that already are or could in the future hinder or even prevent cities from seizing the opportunities listed above, thus precluding a transition to Green Growth. These barriers are listed below.

- Limited role of ULBs in the energy sector with governance, planning and decision making resting with the National and State Governments.
- Lack of capacity in ULBs to monitor energy consumption and project future energy requirements, let alone undertake strategic planning to tackle projected energy shortages. ULBs also lack capacity to administer any financial incentives schemes or regulatory programmes. Emphasis on energy management in municipal budgets is low.
- Relatively higher capital cost of EE equipment and technologies. Low acceptance of RE systems due to issues of high capital costs, irregular resource availability (solar, wind,



biomass resource) affecting reliability of energy supply, and a lack of effective commercial scale energy storage technologies.

- Success of ESCO projects hampered due to issues in performance contracts, lack of robust measurement and verification protocols, limited capacity of ULBs, and absence of effective mechanisms for dispute resolution.
- Subsidized power tariffs for agriculture and low income households leads to levy of higher power charges on industries and commercial establishments. This displaces high energy costs across sectors and inhibits energy conservation potential in certain sectors.
- Lack of skilled personnel, poor knowledge base, low community awareness with regards to RE and EE solutions.

### **Review of the Cities Visited**

*The following sections present the results of the analysis of the ten cities, carried out applying once again the Framework developed in chapter 3.*

*The table below provides a comparative overview of the status, barriers and opportunities for the Energy sector across all the ten cities. The comparative analysis is done through relevant indicators, identified by the team (based on desk research and brainstorming sessions) and further developed to undertake the interviews and data collection during the city assessment visits. The analysis, driven by elements of the Framework, enables to test and validate the background (theoretical) sectoral hypotheses and develop sector specific green growth strategies on this basis.*



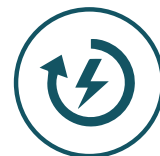
Cities	Agartala	Agra	Dehradun	Cochin	Kota	Ludhiana	Nadiad	Pimpri Chinchwad	Shimla	Vijayawada
<b>Status and Trends</b>										
Frequent power cuts	No	Yes	Yes	No	No	Yes	No	No	Yes	No
Energy demand growth rate	NA <sup>27</sup>	High	High	Moderate	Moderate	Moderate	NA	High	High	NA
Residential use of traditional energy sources <sup>28</sup>	Low	High	High	Low	High	High	Low	Low	High	Low
Dependence on conventional power <sup>29</sup>	High	High	High	High	High	High	High	High	High	High
Energy/Solar Master Plan for city <sup>30</sup>	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	Yes
<b>Opportunities</b>										
Implementation of Energy/Solar Master Plan	No	No	No	No	No	No	No	No	Poor	Fair
RE regulation in by-laws or D.C. Rules/Green building schemes	Yes	No	Yes	No	No	Yes	No	Yes	Yes	Yes
<b>Barriers</b>										
Energy monitoring systems at ULB	NA	No	No	NA	No	No	No	Partial	No	NA
Energy/Solar cell within ULB	Yes	No	No	No	No	Yes	No	Yes	Yes	Yes

<sup>27</sup>N.A. denotes information not available.

<sup>28</sup>Low: less than 20%. High: equal to/greater than 20%.

<sup>29</sup>High: share of conventional power more than 95%.

<sup>30</sup>The Solar Master Plan for Cochin is currently under preparation; the Solar Master Plans for Dehradun and Ludhiana have been prepared but submission to the MNRE for final approval is pending.



## Status and Trends in the Cities Visited

*The analysis of the current status and observed trends in the ten cities is needed to establish the initial benchmark from which the Green Growth process will be started.*

- **Frequent power cuts:** Due to the energy deficit at the national level and preferential power supply to agricultural sector and large metro cities, Indian cities rarely enjoy continuous power availability throughout the year. The cities of Kota and Vijayawada have near uninterrupted power supply due to the presence of power stations in their vicinity while frequency of power cuts is quite low in Agartala, Cochin, Nadiad, and Pimpri Chinchwad. Reliable power supply is an issue in the remaining cities with Agra and Ludhiana facing serious issues in power availability.
- **Energy demand growth rate:** Energy demand is growing significantly in the project cities, in concurrence with the high growth and development that these cities are witnessing. Energy use is rising rapidly in the cities of Agra, Dehradun, Pimpri Chinchwad and Shimla.
- **Residential use of traditional energy sources:** Significant proportion of households in Agra, Dehradun, Kota, Ludhiana, and Shimla are reliant on traditional fuels such as kerosene and fuel wood for cooking and water heating. Other than Ludhiana, fuel wood is used more than kerosene in the households in these five cities. Most of the households in the remaining five cities have shifted to cleaner LPG and PNG fuel, with Nadiad and Agartala leading the way.
- **Dependence on conventional power:** All the cities are almost entirely dependent on conventional grid connected power to meet their energy demand and the number of functional RE systems is miniscule.
- **Presence of PNG network:** A city-wide PNG network can meet thermal energy requirements in households, commercial establishments, institutions, and industries in a clean, reliable and hassle-free manner. PNG supply exists to varying extent (with regards to physical coverage, type of consumers, and number of connections) in the cities of Agartala, Cochin, Kota, Pimpri Chinchwad and Vijayawada; although none of these cities have a city-wide gas network. The remaining five cities are yet to have an operational PNG network, with laying of a pipeline network supplying PNG particularly difficult in the case of Shimla due to the topography.

## Opportunities in the Cities Visited

*The existing and emerging opportunities identified at the national level (and previously described) have been tested in the ten cities visited, to assess their feasibility and applicability.*

- **Energy/Solar Master Plan:** A RE or Solar Master Plan is the first step for cities to assess current and future energy demand and undertake strategic planning for promoting and implementing green interventions to reduce energy demand. Although seven of the cities viz. Agartala, Agra, Cochin, Dehradun, Ludhiana, Shimla, and Vijayawada have developed or are in the process of developing Master Plans under the Solar Cities Programme, the implementation of these plans has been highly unsatisfactory across all these cities. Kota has been engaged in efforts for its inclusion under the Solar Cities Programme and Pimpri Chinchwad is presently working with developmental agencies on the agenda of low emission development.



- **RE regulation in by-laws or D.C. Rules/Green building schemes:** Notifications/incentives for RE technologies such as solar water heating systems exist in building by-laws or development control regulations in the cities of Agartala, Dehradun, Ludhiana, Pimpri Chinchwad for different building types and sizes. The GRIHA-Green Building Rating System implemented by Pimpri Chinchwad to promote efficient design and RE integration in buildings by offering incentives to both building developers and home owners is noteworthy.

## Barriers in the Cities Visited

*Many of the barriers previously outlined and potentially interfering with a Green Growth process at the national level were also encountered in the ten cities visited during the project. Additional barriers, specific to some of the cities, have emerged as well.*

- **Energy monitoring systems at ULB:** All the cities lack adequate monitoring systems to track the energy performance of all municipal facilities, let alone recording city wide energy use. While Pimpri Chinchwad has established a central monitoring system to track the energy consumption in its municipal services, the system does not cover all its facilities/buildings.

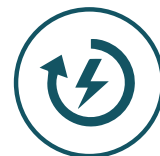
- **Energy/Solar Cell within ULB:** A dedicated Solar Cell has been established only in the cities of Agartala, Ludhiana, Shimla and Vijayawada while Agra, Dehradun and Cochin lack a Solar Cell, which is a pre-requisite to build adequate capacity within the ULB for Master Plan implementation and conduct awareness/promotional activities under the Solar Cities Programme. In cities where the Solar Cell exists, it is under-staffed and lacking requisite expertise to undertake proposed activities. The lack of municipal capacity has clearly hampered implementation of the Solar Master Plans. Of the remaining three cities of Agra, Nadiad and Pimpri Chinchwad, only the latter has dedicated staff for energy conservation.

## Strategies for Green Growth in Urban Energy Sector

*Based on the analysis of the current state and future trends, and the assessment of the existing/emerging opportunities and corresponding barriers, a number of Green Growth strategies have been outlined, that will help cities overcome the barriers and fully leverage the existing opportunities. Cities can choose the combination of either of these strategies according to the applicability to the local context and to the target vision they are striving for. For each city, a prioritization of these strategies can be found in Volume 2 of this report.*

- **Promote energy audits and energy performance standards:** A city should ensure optimal energy use by promoting periodic energy audits for key sectors/energy end users to help establish their baseline energy consumption and also to encourage uptake of RE and EE interventions in identified areas. The baseline energy data can feed into energy performance standards which are set up across sectors/energy end users to regulate their energy use. The promotion can be achieved through mandatory regulations or by offering fiscal incentives.

- **Promote EE appliances and technologies:** EE appliances should be promoted in commercial establishments, residential & commercial buildings, industries, Government/institutional buildings, municipal facilities, educational campuses, low income housing schemes, slum settlement to reduce energy demand in the city. This could be achieved through incentive schemes, policy mandates integrated in building by-laws/building approval process, appliance retrofit programmes undertaken by ESCOs and power supply companies, etc.



- **Promote green energy systems:** Promoting small scale and cluster scale decentralized RE systems can reduce energy demand, replace fossil fuels and enhance energy generation capabilities of a city. Incentive schemes and mandatory regulations can help promote small scale RE applications such as solar water heaters, solar cookers, solar PV systems, small wind turbines, solar lighting, solar hoardings across major building/land use types as applicable. Fiscal incentives/subsidies (capital cost and energy generation based) for decentralized RE systems of a larger size can support other policy/regulatory mechanisms to stimulate their use in industrial estates, commercial clusters, IT parks, group housing complexes.

- **Promote clean green fuels:** Use of clean fuels such as natural gas to meet thermal energy demand in households, institutions, hotels, hospitals, school, municipal canteens, industries can be promoted through enabling fiscal benefits, improved infrastructure, fast track clearances etc. Improved cook stoves and biogas plants should be promoted in cities where significant biomass potential exists.

- **Establish Energy Cell for the city:** The city should set up a well-equipped Energy Cell having dedicated staff with strong expertise in areas such as strategic energy planning, conducting energy audits, developing feasible project proposals, RE/EE implementation, energy modeling & forecasting, and programme implementation. The Energy Cell should be in charge of development and implementation of energy Master Plan, establishment of energy monitoring and recording systems/protocols, promotional/awareness generation activities, disbursement of subsidies/soft loans for RE/EE applications, and co-ordination between municipal departments, state nodal agencies, and Central Government agencies to develop and implement plans/programmes.

- **Undertake awareness generation on RE/EE:** The city should place a high priority on generating awareness through resource centres, energy parks, demonstration centres, exhibitions, publicity campaigns, print media, educational programmes, workshops; targeting specific stakeholder groups such as school children, youth, citizens, municipal staff, policy makers, businesses, industries etc.

- **Promote local knowledge base and green energy industry:** Creation of local industry base and expertise can help cater to increased market demand for RE/EE technologies and services (resulting from enabling strategies/programmes in the city) and create green jobs. Options such as tax cuts, accelerated depreciation, import duty reductions, financial incentives for undertaking green energy research, and training and certification courses can help to this end.

- **Incorporate urban energy into city Master Planning process:** The city should stress on incorporating urban energy into the overall urban development/Master Planning process and ensure its integration into infrastructure, services and physical form at the urban scale. This would trigger improved emphasis on urban energy management in local government budgets.



## 4.2.5 Urban Economy and Business and Green Growth

### Introduction

Economic growth and urbanization are often linked together. Cities are the driving force for economic development; at the same time, economic growth stimulates urbanization. However, despite this close link, local economy is never considered a part of a city's Development Plan.

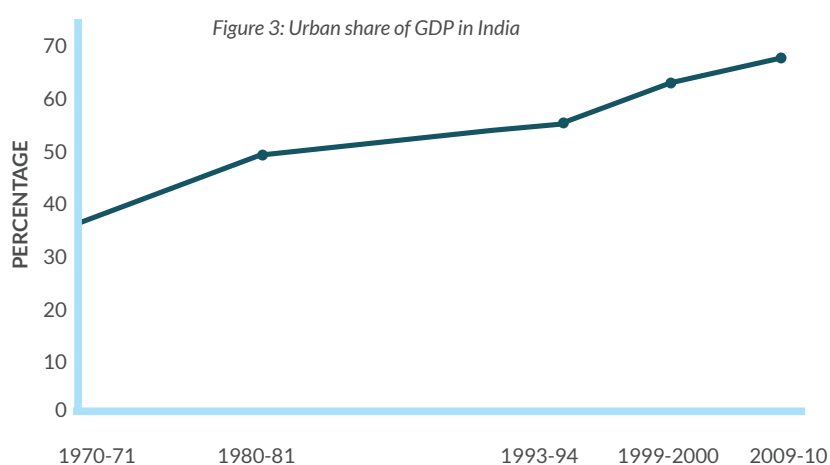
Urban economy is focused on promoting urban strategies and policies that strengthen the capacity of cities to realize their full potential as drivers of economic development, and of wealth and employment creation. However, the lack of economy-related data at the city level - normally centralized at the district and state level - represents one of the main challenges for Indian cities to develop appropriate interventions to scale up the sector.

### Sector Growth Story

Analyzing the **current status** of the Economy and Business sector - including its present growth as well as prevailing policies and practices, evaluating the expected future growth trends and identifying the main actors who can support a transition to Green Growth helps develop an accurate picture of the starting point of a city's Green Growth process.

Commerce and business in Indian cities are regulated by national and state policy. In line with these, large industries are generally located outside the municipal boundaries in state developed industrial parks or Special economy Zones (SEZs), while only few traditional ones exist within the city itself, and consist mainly of small households, and small and medium industries. Industry's economic output is thus generally concentrated in districts that host some of the largest cities, across most economic sectors.

India has recorded an impressive GDP growth of an average of 8% during the 11th Five Year Plan period (2007-12). A substantial part of this growth is attributed to the considerable urban sector performance: current data on the urban share of the GDP for the Indian economy is not available on a regular and consistent basis, but estimates by the Central Statistical Office (CSO) indicated that this share increased from 37.7% in 1970-71 to 52% in 2004-2005. The midterm appraisal of the Eleventh Plan had projected the urban share of GDP at 62-63% in 2009-10<sup>31</sup>.



Source: HPEC report on Urban Infrastructure in India

<sup>31</sup>Planning Commission, 'Economic Sectors: 12th Five Year Plan (2012-2017)', Volume II, SAGE Publications, 2013.





The HPEC report<sup>32</sup> states that “higher levels of per capita income are associated with higher levels of urbanization” across Indian states, and predicts that the urban share of GDP will “increase to 75% in 2030”. As per the Indian Institute of Human Settlements, the top 100 largest cities alone are estimated to produce about 43% of India’s GDP<sup>33</sup>. According to the McKinsey report<sup>34</sup> on the state of urbanization in India, “cities could generate 70% of net new jobs created by year 2030, produce more than 70% of Indian GDP and drive a near four-fold increase in per capita incomes across the nation”.

## Actors Involved

District and Municipal Administrations - including Development authorities - are the key actors overseeing this urban sector. Though urban local bodies are responsible for issuing trade and food licenses, they are highly unaware of how they could facilitate business in the city or what trade activities they should restrict and why. Since commerce and industries are considered important for financial reasons, state governments have retained their control. The Ministry of Commerce and Industries at the national level, and the Commissionerates/ Directorates of industries as well as Industrial Corporations at the state level, are responsible for the promotion of specific trade/commerce activities.

## Green Growth Visions

*The two visions below present an ideal scenario of how the Economy and Business sector would appear in the future, had the city fulfilled or even exceeded all its development objectives. These visions, achieved either through a gradual, incremental process (efficient) or a more radical paradigm shift (transformative) become the ultimate Economy and Business ‘target’ that cities should aim for.*

### Efficient Green Growth

A city with ample business opportunities, where businesses utilize minimal resources and work with advanced efficient technology. Economic development is based on efficient, clean and renewable energy sources. The City Plan for local economic development is focused on capacity development of the youth to improve productivity of existing economic sectors.

### Transformative Green Growth

A city with an economy that is productive and socially inclusive and aims to improve human wellbeing and local natural resource use while reducing costs, ecological scarcities and environmental risks. A city where business opportunities are promoted while improving the quality of life for its citizens, based on locally available skills and resources so as to achieve a vibrant, safe and environment friendly city. The economic plan looks at development activities and taxation policies to encourage green businesses, and is part of the city’s legal Master Plan.

<sup>32</sup>High Powered Expert Committee (HPEC) for Estimating the Investment Requirements for Urban Infrastructure Services, ‘Report on Indian Urban Infrastructure and Services’, March 2011.

<sup>33</sup>Urban India 2011: Evidence, IIHS, Autumn Worldwide.

<sup>34</sup>‘India’s Urban Awakening: Building Inclusive Cities, Sustaining Economic Growth’, published by McKinsey Global Institute, 2010.



## Green Growth Benefits

- **Personal benefits include:** improved quality of life; increased business and job opportunities; increased per capita income.
- **Community benefits include:** increased productivity and competitiveness; improved public health; lower local environmental degradation; job creation; better quality of life; local employment opportunities for the youth and reduce job-search related migration.
- **National/global benefits include:** long-term sustainable growth; reduction of risks associated with climate change/energy imports/water scarcity/loss of ecosystem services; increased employment; poverty reduction; energy demand reduction with consequent import expenditures reduction and increased energy self-reliance.

## Options and Opportunities

Through the analysis of the Urban Economy and Business sector, undertaken to assess its “Current Status” and “Growth Trends”, a number of existing or emerging options and opportunities have emerged. These can be used and leveraged by cities to accelerate the transition to their targeted Green Growth vision. These opportunities are listed below.

- The Government of India has decided to develop 100 “Smart Cities” in the country to stimulate employment opportunities and economic activities, while improving quality of life. A Smart City is characterized by an ideal combination of sustainability and competitiveness, thus attracting capital investments. This will be done by providing quality infrastructure and adequate availability of electricity, water, etc. and offering simple and transparent online processes to facilitate the establishment and efficient management of enterprises. The labour force will be trained according to the skills required by the local industries.
- Urban housing is an important component of economy in Indian cities since it contributed to 3.13% of the national GDP in 2003-04. Currently, 16% of the Indian work force is engaged in the construction sector; it is estimated that additional investments in the construction/housing sectors would create an overall employment generation in the economy eight times higher than direct employment<sup>35</sup>. The Government of India, in line with its vision of “housing for all by 2022”, is supporting various affordable housing programmes, to address the shortage of 18 million dwelling units.
- The Delhi – Mumbai Industrial Corridor (DMIC) is India’s most ambitious infrastructure programme aiming to develop new industrial cities as “Smart Cities” along the corridor, and converging next generation technologies across infrastructure sectors. The goal is to expand India’s manufacturing and services base and develop DMIC as a “Global Manufacturing and Trading Hub”. This initiative intends to develop industrial zones across six states in India, and will promote economic development in the region. The programme will provide a major impetus to planned urbanization in India with manufacturing as the key driver. The programme envisages the development of infrastructure linkages like power plants, assured water supply, high capacity transportation and logistics facilities as well as softer interventions like skill development programmes for employment of the local population. Similar other corridors are at an advanced stage of planning:
  - ✓ Amritsar - Kolkata Industrial corridor
  - ✓ Mumbai - Bangalore corridor
  - ✓ Chennai Bangalore corridor
  - ✓ Vishakhapatnam and Chennai corridor

<sup>35</sup>Ministry of Housing and Urban Poverty Alleviation, Government of India, ‘National Urban Housing and Habitat Policy’, 2007.



## Barriers to Green Growth

*Evaluating the current and future trends of the Urban Economy and Business sector led to the identification of barriers that already are or could in the future hinder or even prevent cities from seizing the opportunities listed above, thus precluding a transition to Green Growth. These barriers are listed below.*

- Urban local bodies don't have any role in the promotion of their local economy and in the planning and decision making related to economic subjects, as these are in the hands of National and State Governments.
- The lack of economy-related data at the city level prevents cities from identifying the exact interventions needed to support their economic development, making it harder to capitalize on the various programmes offered by the national government.
- Inadequate local government capacity, lack of skills in the local workforce, absence of basic infrastructure for business and irregular power supply, together with the multiple layers of taxation, make Indian cities an unattractive place for business.



CYCLE RICKSHAW DRIVING PROVIDES ESSENTIAL EMPLOYMENT FOR MIGRANTS FROM RURAL AREAS, AGARTALA



## Review of the Cities Visited

The following sections present the results of the analysis of the ten cities, carried out applying once again the Framework developed in chapter 3.

The table below provides a comparative overview of the status, barriers and opportunities for the Local economy and business sector across all the ten cities. The comparative analysis is done through relevant indicators, identified by the team (based on desk research and brainstorming sessions) and further developed to undertake the interviews and data collection during the city assessment visits. The analysis, driven by elements of the Framework, enables to test and validate the background (theoretical) sectoral hypotheses and develop sector specific green growth strategies on this basis.

Cities	Agartala	Agra	Dehradun	Cochin	Kota	Ludhiana	Nadiad	Pimpri Chinchwad	Shimla	Vijayawada
<b>Status and Trends</b>										
Local economy policy/plans	No	No	No	No	No	No	No	No	No	No
Local Taxation on business	No	No	No	No	No	No	NA	Yes (LBT)	No	Yes
Availability of skilled labour	No	Yes	No	No	No	Yes	Yes	Yes	No	Yes
<b>Opportunities</b>										
Involvement of ULB in Local economy development	No	No	No	No	No	No	No	No	No	No
Proximity to trade corridor/route	No	Yes	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Local Incentives to promote economy	No	No	No	No	No	No	No	No	No	No
<b>Barriers</b>										
Interrupted Power supply	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	No
Environmental restrictions	Yes	Yes	Yes	Yes	No	No	No	No	Yes	No
Economic status at city Level	No	No	No	No	No	No	No	No	No	No
Availability of continuous gas (clean fuel) for business	No	Yes	No	Partial	No	No	No	Yes	No	Partial



## Status and Trends in the Cities Visited

*The analysis of the current status and observed trends in the ten cities is needed to establish the initial benchmark from which the Green Growth process will be started.*

- **Local economy policy/plan:** Currently economic development is the outcome of a policy framework managed mostly by state level governments/agencies, unaware of local aspirations. None of the ten project cities has a local Policy/Plan for the development of economy at urban level.
- **Local taxation on business:** Local taxation is one of the biggest hurdles for trade and business. Even though most of the states have asked cities to abolish their octroi, Pimpri Chinchwad Municipal Corporation still levies it.
- **Availability of skilled labour:** Only five project cities have easily available local manpower; in the other cities, businesses need to compete for the limited productive local man power due to the migration of people to metro cities.

## Opportunities in the Cities Visited

*The existing and emerging opportunities identified at the national level (and previously described) have been tested in the ten cities visited, to assess their feasibility and applicability. Additional opportunities, specific to some of the cities, have emerged as well.*

- **Involvement of ULB in local economy development:** An increased involvement of the local administration in the promotion/development of the local economy can create more opportunities in the city. The ten cities have so far not considered economy development as their mandate and have on the contrary shown resistance to promote local business opportunities in the cities, though no national or state policies disallow it.
- **Proximity to trade corridor/route:** Proximity to trade routes is essential for the development of a city. Other than Agartala, Shimla and Dehradun, all other cities are located strategically on important trade routes of country and can leverage this opportunity. Agra is connected to the National Highway; Kota, Nadiad and Pimpri Chinchwad are close to the Delhi Mumbai Industrial corridor; Cochin is close to a major port and Ludhiana will be part of the Amritsar Kolkata Industrial link.
- **Local incentives to promote economy:** Currently none of the project cities are providing financial incentives for local business; this could easily be done by involving the district administration. Offering such incentives (in the form as tax relaxation, import duty reduction etc.), would attract businesses and accelerate economic growth.

## Barriers in the Cities Visited

*Many of the barriers previously outlined and potentially interfering with a Green Growth process at the national level have been encountered in the ten cities visited too. Additional barriers, specific to some of the cities, have emerged as well.*

- **Interrupted power supply:** Due to the energy deficit at the national level and preferential power supply to the agricultural sector and large metro cities, businesses in cities suffer from recurrent power cuts throughout the year, preventing them from easily taking measures and



steps that could be taken to accelerate their growth. Only the cities of Kota, Nadiad and Vijayawada have near uninterrupted power supply; the frequency of power cuts is quite low in Agartala, Cochin, and Pimpri Chinchwad; reliable power supply is an issue in the remaining cities, with Agra and Ludhiana suffering the most.

- **Environmental restrictions:** Due to their topography and their location in environmentally sensitive areas, five cities have restrictions over the nature of industries that are permitted, limiting the industrial growth of the city (Agartala, Dehradun, Shimla and Cochin because of their location on either hilly terrain or proximity to coastal areas; Agra, because of its heritage importance and proximity to the Yamuna river).
- **Awareness of economic status at city level:** None of the cities are aware of the exact status of their economy, thus limiting the number of measures that can be taken to promote it.
- **Availability of continuous clean fuels for business:** The lack of availability of clean fuels, such as natural gas, is one of the biggest issues for business in all cities. Except Agra, where the Supreme Court had mandated the compulsory use of natural gas for business, all other cities are not able to ensure continuous gas supply.

### Strategies for Green Growth in Urban Economy & Business Sector

*Based on the analysis of the current state and future trends, and the assessment of the existing/emerging opportunities and corresponding barriers, a number of Green Growth strategies have been outlined, that will help cities overcome the barriers and fully leverage the existing opportunities. Cities can choose the combination of either of these strategies according to the applicability to the local context and to the target vision they are striving for. A prioritization of these strategies, for each city, can be found in Volume 2 of this report.*

- **Technology innovation:** Cities should invest in technology innovation and research to improve productivity. Environmental technologies for retrofitting the existing urban form, reducing water leakages, foster smart transport systems etc., should be explored for creating more eco-efficient cities/smart cities and increasing business opportunities, thus leading to jobs creation.
- **Streamlining the approval process:** Cities should facilitate policy measures that streamline approval processes for business, ensuring time bound clearance for key economic sectors, promoting use of ICT to facilitate approvals, etc. This will help overcome the challenge of the excessive and time-consuming regulatory approvals currently impacting business growth of business in cities.
- **Infrastructure upgrade:** Cities should fast-track improvement in urban infrastructure investments to increase competitiveness of cities. The availability of adequate and cheap power, water and land is a basic requirement that attract business and investments.
- **Integration of economy in development plan:** Cities should integrate local environmental and economic policies in their development planning. Spatial development plans should promote densification and consider the development of business and economic activities.
- **Promote local knowledge base in the cities.** Cities should encourage and promote local educational and training institutes, and research facilities, which can provide advanced



knowledge and help local business to improve their competitiveness, as well as train the local workforce on the required skills.

- **Eco-budgeting:** Cities should complement traditional accounting systems with environmental ones in which physical environmental resources are measured instead of only finances. For example, the EcoBudget approach - developed by ICLEI - Local Governments for Sustainability - helps cities to plan, control, monitor, report, and evaluate the consumption of natural resources (such as climate stability, air quality, land, water, raw materials, and biodiversity) for issues of significant priority within the geographical area of the municipality.<sup>36</sup>

- **Innovative business models:** Cities should promote and encourage innovative business models where businesses consider their entire environmental impact along with the impacts of their suppliers and clients.

- **Redefining the urban economic structure:** Cities should, within their possibilities, mainstream their involvement into local economic development and planning, pro-actively developing enabling policies and fiscal incentives for business. The roles and responsibilities between the local and the state level should be clearly defined.

- **Promote sustainable procurement:** Cities should promote and adopt sustainable procurement and innovation in procurement models to create green markets and increase demand for greener products and services.



GENERATION OF ENERGY FROM SEWAGE GAS CAN HELP IN RECOVERY OF METHANE; A POTENT GHG, AND REDUCE DEPENDENCE ON GRID ENERGY

<sup>36</sup>GIZ and ICLEI, 'Discussion Paper: Green Urban Economy - Conceptual basis and courses for action', 2012.



## 4.2.6 Housing and Buildings Sector and Green Growth

### Introduction

Buildings are one of the basic necessities of humans. They use up resources and can generate waste. Available data suggests that buildings can be responsible for up to 40% of the energy, 30 % of raw materials, 20% of water and 20% of land used up by cities. Additionally, they account for 30% of solid waste generation, and 20% of liquid effluents discharged in our cities.<sup>37</sup>

While buildings and housing are well recognized as a sector where technology improvement can bring about major changes, an underlying issue is the absence of reliable information on the status of built environment, housing and its shortage, which is necessary to accordingly scale up the required interventions.

Over 66% of the built assets required in India are yet to be built, underlining the importance of having a Green Growth perspective for this sector.

### Sector Growth Story

Analyzing the **current status** of the Housing and Buildings sector - including its present growth as well as prevailing policies and practices, evaluating the expected **future growth trends** and identifying the **main actors** who can support a transition to Green Growth helps develop an accurate picture of the starting point of a city's Green Growth process.

During 2001-11, Indian urban population grew at a compound annual growth rate of 2.8%, resulting in an urbanization increase of 31.1 %. Indian cities doubled their built-up area between 2001 and 2005 and are expected to add 35 billion sq.mt of new buildings by 2050<sup>38</sup>. Most of this growth is expected to occur in urban residential buildings.

Despite the massive increase in built-up areas, and the number of populace residing in slums, unauthorized settlements and deteriorated housing seems to be expanding at a fast pace. Rapid increase in urban population has created an issue of land shortage, and a shortfall in housing and basic amenities. While on one hand there is a high housing shortage, on the other there is a massive and rapidly growing stock of vacant houses. According to the 2011 census, the housing stock in urban India stood at 78.48 million for 78.86 million urban households. Though the gap between household and housing stock is narrowing, the actual high shortage is due to parts of the current stock being dilapidated and people living in congested dwellings.

Private developers in Indian cities primarily target the luxury, high-end and upper-mid housing segment, which is more lucrative than low-income housing. This leads to constant supply for this segment and increasing market competitiveness for developers; on the other side, housing for the poor and economically weak section is primarily provided by the government and is insufficient to fill the existing shortage that forces them to settle in slums and deteriorated housing. This is primarily due to the high prices of land and real estate in urban areas that have forced the poor and economically weaker section of the society to occupy marginal lands, characterized by poor housing stock, congestion and obsolescence. Considering these factors, there is a wide gap between the demand and supply of housing (both in terms of quality and quantity) in urban India.

<sup>37</sup>Anon, 'Green Buildings - an overview, Capacity Building Series (2008-2009)', TARA Nirman Kendra, 2009.

<sup>38</sup>Sophie and Laustsen, 'Status report -Mitigation potential from India's buildings', Global Buildings Performance Network, 2013.



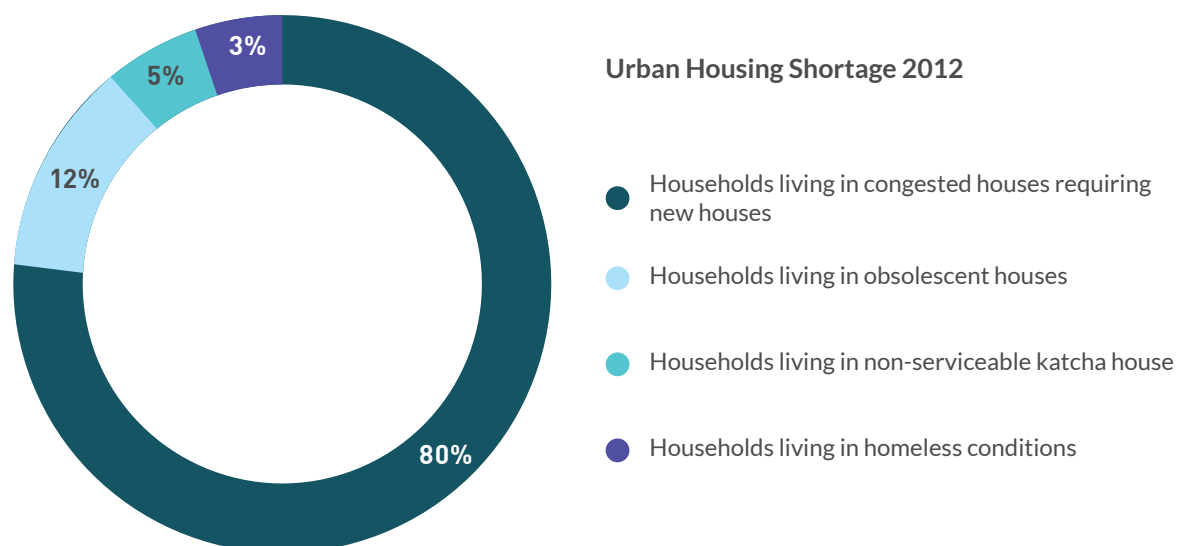


**Table 3: Housing shortage by Income Category**

Category	Monthly Income	Distribution of Housing Shortage as on 2012	
		No. (in million)	In percentage
Economically weak section	>5000	10.55	56.18
Low income group	5001-10000	7.41	39.44
Medium income group and above	>10000	0.82	4.38
<b>Total Shortage</b>		<b>18.78</b>	<b>100</b>

*Source: estimate of the Technical Group on Urban Housing Shortage (TG-12) (2012-17) constituted by The National Buildings Organization, Ministry of Housing & Urban Poverty Alleviation*

According to the estimate of a technical group formed by MoHUPA (Ministry of Housing and Urban Poverty Alleviation), the urban housing shortage in the country was found to be around 18.78 million units in 2012. The group further estimated that 56% of this shortage pertains to houses for economically weaker sections (EWS) and another 39% for lower income groups (LIG); for middle and high income groups (MIG and HIG) the estimated shortage is only 0.82 million.



As around 95% of the housing shortage of 18.78 million pertains to Economically Weaker Sections (EWS) and Low Income Groups (LIG), the issue of affordability assumes critical significance in the housing sector.

Urban buildings are private endeavors only regulated by local governments. Development authorities and municipal corporations govern local planning and construction permissions. Annual property tax is also collected by municipal corporations and usually forms a major part of their revenue stream. Local Development Control Regulations and building bye laws govern building typology and form in a city. Certain cities due to terrain, disaster proneness and/or historical importance issue additional construction regulations that are recommended by the state.



## Actors Involved

Although housing in India is a State subject and almost all plans, policies and programmes related to housing are undertaken by the State Government, the National Government is responsible for the formulation and implementation of social housing schemes, in addition to general directives and National policies. National level bodies such as Planning Commission, Ministry of Urban Development (MoUD) and Ministry of Housing and Poverty Alleviation, provide all policy support, and govern and implement programmes on housing. The National Building Construction Corporation works in developing real estate projects providing construction consultancy functions under the aegis of MoUD. The National Housing Bank set up by the Reserve Bank of India is the primary financial institution for housing in the country. The Housing and Urban Development Corporation, the central finance company with the mandate to facilitate housing finance to cities and state governments, provides financial support to accelerate the pace of housing and urban development in the country. ULBs are responsible for formulating city specific building bye laws and development control regulations, for implementing central and state sector schemes pertaining to housing sector at the city level, and for monitoring the growth of unauthorized colonies, unauthorized constructions and commercialization of residential areas.

## Visions

*The two visions below present an ideal scenario of how the Housing and Buildings sector would appear in the future, had the city fulfilled or even exceeded all its development objectives. These visions, achieved either through a gradual, incremental process (efficient) or a more radical paradigm shift (transformative) become the ultimate Housing and Buildings 'target' that cities should aim for.*



WELL EQUIPPED AFFORDABLE HOUSING WITH GOOD ACCESSIBILITY CAN ADDRESS MULTIPLE CONCERNS OF LOW INCOME GROUP



### Efficient Green Growth Vision

A slum free city with an abundant and well planned housing stock that is characterized by energy and resource efficiency, waste reduction and pollution prevention. A city where the local administration provides efficient regulations and processes for building approvals and registrations with well integrated infrastructure provision, so that all user groups have access to basic services. Locally revised bye laws incentivize green buildings, promote waste water recycling, renewable energy use etc.

### Transformative Green Growth Vision

A city with adequate high quality housing stocks with security of tenure for all users and income groups, built on the principles of sustainable design in which the impact of a building on the environment will be minimal over its lifetime. The city has spatially well located housing units so as to reduce travel needs and increase accessibility to basic services such as water, sewerage, health, transport, education and sustainable livelihood. The city has a prominent local green building industry base and uses locally sustainable materials, ultimately promoting local economy.

### Green Growth Benefits

- **Personal benefits:** Better living conditions that will lead to improved health, safety and access to water supply and sanitation.
- **Community benefits:** improved access to social services for urban poor communities leading to better education, improved health and access to sustainable livelihoods, resulting in poverty reduction.
- **National/global benefits:** Reduced vulnerability and increased security for poor segments of the population, who will have the possibility to invest and upgrade their housing and will be encouraged to connect and pay for municipal services (i.e. metered water connections, toilets with sewerage, metered power supply, etc.); reduced O&M costs for common and free services such as community toilets and community stand-posts; full integration of the poor into the society and inclusion in the property tax net, adding to the city revenues.

### Options and Opportunities

*Through the analysis of the Housing and Buildings sector, undertaken to assess its “Current Status” and “Growth Trends”, a number of existing or emerging options and opportunities have emerged. These can be used and leveraged by cities to accelerate the transition to their targeted Green Growth vision. These opportunities are listed below.*

- The National Urban Housing & Habitat 2007 Policy lays emphasis on national and state government retaining its role in social housing so that affordable housing is made available to EWS and LIG of the population.
- The Basic Services for the Urban Poor (BSUP) scheme launched in 2005 is managed by



the Ministry of Housing and Urban Poverty Alleviation (MoHUPA). It seeks to provide seven entitlements or services (security of tenure, affordable housing, water, sanitation, health, education and social security) to low-income segments in the 65 cities component of NURM.

- The Integrated Housing and Slum Development Programme (IHSDP) scheme managed by the Ministry of Housing and Urban Poverty Alleviation (MoHUPA) is applicable to all cities and towns as per 2001 census except cities/towns covered under the Basic Service for Urban Poor (BSUP) scheme. IHSDP was launched in 2005 with the aim of achieving a holistic slum development that enables a healthy urban environment, by providing adequate shelter and basic infrastructure to the urban slum dwellers. The scheme also seeks to enhance public and private investments in urban housing.

- The Rajiv Awas Yojana (RAY) scheme launched by MoHUPA envisages a “Slum Free India” with inclusive and equitable cities in which every citizen has access to basic civic infrastructure and social amenities. It will provide support to enable the states to redevelop all existing slums in a holistic and integrated way and create new affordable housing stock. Listed below are the objectives of the scheme:

- Improving and provisioning of housing, basic civic infrastructure and social amenities.
- Enabling reforms to address some of the causes leading to creation of slums.
- Facilitating a supportive environment for expanding institutional credit linkages for the urban poor.
- Institutionalizing mechanisms for prevention of slums including creation of affordable housing stock.
- Strengthening institutional and human resource capacities at the Municipal, City and State levels through comprehensive capacity building and strengthening of resource networks.

- The Energy Conservation Building Code (ECBC) was launched by the Ministry of Power, Government of India in May 2007 for promoting energy efficiency in the building sector. The ECBC establishes minimum requirements for energy-efficient design and construction for buildings with a connected load of 100 kW/120 kVA or more and provides guidelines for building design, including the envelope, lighting, heating, air-conditioning, and electrical systems. Currently ECBC is on voluntary basis but various states such as Rajasthan, Odisha, Uttarakhand, Punjab, Karnataka and Andhra Pradesh had issued notification for its implementation<sup>39</sup>. It is estimated that the nationwide mandatory enforcement of the code will yield considerable annual energy savings.

- Some municipal corporations such as Pune and Noida have adopted green rating systems offering builders higher FAR for green building initiative within their municipal limits. This is an example of an opportunity that any city can leverage to promote green buildings.

## Barriers

*Evaluating the current and future trends of the Housing and Buildings sector led to the identification of barriers that already are or could in the future hinder or even prevent cities from seizing the opportunities listed above, thus precluding a transition to Green Growth. These barriers are listed below.*

- Technical manpower shortages, procedural and legal vulnerability, infrastructure bottlenecks, delays in land acquisition, high land values, delays in Master Plan/development plan review and implementations, etc.

<sup>39</sup>The statewide status of activities for the implementation of ECBC: <http://www.beeindia.in/schemes/schemes.php?id=3>

<sup>40</sup>Ministry of Environment and Forests, Government of India, 'State of Environment Report - India', 2009.



- Lack of standardization and clarity on policies to formalize illegal settlements through distribution of tenure rights<sup>40</sup>.
- Outdated rent control regulations, policy, planning and regulation deficiencies, limited access to housing finance and absence of clear definition on built environment.

## Review of the Cities Visited

The following sections present the results of the analysis of the ten cities, carried out applying once again the Framework developed in chapter 3.

The table below provides a comparative overview of the status, barriers and opportunities for the Housing and Buildings sector across all the ten cities. The comparative analysis is done through relevant indicators, identified by the team (based on desk research and brainstorming sessions) and further developed to undertake the interviews and data collection during the city assessment visits. The analysis, driven by elements of the Framework, enables to test and validate the background (theoretical) sectoral hypotheses and develop sector specific green growth strategies on this basis.

Cities	Agartala	Agra	Dehradun	Cochin	Kota	Ludhiana	Nadiad	Pimpri Chinchwad	Shimla	Vijayawada
<b>Status and trends</b>										
Slum Population <sup>41</sup>	Low	Low	High	High	High	High	Low	Low	Low	High
Status of BSUP/ RAY projects <sup>42</sup>	Fair	Fair	Fair	Fair	Fair	Poor	NA	Fair	Poor	Fair
Slum free city plan of action	Yes	No	No	No	Yes	In Process	In Process	No	No	Yes
City specific bye laws / development control regulation	No	Yes	Yes	No	No	No	Yes	Yes	Yes	No
<b>Opportunities</b>										
Incentives for Green/energy efficient buildings	No	No	No	No	Yes	No	No	Yes	No	No
GIS based property mapping	In Process	In Process	In Process	In Process	NA	In Process	No	In Process	In Process	In Process
Online approval of buildings	In Process	No	No	No	No	No	In process	Yes	No	In Process

<sup>41</sup>Low: less than 15%. High: Equal to/greater than 15%.

<sup>42</sup>Fair: more than 75% of the work is completed under sanctioned projects.  
Poor: less than 75% of the work is completed under sanctioned projects.



Cities	Agartala	Agra	Dehradun	Cochin	Kota	Ludhiana	Nadiad	Pimpri Chinchwad	Shimla	Vijayawada
<b>Barriers</b>										
Availability of land with Municipal Corporation / Council for affordable housing <sup>43</sup>	Low	Low	Low	Low	High	High	High	High	Low	Low
Housing Gap Status	Partially	NA	NA	NA	NA	Partially	Partially	NA	NA	Partially

### Status and Trends in the Cities Visited

The analysis of the current status and observed trends in the ten cities is needed to establish the initial benchmark from which the Green Growth process will be started.

- **Slum population:** All cities have moderate to high percentage of population residing in slums, except Agartala, Agra and Vijayawada who, due to low economic activity, have a lower rate of migration. The remaining cities are thus forced to tackle the issue of migration as a result of their economic growth. None of the project cities have clarity over their exact numbers of slums and have to rely only on census data, which is updated every ten years. Except Nadiad, who has just started looking into the issue, all project cities are trying to construct affordable housing for the urban poor, but the quantity of dwelling units built is still quite low compared to the actual demand. Most cities, especially Kota and Pimpri Chinchwad, share artificial shortage in housing.

- **City specific bye laws:** Five project cities had taken the step to draft city specific building bye laws and development control regulation, while the others are still dependent on model/standard bye laws circulated by the state government. In the absence of local bye laws and development control regulations, it is difficult for local government to manage the needs of an ever increasing population in efficient and sustainable manner.

### Opportunities in the Cities Visited

The existing and emerging opportunities identified at the national level (and previously described) have been tested in the ten cities visited, to assess their feasibility and applicability.

- **Energy efficient buildings:** As energy demand is growing significantly in the project cities, energy efficiency is essential. The only cities to promote green /energy efficient buildings are Pimpri Chinchwad and Ludhiana. Pimpri Chinchwad provides various financial incentives to developers as well as property owners for implementing green building norms. The remaining cities still lag behind in promoting efficiency in buildings. As almost all the project cities are growing rapidly in terms of population, the majority of the built area required is yet

<sup>43</sup>Low: sanctioned affordable housing projects are delayed as the city is unable to designate litigation free land for the project.

High: the city is able to designate litigation free land within accessible limits of the city, without causing any delay to the sanctioned affordable housing project.



to be constructed. This provides an opportunity for cities to offer incentives and promote energy efficient/ buildings. Cities have also the option to develop bye laws to densify their urban area and thus reduce energy requirements. Various provisions in Development Control Regulations (DCR) can also promote the use of renewable energy, thus reducing electricity costs.

- **GIS mapping:** Implementation of GIS based property mapping provides an opportunity for the cities to bring the maximum number of buildings under the tax slab. It can help in creating a digital base-map of the city that will have a record of all properties as well as municipal services like drainage lines, water network, man-holes, streetlights and buildings and other attributes. Currently eight out of the ten cities are in process of implementing it.

- **Online approval of buildings:** Currently only Pimpri Chinchwad has a system in place for online approval of buildings while two cities (Agartala and Nadiad) are in the process of setting it up. The system will make it easier for cities to effectively enforce various building regulations specified in city specific building bye laws, eliminate potential delays, avoid inconsistencies, secure integration with related departments (water supply, electric, sewerage ) and enable easy extraction of data that will make accurate and updated information available for the public domain.



DUE TO HIGH PROFIT MARGINS, PRIVATE DEVELOPERS TARGET THE HIGH END HOUSING SEGMENT

## Barriers in the Cities Visited

*Many of the barriers previously outlined and potentially interfering with a Green Growth process at the national level have been encountered in the ten cities visited too.*

- **Availability of land:** The lack of land availability is one of the major issues in all project cities. Except in Shimla, land prices have been quadrupled in all cities creating a huge gap between housing demand and supply. In all project cities, affordable housing is provided by local governments/development authorities using grants from both central as well as state government; as land is one of the major cost components, the limited availability of land is thus a major barrier for slum-free cities. Another barrier to affordable housing is the remote location of such building projects, making social amenities and basic services such as water, health etc. inaccessible to the poor. Except Agartala and Pimpri Chinchwad, who provide affordable housing, the other cities have poor accessibility conditions for urban poor, preventing them from shifting to the proposed remote resettlement housing units.

- **Housing gap status:** Another considerable challenge is the absence of data: only four project cities are partially aware about the status of their housing gap (having formulated a Slum free city plan of action), while the remaining cities have no data at all.

## Strategies for Green Growth in Urban Housing and Buildings Sector

*Based on the analysis of the current state and future trends, and the assessment of the existing/emerging opportunities and corresponding barriers, a number of Green Growth strategies have been outlined, that will help cities overcome the barriers and fully leverage the existing opportunities. Cities can choose the combination of either of these strategies according to the applicability to the local context and to the target vision they are striving for. A prioritization of these strategies, for each city, can be found in Volume 2 of this report.*

- **Collect accurate data** on housing stocks at the national and state level collected through an institutional structure and make it readily available.

- **Provide incentives** for buildings which focus on energy and resource efficiency, waste reduction and pollution prevention, good indoor air quality and natural light to promote occupant health and productivity. This can be done by adopting city specific bye laws and Development control regulations. In progressive cities, specific green building codes could also be developed.

- **Link families to housing credit** through banks or community credit mechanisms, such as Community Led Infrastructure Financing Facility (CLIFF), which was initiated in the USAID-supported Crosscutting Agra Programme (CAP)<sup>44</sup>. The CLIFF under CAP enabled poor people to access credit for housing upgrading i.e. building toilets in the houses. To prevent housing from being converted into a cash asset, the ULB may need to develop contracts between the owners, the local body and banks (if credit is provided) for apartment ownership, setting the terms of sale and transfer etc.

- **Simplifying procedures** for obtaining planning and construction approvals. Single window and channel procedures are needed to help bring in transparency in the local construction activities.

<sup>44</sup>CBUD-PMU, Ministry of Housing and Urban Poverty Alleviation, 'Reforming Agra by re-imagining through slum Up-gradation', Best practices considered under challenge fund.





- **Security of tenure** should be recognized as an important and integral tool for relieving pressures on the housing market. This may be undertaken through regularization of settlements, community or cooperative ownership, security via lease, use rights, enabling in-situ development to take place.
- **Reviewing the processes of Master Planning** and implement changes necessary to ensure a proper assessment of land requirements and allocation of such lands for different uses, including that of affordable housing.
- **Re-densification and re-assignment of land** through an upward revision in the FAR/FSI across cities of different sizes commensurate with investment in infrastructure that it will necessitate.



SIXTY SIX PER CENT OF THE ESTIMATED BUILT-UP IN THE YEAR 2030 IS YET TO COME UP



## 4.2.7 Urban Transport Sector and Green Growth

### Introduction

Transport is the result of the need to move people, goods and services from one location to another. This need for mobility is a result of improvement in land use, infrastructure and services but it often turns into increased vehicle population, traffic, pollution etc.. Rapid growth needs to be supported by an efficient, reliable and safe transport system to be green in the long term.

Even though cities are witnessing an increase in private vehicles, the overall number of private vehicles in Indian cities remains still relatively low and most cities retain a transit friendly, compact urban form at least in the core areas. Policy decisions taken now can affect how people will live in these cities for many decades in future. Indian cities should develop in a way that ensures green growth, allowing for the development of economy while maintaining environmental sustainability. A key to achieve this is to leapfrog to a sustainable and accessible form of transport system where mobility is such that citizens shift from a car or private vehicle dominant transport system to public transport that reduces the costs faced by many industrialized countries today<sup>45</sup>.

As Indian cities are still growing and much of the expected investment is still to be made, India can learn from the international experience and change early without having to go through the entire cycle of learning by making the same mistakes, thus achieving the final result earlier.

### Sector Growth Story

*Analyzing the **current status** of the Transport sector - including its present growth as well as prevailing policies and practices, evaluating the expected **future growth trends** and identifying the **main actors** who can support a transition to Green Growth helps develop an accurate picture of the starting point of a city's Green Growth process.*

Urban transport in India consists of a multitude of modes including non-motorised transport, intermediate public transport, busses, rail based services and private modes (e.g. cars and two wheelers). The distribution of travel among these modes varies significantly across cities. The sector also includes support infrastructure like footpaths, bus stops, signage etc. and traffic management systems, from zebra crossing to traffic signals and routing.

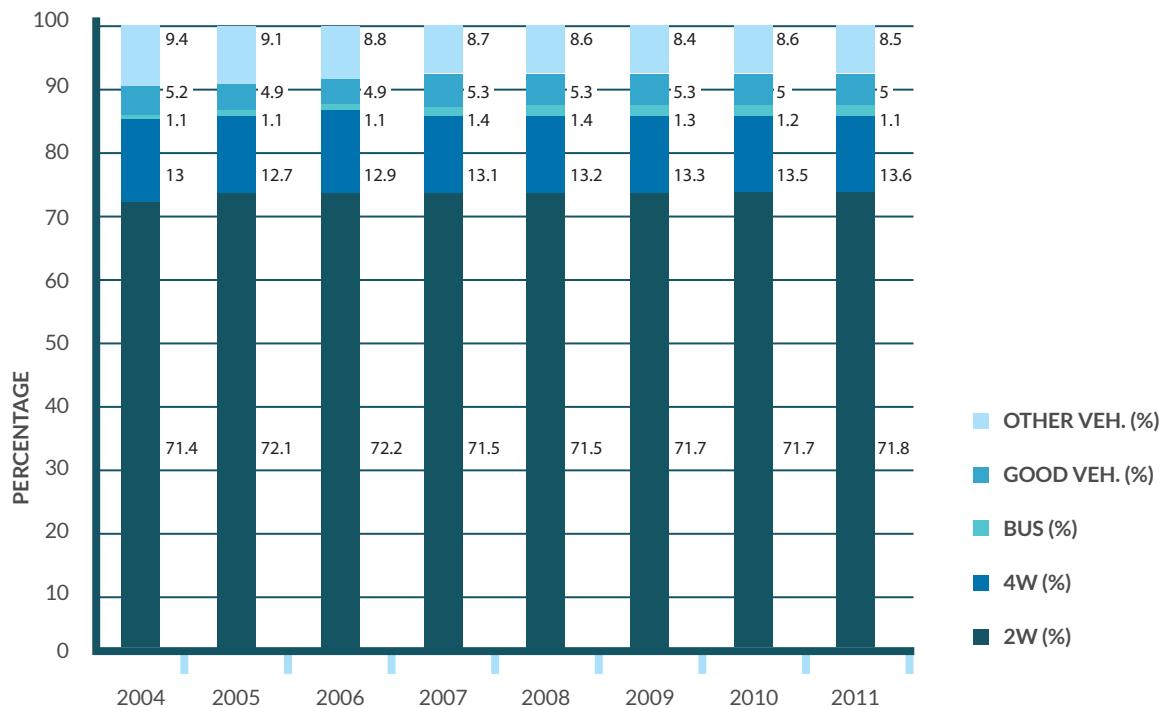
Until recently, urban transport was not seen as a separate sector but was clubbed with rural and state transport together; it is only in the last two Five Year Plans that Government of India's Planning Commission recognized the need to address transport issues in urban areas specifically, even if mainly from the point of managing traffic and easing congestion on city roads. There has been considerable focus on addressing urban transport issues in the recent past, even though the situation on the ground has not yet sufficiently improved. The High Powered Expert Committee (HPEC) appointed by the Ministry of Urban Development suggests in its 2011 report that over 50% of India's necessary urban investment shall be made in roads and transport infrastructure.

There are currently no acts or laws that specifically regulate the urban transport sector, which is currently treated as an integral part of urban development activities. The key guiding policies at the national level focusing on urban transport in India are the Motor Vehicles Act (MV Act 1988) and the National Urban Transport Policy (NUTP 2006).

<sup>45</sup>UNESCAP, 'Low Carbon Green Growth Road Map for Asian and The Pacific - Urban Transport', Transport Research Laboratory, United Nations publication, 2012.



Road design standards by the Indian Road Congress (IRC), planning norms from the Urban and Regional Development Planning Formulation and Implementation (URDPFI) guidelines and the MV Act are the statutory documents that guide the sector.



Percentage composition of vehicles registered till 2012 (Source: Ministry of Road Transport and Highways, Road Transport year book India (2012))

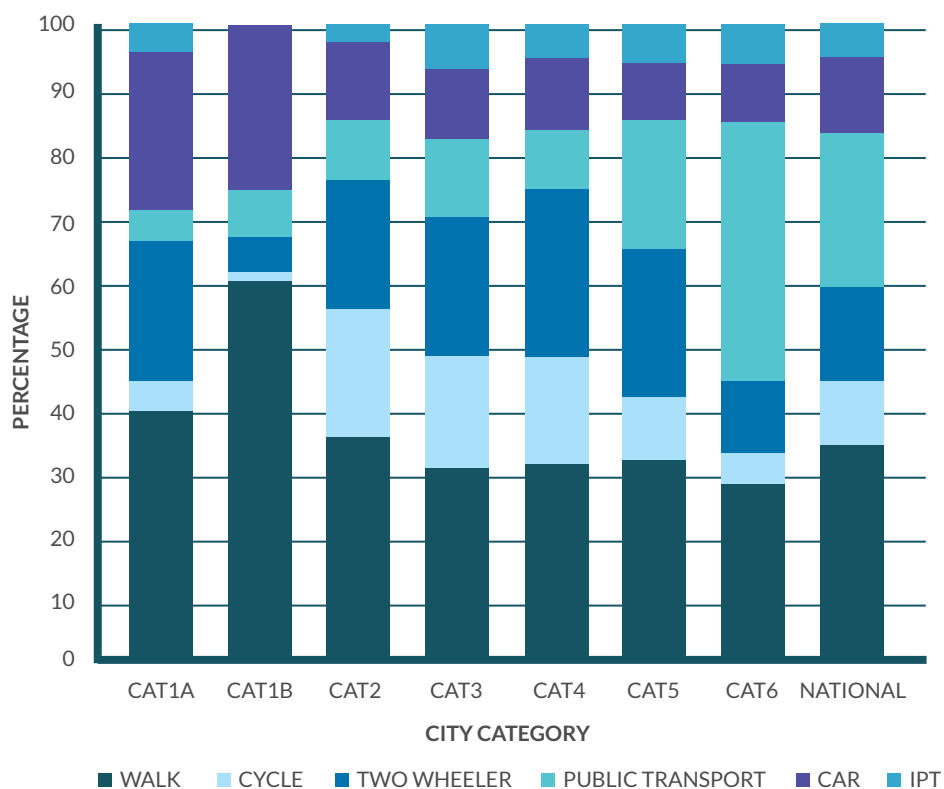


A WELL MANAGED IPT SYSTEM CAN BOOST PUBLIC TRANSPORT



Fast increasing vehicle populations can be attributed to the existing trend showing increased ownership of and mobility through private vehicles i.e. cars and two wheelers in particular. The composition of vehicle population across the past years shows that 85% of vehicles in Indian cities are private passenger ones.

Nationally, an average of 30% of people travel by personal cars and two wheelers in Indian cities. In some cities, this number is even higher.



Mode shares in various cities in comparison with national average (Source: Wilbur Smith Associates report for Ministry of Urban Development, 2008)

City category	Population
Category 1A	<0.5 Million Plain Terrain
Category 1B	<0.5 Million Hilly Terrain
Category 2	0.5 to 1 Million
Category 3	1 to 2 Million
Category 4	2 to 4 Million
Category 5	4 to 8 Million
Category 6	>8 Million

Categories of cities considered for mode shares (Source: WSA report, 2008)



## Actors Involved

Following are the main entities responsible for different aspects of transport::

- For network aspects covering roads and related infrastructure: municipal corporations, development authorities (or improvement trusts), highways authorities and public works departments.
- For public transport fleets: state transport undertakings, private operators, municipal corporations, special purpose vehicles (SPVs) and PPP project entities.
- For intermediate public transport fleets: private operators and their associations.

All transport is generally regulated by permits from state transport departments while the enforcement of operations is overseen by local traffic police units. The funding of large scale projects is usually made by the national government, state governments, external aid, banking agencies or the private sector.

## Green Growth Visions

*The two visions below present an ideal scenario of how the Transport sector would appear in the future, had the city fulfilled or even exceeded all its development objectives. These visions, achieved either through a gradual, incremental process (efficient) or a more radical paradigm shift (transformative) become the ultimate Transport 'target' that cities should aim for.*

### **Efficient Green Growth Vision**

A city where a reliable and formal system of public transport or intermodal public transport covers the entire city through an established route network, allowing citizens to move from one part to the other without having to rely solely on private transport. High quality pedestrian and NMT facilities provide for the last mile connectivity. Parking policies and emission norms linked to ownership for all vehicles promote low emission vehicles in the city.

### **Transformative Green Growth Vision**

A city with a transit oriented development policy that promotes mixed land use and need for less mobility. An incremental multimodal transport plan supported by a reliable and formal system of high quality public transport or intermodal public transport covers the entire city together with excellent last mile connectivity, through NMT and pedestrian facilities. Well enforced parking policies and emission norms linked to ownership for all vehicles promote use of low emission vehicles in the city and restrict fast moving traffic in certain areas.

## Green Growth Benefits

**1. Personal benefits include:** time savings; improved health; additional comfort and convenience; reduced expenditure on fuel and healthcare.

**2. Community benefits include:** reduction in air pollutants; increased social interaction; support to local business; decrease in traffic related noise; reduced traffic jams and parking hassles.

**3. Global benefits include:** reduced air pollution; conservation of natural habitat; reduced need for non-renewable fossil fuel resources and ultimately reduced ozone layer destruction.



IN ABSENCE OF LAST MILE CONNECTIVITY PEOPLE ARE RAPIDLY SHIFTING TOWARDS PRIVATE VEHICLES

### Options and Opportunities

Through the analysis of the Transport sector, undertaken to assess its “Current Status” and “Growth Trends”, a number of existing or emerging options and opportunities have emerged. These can be used and leveraged by cities to accelerate the transition to their targeted Green Growth vision. These opportunities are listed below.

- The National Urban Transport Policy recommends setting up a Unified Metropolitan Transport Authority as an umbrella body to ensure smooth coordination among various agencies, to co-ordinate the entire transport activities of the city and to help address legal and institutional issues. By setting up this new body and writing its mandate to support sustainable and green transport Indian cities can have the requisite local policy support to take a Green Growth path.
- The National Urban Transport Policy recommends developing and implementing a Comprehensive Mobility Plan that includes an integrated approach for land use and urban transport as well as sustainable and green mobility recommendations. NURM made such mobility plans mandatory for accessing funding for transport projects.
- The National Urban Transport Policy recommends the creation of a local urban transport fund. National programs such as the NURM and Smart Cities provide good opportunities for funding capital expenditure; however, ULBs need to develop feasible projects with financially viable operation plans.



## Barriers

*Evaluating the current and future trends of the Transport sector led to the identification of barriers that already are or could in the future hinder or even prevent cities from seizing the opportunities listed above, thus precluding a transition to Green Growth. These barriers are listed below.*

- Disintegrated governance and planning approaches that do not help formulate a common vision or plan at the city level on urban transport.
- Limited knowledge and acceptance on usage of public transport and deriving benefits, including the general perception that public transport is neither reliable, nor comfortable or convenient. Lack of political acceptance on basic decisions such as giving road space to pedestrian facilities and cycle tracks with, giving priority right of movement to public transport such as BRTS.
- Unorganized intermediate public transport system and deteriorating services. Restrictions imposed by various pressure groups who think these are unsafe and a nuisance do not allow low cost sustainable transport measures like organizing intermediate public transport (IPT) and introducing cycle rickshaws etc. The urban poor are not involved in all stages of transport planning.
- Opposition to introduction of pricing measures to control vehicular ownership and peak hour congestion. Strong budget constraints to implement large public transport projects and focus of finances on improvement of road infrastructure. Subsidies decided at the state or national level for certain fuels and on cost intensive mass transport impact sustainability of the city transport system. Lack of knowledge of financial models for urban transport projects for partnership implementation.



CHAOS ON URBAN ROADS: WITH PROPER PLANNING, URBAN TRANSPORT SYSTEM CAN BE EFFICIENTLY MANAGED



## Review of the Cities Visited

The following sections present the results of the analysis of the ten cities, carried out applying once again the Framework developed in chapter 3.

The table below provides a comparative overview of the status, barriers and opportunities for the Transport sector across all the ten cities. The comparative analysis is done through relevant indicators, identified by the team (based on desk research and brainstorming sessions) and further developed to undertake the interviews and data collection during the city assessment visits. The analysis, driven by elements of the Framework, enables to test and validate the background (theoretical) sectoral hypotheses and develop sector specific green growth strategies on this basis.

Cities	Agartala	Agra	Dehradun	Cochin	Kota	Ludhiana	Nadiad	Pimpri Chinchwad	Shimla	Vijayawada
<b>Status and trends</b>										
Quality of public transport <sup>46</sup>	NA	Poor	Poor	Fair	Poor	NA	Poor	Fair	NA	Fair
City bus service	No	Yes	Partial	Yes	Partial	Non-Funtional	Partial	Yes	Yes	Yes
Management of IPT	No	No	No	No	No	No	No	No	No	No
Multimodal Integration	No	No	No	No	No	No	No	No	No	No
Last mile connectivity	No	IPT	IPT	IPT	No	IPT	IPT	IPT	No	IPT
NMT infrastructure	No	No	No	No	No	No	No	Partial	Partial	Partial
<b>Trends</b>										
Vehicular growth rate <sup>47</sup>	Low	High	High	High	High	High	Low	High	High	High
Private participation in Public transport operation	NA	No	Yes	Partial	Yes	No	No	No	No	No

<sup>46</sup>Poor: average waiting time for user is more than 20 minutes.  
Fair: average waiting time more than ten minutes but less than 20 minutes.

<sup>47</sup>Low: less than 5% per annum. High: growth greater than 5% per annum.





Cities	Agartala	Agra	Dehradun	Cochin	Kota	Ludhiana	Nadiad	Pimpri Chinchwad	Shimla	Vijayawada
<b>Opportunities</b>										
Mobility plan for city	No	Yes	No	No	No	Yes	No	Yes	Yes	No
Implementation of mobility plan	No	No	No	No	No	No	No	No	No	No
Urban transport cell at ULB	No	No	No	No	No	No	No	No	No	No
Integrated strategy for land use and urban transport	No	No	No	No	No	No	No	No	No	No
<b>Barriers</b>										
Coordination among agencies	No	No	No	No	No	No	No	No	No	No
Adequate cost recovery	NA	No	No	No	No	No	No	No	No	Yes

### Status and Trends in the Cities Visited

The analysis of the current status and observed trends in the ten cities is needed to establish the initial benchmark from which the Green Growth process will be started.

- Quality of public transport:** All ten cities except Agartala have some sort of public transport system managed by either the State Road Transport Corporation or the local bodies. In Pimpri Chinchwad, Ludhiana and Nadiad, bus services are operated by the ULB; Kota and Dehradun have private bus operators permitted by the Regional Transport Office (RTO); the remaining cities have public transport operated by state agencies. Excluding Pimpri Chinchwad, Cochin and Vijayawada, the existing quality of service in terms of accessibility, adequacy of fleet size, operational route and bus frequency does not encourage users to use public transport. The number of buses in Dehradun and Kota are limited as they are managed by private operators while the bus service in Ludhiana is temporarily non-operational due to financial losses as a result of low cost recovery.

- IPT management:** IPT is regulated by the RTOs and traffic police; however, in none of the cities it is well managed. Integration of various modes is necessary to make public transport smooth; however, due to the involvement of various agencies and the absence of coordination among them, none of the ten cities have taken any step towards multimodal integration.

<sup>49</sup>ICLEI South Asia, 'NMT Readiness assessment of Indian Cities', 2013.



- **Last mile connectivity:** Last mile connectivity is one of the critical factors for mobility of people in any city<sup>48</sup>. In all ten cities, people are dependent on either private vehicles or intermediate para transit for the last mile. In absence of effective management of IPT, or park and ride facilities, most people prefer to shift towards private vehicles.

- **NMT infrastructure:** Out of the ten cities, three cities have dedicated NMT infrastructure but provide the service only partially.

- **Vehicular population growth:** All cities, except Agartala and Nadiad, are witnessing either high growth in number of vehicular population.

- **PPPs:** Few cases of successful PPP projects were observed only in Dehradun, Cochin and Kota.

### Opportunities in the Cities Visited

*The existing and emerging opportunities identified at the national level (and previously described) have been tested in the ten cities visited, to assess their feasibility and applicability. Additional opportunities, specific to some of the cities, have emerged as well.*

- **Mobility plans:** A comprehensive mobility plan or study can be a major opportunity where the city analyzes its urban transport status in detail and makes appropriate long term plans for the future. Four cities have mobility plans in place (Shimla, Agra, Ludhiana and Pimpri Chinchwad); the city of Vijayawada has conducted a comprehensive traffic study. The other cities still lack basic mobility plans. None of the cities with mobility plans have till date implemented the suggested strategies, due to lack of capacity. The national government mandates all cities to develop city mobility plans to fund recommended transport projects and this is an opportunity the cities could utilize to take up the Green Growth path soon.

- **Urban transport cell:** NUTP 2006 recommends dedicated urban transport cells in the ULB to develop capacity related to urban transport. Cities can leverage this recommendation and set up the cell to enhance their local technical capacity.

- **Integrated strategy for land use and urban transport:** Integrating land use and transportation elements will reduce trip lengths and thus help reduce congestion. Though NUTP 2006 earmarks steps for transit oriented development, this has been early for all assessed cities to take this idea forward. However it remains as a major opportunity to leverage.

### Barriers in the Cities Visited

*Many of the barriers previously outlined and potentially interfering with a Green Growth process at the national level have been encountered in the ten cities visited too.*

- **Lack of coordination among agencies:** Coordination between different agencies is a pre-requisite for successful urban transportation in any city but in absence of clear roles, the lack of coordination hampers the prospect of sustainable transport. Almost all 10 cities visited showed coordination issues related to urban transport.

- **Adequate cost recovery:** With the exception of Vijayawada, where Andhra Pradesh State Road Transport Corporation (APSRTC) is able to generate operating profits, the remaining cities are not even able to recover operating expenses, due to inefficient systems – to the extent that the bus services in Ludhiana had to be temporarily shut down due to high operating losses.



## Strategies for Green Growth in Urban Transport Sector

*Based on the analysis of the current state and future trends, and the assessment of the existing/emerging opportunities and corresponding barriers, a number of Green Growth strategies have been outlined, that will help cities overcome the barriers and fully leverage the existing opportunities. Cities can choose the combination of either of these strategies according to the applicability to the local context and to the target vision they are striving for. A prioritization of these strategies, for each city, can be found in Volume 2 of this report.*

- **Set up a well-established and reliable public transport system**, tailored to the population and area of the city. This could include metro rail, mono rail, BRT, Lite BRT, Bus system, minibus system, trams, rope ways system, boat-jetty network or a combination of them depending on their feasibility.
- **Ensure multimodal integration** while developing transport plans and projects. Indian cities have a large mix of transport modes being used; they should ensure that networks are completed using multimodal integration and that all existing modes are considered and included when planning for a new system. Information and telecommunications systems should be used to support this integration.
- **Apply Transit Oriented Development** principles, integrating land use and transport, to ensure that vehicular miles traveled are minimized.
- **Promote clean fuel based vehicles**, such as CNG, hybrid, electric, etc., by offering subsidies or providing better infrastructure.
- **Promote Non-motorized transport** and offer a good network of footpaths and good infrastructure to enable safe cycling and other NMT modes.
- **Restrict polluting vehicles in certain areas**, such as city centres, squares, market places, heritage and environmental precincts by charging extremely high parking/stopping/entry fees.
- **Organize parking of private vehicles** applying differential parking fees keeping in mind local land prices and how they want flow of private vehicles to be maintained in certain areas. This can also be done by charging one time standard fee from all households depending on the specification of the car and numbers of owned.



## 4.2.8 Urban Water and Sanitation Sector and Green Growth

### Introduction

Water is a resource having immense significance for human existence and a driver of economic development in urban areas. However, it is becoming scarcer due to population growth, urbanization and climate change impacts. The Urban Water and Sanitation Sector includes municipal services such as supply of water, and collection and treatment of waste water and faecal sludge. This includes the provision and operation of facilities to ensure that proper quantity and quality of water is delivered to cities and the sewage discharged from urban communities is properly collected, transported, and treated to the required degree and disposed-off/reused without causing any health or environmental problems.

There can be no development without water, but not all water can go towards development. Cities need to understand the implications that other sectors can have on urban water management. With rapid urbanization in India, cities have a huge opportunity to move towards a holistic green growth pathway ensuring better access to water and sanitation, utilization of water resources in a sustainable manner, and water security in the long term.

### Sector Growth Story

*Analyzing the current status of the Water and Sanitation sector - including its present growth as well as prevailing policies and practices, evaluating the expected future growth trends and identifying the main actors who can support a transition to Green Growth helps develop an accurate picture of the starting point of a city's Green Growth process.*

The country has seen a significant increase in access to both water supply - from 69% in 1990 to 92% in 2011, and sanitation - from 18% in 1990 to 35% in 2011<sup>49</sup>, triggered by enabling programme initiatives<sup>50</sup> and governing policies such as the revised National Water Policy<sup>51</sup> (NWP) (2002) and the National Urban Sanitation Policy (2008). The 73rd and 74th Constitutional Amendment Acts (CAA) have resulted in noteworthy transfer of responsibilities for provision of drinking water and sanitation facilities, traditionally resting with state governments, onto urban local municipal governments and their agencies.

While the total water resource availability has remained constant, water demand in India has grown steeply over the years, rising to nearly 750 billion cubic meters (bm<sup>3</sup>) in 2010 from 550 bm<sup>3</sup> in 1990<sup>52</sup>, driven by high growth in population, increasing urbanization, changing lifestyles, and economic growth. Conflicts in water demand within major competing users, namely domestic agricultural and industrial sectors<sup>53</sup>, have been gaining prominence with growing industrialization and changing consumption patterns in urban areas.

Most Indian cities are traditionally dependent on rainfall for their annual water supply and have to source water from long distances ranging from 50 to 200 km, increasing the cost

<sup>49</sup>India Sanitation facility access: [http://www.indexmundi.com/india/sanitation\\_facility\\_access.html](http://www.indexmundi.com/india/sanitation_facility_access.html). Accessed on September 2014.

<sup>50</sup>Programmes such as the Accelerated Urban Water Supply Programme, Jawaharlal Nehru National Urban Renewal Mission (NURM), Service Level Benchmarking (SLB) Programme, Urban Infrastructure Development Scheme for Small and Medium Towns (UIDSSMT) were rolled out targeting service infrastructure development in cities.

<sup>51</sup>The NWP was formulated in 1987 and further revised in 2002; a draft NWP has been put up for revision in 2012.

<sup>52</sup>KPMG, 'Water sector in India: Overview and focus areas for the future', PanIIT Conclave, 2010.

<sup>53</sup>Agriculture, domestic and industrial sector account for 89%, 9% and 5% of the surface water withdrawals in India.



of raw water and the possibility of leakages. Only 36.8 million of the 53.7 million urban households in the country have tap water supply, of which 72% have it within the premises, 22% have it outside the premises and 6% have tap water available within 100 meters<sup>54</sup>. Most of the larger cities depend on municipal services for water supply while the smaller towns are dependent on groundwater through informal water supply, i.e. individual dug-wells, bore wells, tube-wells, hand-pumps etc. India is the largest consumer of groundwater in the world with an estimated usage of 230 km<sup>3</sup> per year<sup>55</sup>. The trend of reliance on private supplies through tankers fetched from unregulated water bodies is also increasing. Inadequate coverage, intermittent supplies, low pressure, and poor quality are some of the most prominent features of water supply in the cities of India.

The Service Level Benchmarking Exercise conducted by the Ministry of Urban Development (MoUD) in 2010-11 in over 1400 cities/towns indicates that the existing service levels in the urban water and wastewater sector in India leave a lot to be desired (see Table 4).

**Table 4: Status of the Urban Water Supply and Sewerage service in Indian Cities<sup>56</sup>**

Performance Indicator	Benchmark	Current Status
<b>Water Supply</b>		
Coverage of supply connections	100%	50.2%
Per capita water supply	135 lpcd	69.2 lpcd
Extent of water connection metering	100%	13.3%
Non- revenue water (NRW)	15%	32.9%
Continuity of water supply	24 hours	3.1 hours
Cost recovery in water supply service	100%	38.8%
<b>Sewerage</b>		
Coverage of toilets	100%	69.5%
Coverage of sewage network services	100%	12.2%
Adequacy of sewage treatment capacity	100%	5.3%
Reuse and recycling of Sewage	20%	4.0%

<sup>54</sup>Nallathiga, R., 'Reforming Urban Water Supply Sector in India', Centre for Good Governance, Hyderabad, 2008.

<sup>55</sup>UNICEF, FAO and Saci WATERS, 'Water in India: Situation and Prospects', 2013.

<sup>56</sup>Ministry of Urban Development, Government of India, 'Status Report on Service Levels in Urban Water and Sanitation Sector: 2010-11', 2012.



Even in places where water supply is adequate, the share of Non-revenue water (NRW) is extremely high due to several reasons, such as old water systems and poor maintenance, illegal connections, leakages, absence of metering, lack of proper mapping systems and no incentives to reduce inefficiencies<sup>57</sup>. Thus, poor service delivery in cities is compounded by poor cost recovery and poor revenue generation. Cities also face water quality issues such as presence of fluoride (66 million people across 17 states estimated to be at risk), varying iron levels, excess arsenic in ground water (nearly 13.8 million people reported at risk), presence of nitrates and heavy metals, bacteriological contamination and salinity<sup>58</sup>.

With regards to sanitation, only 38% of India's urban population has access to sanitation services. 18.6% of urban households lack toilet facilities within their premises and 54.6% of urban slums have no access to toilets<sup>59</sup>. About 30 million urban households are connected to septic tanks as per Census 2011. Sewage treatment capacity existed for merely around a third of the total 38,000 MLD of sewage produced in cities<sup>60</sup> as of 2008. Moreover, the existing wastewater treatment capacity is lying underutilized because of high operation and maintenance costs of the sewerage treatment plants (STPs) and their non-conformance to environmental standards for discharge into streams<sup>61</sup>. Hence most of the time, domestic sewage and industrial effluent are untreated, and their discharge contaminates locally available water courses (surface as well as ground water) while potentially jeopardizing both public health and the ecosystem.

Overall, the current trend in the urban water and sanitation sector is towards infrastructure provisions governed by municipal bodies like conventional networks, underground/over-ground storage reservoirs, centralized water and wastewater treatment facilities and is characterized by issues of inefficient water distribution network, water quality issues, pollution in water bodies and groundwater depletion.

India's demographic and economic growth coupled with rapid urbanization will lead to a significant increase in the future water requirement across all sectors. Under the current scenario, water demand is expected to grow by 20% just in the next decade, with industrial requirements expected to double and domestic demand growing by 40%. Irrigation meanwhile is likely to require only 14% more water in the next ten years owing largely to the shifting urban landscape<sup>62</sup>. To meet the rising demand, the water sector has to be strengthened to supply about 150 lpcd of water supply to residents and another 40-60 lpcd of supply to commercial and industrial requirements by 2031. This would require an estimated capital expenditure of INR 3,209 billion and INR 2,426 billion respectively on urban water supply and sewerage infrastructure in the period 2012-2031<sup>63</sup>. The overall planned investment in the 12th Five Year Plan (FYP) is INR 2,000 billion for the water and sanitation sector, more than double the sectoral allocation of INR 960 billion in the 11th FYP.

<sup>57</sup>High Powered Expert Committee (HPEC) for Estimating the Investment Requirements for Urban Infrastructure Services, 'Report on Indian Urban Infrastructure and Services', March 2011.

<sup>58</sup>Planning Commission, Government of India, 'Water Supply & Sanitation: India assessment 2002', A WHO-UNICEF sponsored study.

<sup>59</sup>Sustainable Sanitation and Water Management: <http://www.sswm.info/>

<sup>60</sup>Central Pollution Control Board (CPCB), 'Status of water supply, wastewater generation and treatment in Class I Cities and Class II Towns of India', Control of urban pollution series, CUPS/70/2009-10, 2009.

<sup>61</sup>CPCB estimates about 39% of STPs are not conforming to the general standards prescribed under the Environmental (Protection) Rules for discharge into streams.

<sup>62</sup>Amarasinghe, U. A., Shah, T., Turral, H., Anand, B.K, 'India's Water Future to 2025-2050: Business as Usual Scenario and Deviations', International Water Management Institute, IWMI Research Report 123, 2007.

<sup>63</sup>High Powered Expert Committee (HPEC) for Estimating the Investment Requirements for Urban Infrastructure Services, 'Report on Indian Urban Infrastructure and Services', March 2011.



## Actors Involved

MoUD, Ministry of Drinking Water & Sanitation and the Ministry of Environment and Forests (MoEF) are the nodal ministries in charge of various aspects of urban water supply, sanitation and the environment in India. The Central Public Health and Environmental Engineering Organization (CPHEEO) is a technical wing of the MoUD that formulates policy guidelines, strategies and technical manuals with regards to water supply and sanitation for the states and urban local bodies. The CPHEEO plays a vital role in processing the schemes posed for external funding agencies including World Bank, the Asian Development Bank (ADB) and bilateral and multilateral funding agencies and institutional financing such as the Life Insurance Corporation of India (LIC). The Central Pollution Control Board (CPCB), a statutory organization constituted with the powers and functions under the Water (Prevention and Control of Pollution) Act (1974), provides technical services to the MoEF.

Water supply and sanitation is a state responsibility under the Indian Constitution. With the 74th CAA and devolution of powers, funding for water supply and sanitation is allocated by the Centre within State budgets, and urban local governments or State Level organizations are responsible for its planning and implementation. States generally plan, design and execute water supply schemes through their state departments' public health and engineering department or state water supply and sewerage boards.

## Green Growth Visions

*The two visions below present an ideal scenario of how the Water and Sanitation sector would appear in the future, had the city fulfilled or even exceeded all its development objectives. These visions, achieved either through a gradual, incremental process (efficient) or a more radical paradigm shift (transformative) become the ultimate Water and Sanitation 'target' that cities should aim for.*

### **Efficient Green Growth Vision**

A city providing adequate access to safe, secure and affordable water, sanitation and hygiene for all its citizens and with no open defecation. The city has a well-maintained refurbished service network having low leakages and sewer infiltration. All service connections are metered and rationalized volumetric tariffs are levied to check excess water use and sewage generation and to ensure adequate recovery of costs. Municipal facilities are highly water and energy efficient and have leakage detection and real-time monitoring and control systems. Water efficient equipment such as low flow taps and waterless toilets are used in public/institutional and new residential buildings. Rooftop rainwater harvesting systems exist in all buildings and rainwater harvesting structures/recharge wells are located in public/institutional campuses. Wastewater recycling and reuse is promoted across industrial clusters, residential houses, commercial establishments and schools through bye laws, mandates and fiscal incentives. Decentralized systems exist in informal and poor settlements, many of which are managed by the community. Extraction of groundwater and pollution of water bodies is regulated, leading to a safe environment.

### **Transformative Green Growth**

A city providing safe, secure, affordable uninterrupted water supply and high quality sanitation facilities to all its citizens and with no open defecation. The city has centralized facilities as well as several decentralized systems, connected by well-designed and well laid out service network with leakages and sewer infiltration near absent. Smart meters are installed for all



service connections, with water use and sewage generation minimized through rationalized volumetric tariffs and incentives/regulations. Service provision for water and sanitation is highly profitable. Municipal facilities are highly efficient, having leakage detection and real-time monitoring and control systems along with reliable tools to predict resource availability and quality and to allocate water demand across users. The city has a closed loop water cycle which looks at optimizing water resources (surface as well as groundwater) and water use through catchment management, widespread reuse of wastewater along with rain water harvesting and groundwater recharge. As a result water related disasters such as flash floods are minimized in the city. Rainwater harvesting systems and recharge wells are situated at appropriate locations all across the city and in all buildings. Wastewater recycling and reuse is practiced in all major building/land use types to have minimal wastewater discharge. Water efficient equipment is used in all new and old buildings. Incentives schemes and mandates are put in place to ensure water productivity of major water users is high. Participatory decision making which involves a highly aware community ensures that all water resources are well managed and service provision is catering to all demands. The city has clean water bodies with rich aquatic biodiversity.

### Green Growth Benefits

- **Personal benefits** include access to clean and safe water and sanitation; better hygiene; improved health and well-being; reduced expenditure on water; increased disposable income.
- **Community benefits** include improved ground water levels; decontamination of surface and ground water bodies; reduced water losses; improved public health; improved drinking water quality; enhanced biodiversity; increased productivity; city competitiveness.
- **National/global benefits** include improved water security; natural resource conservation; reduced public expenditure; increased climate resilience; contribution to meeting millennium development goals.

### Options and Opportunities

*Through the analysis of the Water and Sanitation sector, undertaken to assess its “Current Status” and “Growth Trends”, a number of existing or emerging options and opportunities have emerged. These can be used and leveraged by cities to accelerate the transition to their targeted Green Growth vision. These opportunities are listed below.*

- National policy support is available, such as the NUSP, which aims to address urban sanitation challenges through the preparation of comprehensive and holistic City Sanitation Plans (CSPs) to outline strategies and programmes for the development of domestic wastewater services, solid waste management services, and micro drainage services<sup>64</sup>.
- Volumetric water tariffs are being promoted to help check excess water usage and improve financial cost recovery. Undertaking water audits and leakage mapping is enabling cities to reduce NRW and increase efficiency of the water distribution system. Cities are adopting technologies like SCADA and leakage monitoring systems to cut down water losses.
- Information and Communication Technology (ICT) and GIS based tools are being applied to map water supply, drainage and sanitation networks and facilitate the management and assessment of huge spatial and non-spatial data for planning purposes.

<sup>64</sup>Significant emphasis is placed on environmental considerations, public health implications, reaching the unserved and urban poor population, improving hygienic conditions for women, institutional capacity, financing and tariffs, raising awareness, and stakeholder engagement.





INNOVATIVE GREEN SOLUTIONS CAN RESOLVE URBAN SANITATION ISSUE

- Cities are looking at utilizing rainwater harvested through recharging/harvesting structures in appropriate locations for potable and non-potable uses to help improve the water table, augment water sources and prevent water logging and flooding. Use of rainwater harvesting systems and wastewater treatment systems is being promoted through amendments in building bye laws. Potential of alternative water sources such as wastewater is being tapped for non-potable reuse in industries and agriculture to help reduce the demand for freshwater sources.
- Low cost technologies such as decentralized wastewater treatment system (DEWATS) and Ecosan are gaining prominence as viable alternatives to capital intensive centralized sewerage/sanitation options. Such technologies also have lower operation and maintenance (O&M) costs.
- Community participation and mobilization is being undertaken to ensure successful O&M of small scale solutions for water supply and sanitation.
- Promoting water conservation and using water efficient devices such as low flow faucets or low flow showerheads at the user side can help reduce water demand.
- National programmes like the Swachh Bharat Abhiyan (Clean India Campaign) are being supported by Corporate Social Responsibility (CSR) initiatives to deploy sanitation infrastructure.



- Public private partnership models are being explored by cities in areas such as metering and O&M of water supply facilities, designing, financing and construction of water and sewerage treatment plants and also for small scale solutions at the local level.

## Barriers

*Evaluating the current and future trends of the Water and Sanitation sector led to the identification of barriers that already are or could in the future hinder or even prevent cities from seizing the opportunities listed above, thus precluding a transition to Green Growth. These barriers are listed below.*

- Lack of metering for water connections hampers levying of volumetric tariffs while also leading to high NRW, physical losses and poor financial recovery.
- Lack of municipal capacity and systems to undertake adequate maintenance of physical infrastructure, monitoring and administration of mandatory regulations/requirements, design, planning and implementation functions, and ICT/GIS tool based mapping, modeling and planning activities.
- Enforcement of mandates for rainwater harvesting and wastewater treatment/recycling systems is poor in Indian cities, with such systems completely absent or defunct in buildings.
- Recent policies continue to be fixated on conventional centralized systems, as in the case of the NUSP which focuses on safe sanitation and sustainability by promoting conventional network-based sewerage systems but lacks elements for promoting or incentivizing unconventional cost-effective solutions.
- Decentralized governance principles are yet to be followed i.e. citizen group empowerment, local level access and community/public involvement is quite low. There is a lack of awareness with regards to urban water and sanitation issues in the community.
- Unrealistically low water prices due to lack of economic pricing of water by the National and State governments encourage inefficient domestic and industrial usage of water. There is a dearth of incentives and mechanisms to reduce inefficiencies and promote conservation and reuse of water and wastewater.
- Low involvement of public private partnerships in the water and sanitation sector, with private sector involvement currently limited to maintenance contracts. Political unwillingness, low tariffs, lack of financially viable bankable projects, issues in metering, low willingness to pay on the community side and complex contractual structures are some of the reasons for this.



## Review of the Cities Visited

The following sections present the results of the analysis of the ten cities, carried out applying once again the Framework developed in chapter 3.

The table below provides a comparative overview of the status, barriers and opportunities for the Water and Sanitation sector across all the ten cities. The comparative analysis is done through relevant indicators, identified by the team (based on desk research and brainstorming sessions) and further developed to undertake the interviews and data collection during the city assessment visits. The analysis, driven by elements of the Framework, enables to test and validate the background (theoretical) sectoral hypotheses and develop sector specific green growth strategies on this basis.

Cities	Agartala	Agra	Dehradun	Cochin	Kota	Ludhiana	Nadiad	Pimpri Chinchwad	Shimla	Vijayawada
<b>Status and trends</b>										
Coverage of water supply connections <sup>65</sup>	Low	Low	Low	High	High	High	Low	High	Low	NA
Adequacy of water supply (135 lpcd per capita)	No	No	No	Yes	Excess	Excess	No	Yes	No	NA <sup>66</sup>
Continuity of water supply <sup>67</sup>	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low
Non-revenue losses in water supply (<15%)	No	No	No	Yes	No	No	No	No	No	NA
Notable ground-water dependency / depletion	No	Yes	Yes	No	No	Yes	Yes	No	No	No
Toilet coverage <sup>68</sup>	Low	High	Low	Low	High	High	Low	High	High	NA
Sewerage network service coverage <sup>75</sup>	Low	Low	Low	Low	Low	High	Low	High	Low	NA
Adequacy of sewage treatment capacity <sup>75</sup>	Nil	Low	Nil	Nil	Nil	Low	Low	High	Excess	NA
Extent of sewage recycling and reuse (>20%)	Nil	High	Nil	NA	Nil	NA	NA	Low	Nil	NA
Storm water drainage network coverage <sup>75</sup>	Low	Low	Low	Low	Low	Low	Low	Low	Low	NA

<sup>65</sup>Low: less than 80 % coverage, High: greater than 80 % coverage.

<sup>66</sup>Service level benchmark data not shared by the city.

<sup>67</sup>Low: Non availability of continuous water for 24 hours as per Service level benchmark for water supply by Ministry of Urban Development, Government of India.

<sup>68</sup>Low: less than 80 %. High: 80-100%. Excess: greater than 100%.



Cities	Agartala	Agra	Dehradun	Cochin	Kota	Ludhiana	Nadiad	Pimpri Chinchwad	Shimla	Vijayawada
<b>Opportunities</b>										
City Sanitation Plan	Yes	Yes	No	Yes	No	No	No	Yes	Yes	Yes
Regulatory provision for rooftop rain water harvesting systems in by-laws or D.C. Rules	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regulatory provision for reuse of recycled wastewater in by-laws or D.C. Rules	Yes	Yes	Yes	No	NA	Yes	NA	Yes	No	No
<b>Barriers</b>										
Extent of functional metering for water supply <sup>69</sup>	Nil	Nil	No	NA	Low	Low	NA	High	Low	NA
Non-volumetric water tariff <sup>70</sup>	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Yes
Cost recovery in water supply service <sup>71</sup>	Low	Low	Low	NA	Low	NA	NA	Low	Low	NA
Cost recovery in sewage treatment service <sup>78</sup>	NA	Low	Low	NA	NA	NA	NA	High	Low	NA

<sup>69</sup>Low: less than 80 %. High: greater than 80 %.

<sup>70</sup>Flat rate adopted for domestic connections.

<sup>71</sup>Low: The city is unable to collect 100% of incurred cost for service provision. High: the city is able to collect 100% of incurred cost for service provision



## Status and Trends in the Cities Visited

The analysis of the current status and observed trends in the ten cities is needed to establish the initial benchmark from which the Green Growth process will be started.

- **Coverage of water supply connections:** Water supply coverage is seen to be low in five of the project cities, with a majority of households in Agartala and Dehradun not having direct connections. The cities of Cochin, Kota, Ludhiana, Pimpri Chinchwad fare much better.
- **Adequacy of water supply:** Five of the project cities fail to provide adequate water supply to meet the CPHEEO norm of 135 lpcd. Water supply is adequate in Cochin and Pimpri Chinchwad (slightly higher than the norm). Notably excessive water supply in the cities of Kota and Ludhiana can lead to higher energy costs and higher residential wastewater generation.
- **Continuity of water supply:** All the ten cities fall well short of achieving continuous water supply. The situation is relatively better in Kota and Ludhiana, both of which have daily water supply duration of over ten hours. Water supply duration is alarmingly low in Shimla, owing to a lack of water sources in its close vicinity and the need to lift water from natural sources through a substantial head for municipal supply.
- **Non-revenue losses in water supply:** All the cities except Cochin have NRW losses substantially higher than the SLB prescribed figure of 15%.
- **Notable groundwater dependency/depletion:** Cities such as Agra, Dehradun, Ludhiana and Nadiad are highly dependent on groundwater extracted through tube-wells and groundwater depletion is alarming in Agra and Ludhiana, emphasizing the need to regulate groundwater extraction in cities with high groundwater dependency.
- **Toilet coverage:** Five of the cities have relatively high coverage of toilets while the cities of Agartala, Dehradun, Cochin and Nadiad in need to improve toilet coverage significantly.
- **Sewerage network service coverage:** With the exception Pimpri Chinchwad and Ludhiana, the coverage of the sewerage network is highly inadequate in the rest of the cities.
- **Adequacy of sewage treatment capacity:** Four of the cities lack facilities for sewage treatment and Agra, Ludhiana and Nadiad require noteworthy augmentation of treatment services. Wastewater treatment capacity is significantly underutilized in Shimla.
- **Sewage recycling and reuse:** Recycling and reuse of waste water is near absent in almost all the cities except Agra and they fall well short of the benchmark value of 15%. Extent of sewage recycling and reuse reported in Agra is quite high and needs further investigation.
- **Storm water drainage network coverage:** A city-wide storm water drainage network is not present in any of the cities, with coverage quite low in the cities of Agartala, Dehradun, Ludhiana, Nadiad and Pimpri Chinchwad.



SEWAGE TREATMENT CAPACITY EXISTED FOR A MERE ONE-THIRD OF 38,000 MLD SEWAGE PRODUCED IN CITIES AS OF 2008

### Opportunities in the Cities Visited

*The existing and emerging opportunities identified at the national level (and previously described) have been tested in the ten cities visited, to assess their feasibility and applicability.*

- **City Sanitation Plans:** CSPs can help cities to develop comprehensive strategies and programmes to address local sanitation issues. CSPs have been developed for only six of the project cities while the cities of Dehradun, Kota, Ludhiana and Nadiad do not have CSPs in place.
- **Regulatory provision for rooftop rainwater harvesting systems and reuse of recycled wastewater in by-laws or D.C. Rules:** Regulatory mandates to promote rainwater harvesting systems and wastewater reuse can help reduce freshwater demand. While regulations for rooftop rainwater harvesting systems exist in all the project cities and those for wastewater treatment and reuse exist in five of the cities, the extent of enforcement and implementation of these systems in the cities needs further investigation.



## Barriers in the Cities Visited

Many of the barriers previously outlined and potentially interfering with a Green Growth process at the national level have been encountered in the ten cities visited too. Additional barriers, specific to some of the cities, have emerged as well.

- **Extent of functional metering for water supply:** All the project cities fall well short of having functional meters for all water connections. This does not allow them to reliably know the status of water usage and leakages in the city.
- **Non-volumetric water tariff:** Six of the cities have a non-volumetric tariff structure, which contributes to poor financial recovery and inefficient water use. Volumetric tariffs exist in Cochin, Kota, Nadiad and Pimpri Chinchwad while Shimla has adopted a flat rate tariff for domestic connections.
- **Cost recovery in water supply and sewage treatment service:** Cost recoveries reported by the project cities for water and sewage treatment service are quite low with the exception of Pimpri Chinchwad, which has nearly full recovery in sewage treatment.

## Strategies for Green Growth in Urban Water and Sanitation Sector

Based on the analysis of the current state and future trends, and the assessment of the existing/emerging opportunities and corresponding barriers, a number of Green Growth strategies have been outlined, that will help cities overcome the barriers and fully leverage the existing opportunities. Cities can choose the combination of either of these strategies according to the applicability to the local context and to the target vision they are striving for. A prioritization of these strategies, for each city, can be found in Volume 2 of this report.

- **Undertake Integrated Urban Water Resource Management:** Cities should look at holistic approaches for the management of water demand as well as water resources. Integrated Urban Water Resource Management involves focusing on efficient and sustainable management of water resources with reduced losses, management of basins and natural drains to prevent development/encroachments and flash flood situations, and exploring alternative sources of water, like runoff through rainwater harvesting and reuse and recycling of wastewater. Integration of plans/schemes for water, wastewater and drainage at the institutional level is required.
- **Promote decentralized green solutions:** Household or community scale low cost decentralized or on-site technologies such as DEWATS and waterless toilets should be promoted in unserved and poor settlements or in areas with low population where centralized systems are not feasible. Small scale decentralized water and wastewater treatment systems can be located in catchments areas to provide safe drinking water and ensure safe disposal of wastewater and faecal sludge. Such systems can be integrated into the centralized system at a later stage.
- **Promote water efficiency:** Efficiency should be promoted in water sourcing, distribution, supply as well as its end use. Cities can regulate water use through metering of connections and differential volumetric tariffs across consumer categories, supported by enabling frameworks such as local metering policies and guidelines. Efficiencies in urban water systems can be improved through the use of technologies such as GIS and SCADA and by undertaking periodic water audits and leakage mapping exercises. Water efficient devices such as low flush toilets and low flow shower heads/faucets can be promoted in residential, public, institutional and commercial buildings through incentives schemes, mandates and retrofit programmes. Enforcing water use standards and offering incentives for water intensive sectors can help to promote efficient water use.



● **Promote rainwater harvesting and restrict groundwater use:** Rainwater harvesting systems should be promoted to conserve freshwater resources, augment depleting groundwater reserves and counter frequent incidences of flooding. Strict enforcement of rainwater harvesting bye laws based on local conditions can boost deployment of rooftop harvesting systems in buildings. Rainwater harvesting structures or recharge wells can be mandated for certain land use types as feasible. Hydrological modeling and flood monitoring can help identify appropriate locations for RWH systems in the vicinity of vulnerable settlements. Interventions such as rules, penalties and check meters installed at appropriate locations can help regulate groundwater extraction.

● **Promote recycling and reuse of wastewater:** Cities should harness the potential of wastewater reuse and recycling to help reduce freshwater demand and generate by-products, like biogas energy and manure. Enforcement of bye laws/mandates and fiscal incentives can promote wastewater recycling and reuse in certain land use/building types for industrial uses, landscape irrigation, agricultural irrigation, use in fountains and fire protection. This can be supported by quality standards and guidelines developed for wastewater reuse at the local level.

● **Encourage private engagement and partnerships:** Private sector engagement should be promoted by putting in place local programmes to leverage CSR initiatives for provision of decentralized green solutions. City governments should put in place enabling frameworks such as PPP procedures or guidelines and look to partner with private sector across aspects of design, planning, construction, O&M, and billing for water and sanitation to help bridge the gap in terms of technical, technological, financial and human resource capacity.

● **Promote community awareness and participation:** Cities should also focus on generating awareness through a well-conceived communication strategy targeting stakeholder groups across the community. This can be done through publicity campaigns, demonstration programmes, pilot projects, workshops, school sanitation ratings etc. Awareness can be the first step towards involving communities in planning, implementation and management of initiatives which contribute to strengthening ownership, addressing cultural/behavioral barriers, gaining feedback from direct beneficiaries, organizing the community for O&M activities and eventually long term sustenance.





## 4.2.9 Urban Solid Waste Management Sector and Green Growth

### Introduction

Urban waste is a term used to describe household waste, construction and demolition debris, sanitation residue, plastic and electronic waste and hazardous waste (industrial and hospital waste) that are produced and discarded by the public on a daily basis. Solid Waste Management (SWM) in India is one of the obligatory functions of Urban Local Bodies (ULBs), responsible for its collection, transportation and disposal.

Even with the most advanced regulations and policies, solid waste management is a sector that remains not well addressed in Indian cities and has considerable negative impacts on local environment and health. As cities grow, with rising urban population and per capita income, the waste produced in Indian cities will only increase. Looking at greener options for waste management in urban areas will help cities to reduce local impacts and grow in a green way.<sup>72</sup>

### Sector Growth Story

*Analyzing the **current status** of the Solid Waste Management sector - including its present growth as well as prevailing policies and practices, evaluating the expected **future growth trends** and identifying the **main actors** who can support a transition to Green Growth helps develop an accurate picture of the starting point of a city's Green Growth process.*

In light of the country's rapid urbanization and the deterioration in the level of sanitation services provided, and as a reaction to the plague epidemic in Surat in 1994, the Government of India (GoI) has, in the last two decades, developed and implemented several policies, norms, acts and rules to guide and strengthen service delivery in the sector. These include the Municipal Solid Waste Management and Handling Rules (2000), which emphasize the principles of 3 R's (Reduce, Reuse and Recycle); the Central Public Health and Environmental Engineering Organization (CPHEEO) manual on Municipal Solid Waste Management, which governs municipal waste management and is currently under revision; the Environment Protection Act (EPA) (1986); the Bio-medical Waste Rules (1998); the Hazardous Waste Rules (2008); the Plastic Waste Rules (2011); the E-Waste Rules (2011); and the Municipal Solid Waste Landfill Regulations etc.

The GoI has also implemented a number of sustainable initiatives, such as developing reports focusing on deficiencies or gaps in the existing SWM system in Class I cities; sanctioning nearly about 40 SWM projects under the National Urban Renewal Mission (NURM) programme and initiated NURM phase II during the 12th Five Year Plan (FYP) period; allocating funds and introducing public-private partnerships for enhancing the SWM services, and starting the Service Level Benchmarking (SLB) programme in 30 states and across 1700 urban local bodies. However, the status of SWM in Indian cities lags behind substantially in nearly all major aspects as indicated by the Service Level Benchmarking Exercise conducted by the Ministry of Urban Development (MoUD) in 2010-11 in over 1400 cities/towns (see Table 5).

<sup>72</sup>Ministry of Environment and Forest, Government of India, 'Solid Waste Management & Handling Rules: 2000'.



**Table 5: Status of the Urban Municipal Solid Waste Management service in Indian Cities<sup>73</sup>**

Performance Indicator	Benchmark	Current Status
Household level coverage	100%	35%
Efficiency of collection of MSW	135 lpcd	75.6%
Extent of segregation	100%	10.8%
Extent of MSW recovered	80%	14.5%
Extent of scientific disposal	100%	9.7%
Cost recovery	100%	7.3%
Efficiency in collection of charges	90%	14.4%

It is estimated that the current waste generation of 1.6 metric tonnes per day per capita as of 2009 would increase by about 1.3% per annum. When coupled with the growth in urban population, this would result in an annual increase of 5% in the overall quantity of solid waste generated, translating to an estimated 260 million tonnes of waste generation annually by 2047. With collection efficiency ranging between 70-90% in the major cities and below 50% in smaller cities and with an estimation that about 91% of municipal solid waste is dumped in open dumpsites or landfills (CPCB 2000), of which a very minor portion is dumped in a scientific manner in sanitary landfills, the future scenario is unlikely to change unless the country sees major improvements in the quality of SWM services. SWM services require high capital costs and the quality of these services can improve with viable and sustainable business models to enable the engagement of the private sector<sup>74</sup>.

According to the High Powered Expert Committee appointed by the Ministry of Urban Development (MoUD), INR 485,820 million worth of capital expenditure and INR 2,739,060 million for operation and maintenance would be required for a period of 20 years from 2012-2031 to strengthen the sector<sup>75</sup>. The GoI is focusing on encouraging the 4 R's (Recycle, Reuse, Reduce and Remanufacture); incentivizing PPP to create the capital intensive infrastructure required for setting up of treatment storage and disposal facilities (TSDF) for hazardous waste management; ensuring segregation of bio-medical waste as per the existing rules; enhancing recycling facilities for E-waste; and ensuring municipal solid waste segregation, collection and setting up of facilities for complete disposal during the 12th FYP<sup>76</sup>. In addition to the above mentioned initiatives, the Government is currently promoting and actively advising all metropolitan cities to generate energy from waste by providing subsidies and incentives to such projects<sup>77</sup>.

<sup>73</sup>Ministry of Urban Development, Government of India, 'Status Report on Service Levels in Urban Water and Sanitation Sector: 2010-11', 2012.

<sup>74</sup>Department of Economic Affairs, Ministry of Finance, Government of India, 'The position paper on the solid waste management in India' 2009.

<sup>75</sup>High Powered Expert Committee (HPEC) for Estimating the Investment Requirements for Urban Infrastructure Services, 'Report on Indian Urban Infrastructure and Services', March 2011.

<sup>76</sup>Planning Commission, Government of India, 'Economic Sectors: 12th Five Year Plan (2012-2017)', Volume II, SAGE Publications, 2013.

<sup>77</sup>India - Waste Generation Scenario: <http://www.eai.in/ref/ae/wte/wte.html>



## Actors Involved

SWM is part of public health and sanitation, and is a state subject according to the Indian Constitution, with the responsibilities of undertaking SWM functions lying with the ULBs. The Ministry of Environment and Forests (MoEF) and the Ministry of Urban Development (MoUD) are the nodal national ministries in charge of various aspects. The Central Public Health Environmental Engineering Organization (CPHEEO) prepares policies, strategies and guidelines for the states and the ULBs. Development authorities, city municipal corporations and municipalities are the responsible authorities for SWM at the city level.

## Green Growth Visions

*The two visions below present an ideal scenario of how the Solid Waste Management sector would appear in the future, had the city fulfilled or even exceeded all its development objectives. These visions, achieved either through a gradual, incremental process (efficient) or a more radical paradigm shift (transformative) become the ultimate Solid Waste Management 'target' that cities should aim for.*

**Efficient Green Growth Vision:** A litter-free city achieving efficiency in collection, transportation, processing and disposal of solid waste. High emphasis is given to source reduction and segregation of waste. Successful source waste reduction and segregation (of wet, dry and hazardous waste) is achieved by creating high level of awareness amongst residents, school children, youth, shop owners, fish and vegetable market associations, hawkers, pavement dwellers as well as the municipal staff; ensuring that the community collectively works towards achieving the vision. This is well complemented by decentralized/ community level waste management systems to reduce the burden of handling large volumes of MSW at a centralized location, with a corresponding reduction in costs of transportation and intermediate storages. Self Help Groups (SHGs) are actively involved in promoting and supporting households in waste segregation practice. The local government has adequate staff with sufficient vehicles and infrastructure to undertake waste collection, source segregation and prompt disposal of waste in street bins in a systematic manner. Implementation of source reduction and segregation is reinforced through strict enforcement, which involves imposing penalties as well as offering enabling incentives.

Well-maintained and efficient facilities exist in the city to process the segregated waste streams, in the form of composting facilities and biogas plants (for organic waste), recycling plants (for dry waste such as paper and glass) and waste to fuel plants (for plastic). The residual inerts are scientifically disposed in a sanitary landfill to keep the city clean and litter free.

**Transformative Green Growth Vision:** A zero waste city focusing on eliminating all solid waste rather than just managing it. The local government formulates and adopts comprehensive plans to minimize waste going to the scientific landfill site. Production and distribution systems are restructured to have a high degree of material efficiency, recyclability and reusability. Significant efforts and actions are taken by the industry to control product and packaging design, manufacturing processes, and material selection. The city has robust policies and fiscal incentives to promote better product design and reusability across sectors. The discarded materials are designed to become resources for others to use. Take-back schemes are implemented for the community/consumers by companies for products such as clothing, glass utensils and jars, plastics bottles, packaging cartons, mobile phones and computers. Valuable raw material such as cotton, glass, metals, plastics and paper from



these products is recovered by industries through recycling facilities existing in the city to reduce efforts for sourcing and related costs for raw material.

Emphasis on waste reduction, source segregation and diversion of waste from landfill and incineration plants to composting, recycling and manufacturing units is evident all over the city. A highly informed and active community practices waste minimization by buying less and reusing products (e.g. carry bags, discarded garments). Waste segregation is the norm in the city, motivated by strict enforcement which involves incentives, subsidies and penalty impositions.

Mandatory bye laws ensure wide spread presence of biogas plants and composting facilities for processing organic waste in all major buildings and land use types across the city such as residential townships/group housing, low income housing projects, public/institutional campuses, schools and educational institutes, restaurants, commercial complexes and markets, and vegetable markets. Refuse derived fuel (RDF) and Waste to Energy facilities, supported by attractive fiscal incentives and setup by private players, recover energy from any additional waste before its final disposal.

### Green Growth Benefits

- **Personal benefits include:** improved health and well-being; poverty alleviation and increased employment, through improved waste management and recycling techniques.
- **Community benefits include:** cleaner and safer neighborhoods; savings in waste management costs due to reduced levels of final waste for disposal; better business opportunities and economic growth.
- **National/Global benefits include:** resource efficiency and conservation; environment protection; savings through the implementation of waste prevention and waste minimization, recycling and recovery; increased jobs and income through recycling and composting programs, supply of valuable raw materials for industry, production of soil-enhancing compost for agriculture; reduction in the need to build more landfills and combustor; reduction in greenhouse gas emission; production of energy from waste.

### Options and Opportunities

*Through the analysis of the Solid Waste Management sector, undertaken to assess its “Current Status” and “Growth Trends”, a number of existing or emerging options and opportunities have emerged. These can be used and leveraged by cities to accelerate the transition to their targeted Green Growth vision. These opportunities are listed below.*

- Creating high level of awareness on the risks of human health and environment amongst residents, school children, youth, shop owners, fish and vegetable market associations, hawkers, pavement dwellers as well as the municipal staff, as well as on the need to cooperation between the public and the municipal staff, will help the enforcement of SWM rules.
- The revised CPHEEO guidelines will allow the cities to address solid waste management in a holistic manner while complying with the revised MSW Handling and Management Rules, 2000.



- Several financial grants are available for local governments from the State Finance Commission, 12th Finance Commission, National Urban Renewal Mission (NURM) and Urban Infrastructure Development for Small and Medium Towns (UIDS&MT).
- By levying SWM taxes, user charges and engaging the private sector in financing waste treatment and recovery, local governments have an opportunity to raise their financial resources for SWM.
- The Ministry of Agriculture (MoA) is providing grants for setting up composting plants for converting municipal solid waste into compost.
- MOEF provides financial subsidies of up to 50% on the capital costs to set up pilot demonstration plants on municipal solid waste composting.
- Some state governments – Uttar Pradesh, Madhya Pradesh, Tamil Nadu, Andhra Pradesh, Maharashtra, Haryana, Karnataka, Gujarat and Rajasthan - have announced policy measures pertaining to allotment of land; supply of garbage; and facilities for evacuation, sale, and purchase of power to encourage the setting up of waste-to-energy projects.
- In addition to financial and technical support from central and state governments, some incentives are also available for financing solid waste infrastructure in urban areas such as tax exemption of certain bonds issued by local authorities, tax holiday for the project entity for SWM, and tax exemption for income of infrastructure capital funds and companies.
- Financial support is available from national entities such the Finance Commission, Central Sector outlay (JnNURM/UIDSSMT), State Sector outlay Institutional Financing (Infrastructure Development Finance Company, Life Insurance Corporation, Housing and Urban Development Corporation, Infrastructure Leasing and financial Services, National Bank for Agriculture and Rural Development, Industrial Finance Corporation of India, etc., as well as from international agencies (World Bank, JICA, ADB, and other Bilateral Agencies), foreign direct investments and the private sector.
- The Ministry of New and Renewable Energy (MNRE) offers financial incentives to a proponent who plans to set up waste-to-energy plants under a program on energy recovery from Municipal Solid Waste. For commercial projects, financial assistance is provided by way of interest subsidy in order to reduce the rate of interest to 7.5%, capitalized with an annual discount rate of 12%.<sup>78</sup>
- Financial assistance is provided on the capital cost for demonstration projects that are innovative in terms of generation of power from municipal/ industrial wastes.
- Rag pickers can be involved in door to door collection of waste and segregation of waste and in several other SWM activities.
- Indian firms are entering into joint ventures to offer integrated solutions in waste treatment, including performing feasibility studies, designing, technical consulting and providing operation and online maintenance services.
- Tax benefits are offered to companies engaging in solid waste projects<sup>79</sup>, providing opportunities for increased uptake of such projects in cities.
- Cities have an opportunity to participate in the recently launched “Swacch Bharat Mission for Urban Areas”. With a total grant of INR. 6200.9 million, this program is focusing on



eliminating open defecation, providing toilets, eradicating manual scavenging, managing municipal solid waste and bringing about a behavioural change in people regarding healthy sanitation practices.

## Barriers

*Evaluating the current and future trends of the Solid Waste Management sector led to the identification of barriers that already are or could in the future hinder or even prevent cities from seizing the opportunities listed above, thus precluding a transition to Green Growth. These barriers are listed below.*

- Lack of awareness and poor public cooperation for successful implementation of door to door waste collection and source segregation.
- Insufficient funds within the local governments to initiate best practices in cities and to meet their SWM obligations.
- MSW rules describe sweeping streets, providing receptacles in various parts of the city for storage of waste, and transporting waste to disposal sites in general terms, but they do not clarify how this cleaning shall or can be done, which hinders the local governments in initiating several SWM activities.
- Inefficiency in implementing effective SWM services at all levels such as collection, storage, transportation, segregation and disposal.
- Street sweepers and waste collectors are not provided with efficient equipment; poor planning is done to ensure that all streets are swept regularly and bins provided at the corners of streets are inadequate in quantity and capacity.
- Door to door collection is grossly neglected by local governments even though it is mandated in the MSW rules. In very few places it is practiced by NGOs or the private sector with or without municipal initiatives.
- The MSW generated in the cities is mostly not treated but is directly taken to open dumpsites. Lack of data and of awareness, insufficient availability of consultants and trained professionals, inadequate finances and lack of industry coordination with the government has resulted in the failure of Waste-to-Energy projects.
- Lack of capacity, improper choice of technologies available and public apathy towards waste have led to an unsatisfactory management of the waste system.
- Private sector participation is quite limited due to the precarious financial status of ULBs, institutional complexity with multiple agencies in service delivery, lack of regulatory or policy enabling framework for PPPs, legal/contractual disputes between private and public sectors, unsatisfactory performances, irrational tariffs/charges, etc.
- Lack of awareness among the public on the risks on human health and environment and lack of technical knowledge among the municipal staff in selecting appropriate technologies and utilizing available sources of grants from national and state governments hinder a sustainable SWM process.

<sup>78</sup>European Business and Technology Centre (EBTC), 'Waste Management in India: Snapshot'. Accessed at [http://www.ebtc.eu/pdf/11ten31\\_SNA\\_Snapshot\\_Waste-management-in-India.pdf](http://www.ebtc.eu/pdf/11ten31_SNA_Snapshot_Waste-management-in-India.pdf)



## Review of the Cities Visited

The following sections present the results of the analysis of the ten cities, carried out applying once again the Framework developed in chapter 3.

The table below provides a comparative overview of the status, barriers and opportunities for the Solid Waste Management sector across all the ten cities. The comparative analysis is done through relevant indicators, identified by the team (based on desk research and brainstorming sessions) and further developed to undertake the interviews and data collection during the city assessment visits. The analysis, driven by elements of the Framework, enables to test and validate the background (theoretical) sectoral hypotheses and develop sector specific green growth strategies on this basis.

Cities	Agartala	Agra	Dehradun	Cochin	Kota	Ludhiana	Nadiad	Pimpri Chinchwad	Shimla	Vijayawada
<b>Status and trends</b>										
HH coverage of DTD Collection	Partial	Partial	Partial	Partial	Not existing	Partial	Not existing	High	High	High
MSW collection efficiency <sup>80</sup>	High	High	Low	High	High	NA	High	High	Low	High
Scientific disposal of MSW	No	No	No	No	No	No	No	Yes	No	No
Presence of Waste processing facilities	Partial	No	No	NA	No	Partial	NA	Yes	Partial	No
Compliance with MSW rules 2000	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial	Partial
<b>Opportunities</b>										
Private sector participation	Yes	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes
<b>Barriers</b>										
Segregation at source	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
SWM dept. equipped with specific technical staff	Yes	No	No	Yes	No	Yes	No	Yes	No	No
Presence of Integrated SWM plan/project	Ongoing	No	Ongoing	NA	No	Ongoing	No	Ongoing	Ongoing	Ongoing

<sup>80</sup>Low: efficiency less than 80%. High: efficiency greater than 80%.



## Status and Trends in the Cities Visited

*The analysis of the current status and observed trends in the ten cities is needed to establish the initial benchmark from which the Green Growth process will be started.*

● **Household coverage of door step collection:** Vijayawada, Pimpri Chinchwad and Shimla have good coverage of DTD collection practice across the city. The cities of Agartala, Ludhiana, Agra, Dehradun, and Cochin are practicing DTD collection but it is yet to extend to a large portion of the households in the city. Implementation of DTD activities is completely lacking in the cities of Kota and Nadiad, because of poor cooperation and lack of awareness among households.

● **MSW Collection Efficiency:** MSW collection doesn't only include door to door collection but also waste gathering from different primary and secondary sources and its transportation to the materials processing facility or to a transfer station or to a landfill disposal site. Municipal Solid Waste collection efficiency is low in Dehradun and Shimla because of the high floating population littering all along the roads. Collection efficiency is observed to be high in the rest of the cities with the involvement of municipal staff, non-governmental organizations and private actors, and because of efficiency in primary collection, street sweeping, secondary storage and transportation of waste.

● **Scientific Disposal of MSW:** Except Pimpri Chinchwad, none of the cities is practicing scientific disposal of solid waste. In other cities such as Vijayawada, waste is dumped in low-lying areas that are within or outside the cities and that are designated as dumping grounds or in unauthorized areas on the outskirts of the city, resulting in extremely unsanitary conditions and creating serious environmental degradation problems. Because of the absence of segregation of waste at its source, domestic waste of all types, infectious waste from medical facilities, and even hazardous industrial wastes are deposited directly at the dumpsites.

● **Presence of waste processing facilities:** Agra, Dehradun, Kota and Vijayawada are facing several problems such as lack of technical knowledge and expertise, insufficient funds and unsatisfactory performances from private parties to opt and initiate different waste processing facilities. Vijayawada has recently submitted a proposal to the state government to restart operations for the closed waste to energy plant in the city. Waste processing facilities are observed to be partial in cities like Agartala, Ludhiana and Shimla. The existing composting plant in Agartala is not operational because of high pollution impacts on the surroundings. Several waste processing facilities such as Compost plant, RDF and Plastic recovery plants are under construction in Agartala.

● **Compliance with MSW Rules, 2000:** There is no compliance with the entire MSW rules in the project cities, because of lack of cooperation, poor awareness, motivation and education among the general public; lack of stringent panel provisions; lack of finances; lack of effective legal remedy; lack of technical knowledge and expertise in the municipalities and lack of institutional facilities.

## Opportunities in the Cities Visited

*The existing and emerging opportunities identified at the national level (and previously described) have been tested in the ten cities visited, to assess their feasibility and applicability.*

● **Private Sector Participation:** To cope with the current inefficiency in handling increased quantity of waste due to the increase in population, the project cities are engaging private





sectors and community-based organizations in managing municipal solid waste. Flexibility, increased efficiency in operations and maintenance, better financing ability and contest ability of the private sector can help municipalities to save money and achieve successful solid waste management results. Except in Kota and Agra, the private sector is involved in all the cities engaged in various activities, such as door-to-door collection, awareness generation, collection and transportation, and establishment of compost plants and waste-to-energy plants.

### Barriers in the Cities Visited

*Many of the barriers previously outlined and potentially interfering with a Green Growth process at the national level have been encountered in the ten cities visited too.*

- **Segregation at Source:** Even though this is the easiest solution to address the issue of SWM in cities, as it saves money, energy and time, segregation at source is not practiced in any of the project cities. Pimpri Chinchwad and Vijayawada have implemented source segregation at ward level on a pilot basis, but failed in succeeding because of poor household awareness and cooperation and poor communication between the local administration and citizens.
- **SWM department equipped with specific technical staff:** All project cities have separate SWM departments with designated technical staff, but Agra, Dehradun, Kota, Nadiad and Shimla have insufficient technical staff which is a hurdle in efficiently managing their Solid Waste.
- **Presence of Integrated SWM Plans/Projects:** Agra and Kota do not have any kind of integrated SWM projects, while Agartala, Dehradun, Ludhiana, Pimpri Chinchwad, Shimla and Vijayawada are at different stages of implementing ISWM projects.

### Strategies for Green Growth in Urban Solid Waste Management Sector

*Based on the analysis of the current state and future trends, and the assessment of the existing/emerging opportunities and corresponding barriers, a number of Green Growth strategies have been outlined, that will help cities overcome the barriers and fully leverage the existing opportunities. Cities can choose the combination of either of these strategies according to the applicability to the local context and to the target vision they are striving for. A prioritization of these strategies, for each city, can be found in Volume 2 of this report.*

- **Undertake integrated SWM plans/projects:** Promoting ISWM activities benefits cities with cleaner and safe neighbourhoods, higher resource use efficiency, resource augmenting, and savings in waste management costs due to reduced levels of final waste for disposal, as well as better business opportunities and economic growth. ISWM follows a strategic approach to sustainable management of solid waste covering all sources and all aspects, such as generation, segregation, transfer, sorting, treatment, recovery and disposal in an integrated manner, with an emphasis on maximizing resource use efficiency.
- **Promote segregation at source:** Segregation at source is the initial activity involved in the entire SWM process. The practice and the extent of segregation define the technologies to be selected for the final disposal of the waste. This initiative has to be promoted in all cities initially on a pilot basis and then extended to the whole city area, bringing advantages such as reduced impact on the waste collection and transportation, reduced dependency on natural



resources and raw materials with excellence in reuse and recycling, and appropriate waste transported to the final disposal site. Door to door collection and segregation at source can be improved by involving Community Based Organizations (CBOs), Non-Governmental Organizations (NGOs), Residents Welfare Associations (RWAs), Rag pickers, etc.

- **Local/Community level composting plants and waste processing plants:** Entertaining local composting at ward levels and mandating the composting plants in large townships, huge commercial complexes and hotels and restaurants reduces the amount of waste generated and benefits municipal corporations, saving time and money. The authorities should involve private actors to educate the public on selecting the appropriate composting technologies for deriving benefits from the end product. Local/Community level waste processing plants have to be initiated for collecting recyclables.

- **Creating wide-spread awareness on solid waste and its management:** Several awareness activities have to be taken up by urban local bodies to educate the public on advantages and consequences of proper and poor SWM. It is important to educate municipal staff with inspirational and successful case studies from around the world, so that they can in turn raise awareness among the general public, using a variety of communication techniques. Raising awareness can result in increased use of city waste collection services by the public and private sectors, funding for waste management from local elected officials, adoption and enforcement of local waste management policies by local elected officials and public participation in organic diversion and recycling programs.

- **Promoting Private Sector Engagement:** It is necessary for the urban local bodies to engage the private sector and change their role of being a “service provider” to that of a “facilitator of services”. Private sector participation brings finances for the modernization of SWM services, helps in providing efficient MSW management services and supports ULBs by promoting cost savings through the rising productivity of manpower and machinery. Additional advantages of private sector participation include updated access to technology and expertise, higher levels of efficiency and accountability, focus on customer satisfaction, and access to finances for new investments.

## 4.3 Synthesis of Good Practices: Guiding Principles for Green Growth in Indian Cities

### Introduction and Sectors Overview

This research is a collection of fifteen urban practices which represent how cities locally respond to urban challenges through the adoption of green growth approaches. The cases have been chosen to illustrate themes of environment, economy, energy, housing, transport, water supply and sanitation and solid waste management. They are spread all over the country and demonstrate a broad range of approaches and cities' commitment to engage with ecologically sustainable, economically efficient and participative urban development (refer to the table below).

Sector	Name Of Good Initiative		
Environment	Planning for reducing the impact of disaster in Surat	Kankaria Lake Redevelopment Project, Ahmedabad	
Economy	Revitalization of Bazaars, Jaipur	Ghat ki Guni: A Revitalisation Project for Tourism Development, Jaipur	
Energy	Green energy generation from sewerage gas by setting up of sewage gas based power plant, Surat	Pioneering India's Solar Cities Program, Thane	
Housing	Crosscutting Agra Programme (CAP), Agra		
Transport	G-Auto, Ahmedabad	Bus Rapid Transit (BRT) System, Ahmedabad	Traffic Transit & Management Centers (TTMC) by Bangalore Metropolitan Transport Corporation (BMTC)
Water supply and sanitation	Decentralized Waste Water Treatment (DEWAT) System in Kachhpura, Agra	Rain Water Harvesting Initiatives, Thane	Waste water recycling and reuse through four tertiary treatment plants in Bangalore
Solid waste management	Centralized Bio-medical Waste Treatment Facility (CBWTF) on Built-Own-Operate-Transfer (BOOT) basis, Surat	Excel composting of municipal solid waste through PPP model, Ahmedabad	

These urban green growth good practices are a rich mix of initiatives, each of which responds to a specific challenge in a city. In this project, the practices were studied and specific questions were asked to understand the practices' relevance to the urban development and Green Growth in other cities in India, such as: What are the innovative solutions that are being tested? What barriers have to be overcome? How are finances committed and managed? Is there capacity in the city, and can this be mobilized? Is the leadership in the city willing to take this step?

At the time these practices were conceived and implemented, the concept of Green Growth

was not prevalent. In the preliminary phases of the project, a set of indicators were identified by the project team, to shortlist initiatives in Indian cities that could correspond to the concept of Green Growth. The team thus examined good practices that are economically viable, environmentally sustainable and socially inclusive, and that lead to improved governance (for details on the methodology for the selection of good practices on Green Growth, refer to volume 3).

It must be acknowledged that these case studies are considered ‘good practices’ in that they provide lessons to learn from. It is often the difficulties that cities have faced and even their failures in overcoming problems that help the reader to understand the challenges of implementation. These case studies show that a detailed examination from a range of viewpoints can reveal interesting ideas, problem-solving solutions, modes of cooperation and collaboration. Good practices are therefore those experiences that have the potential to develop new thinking, and which can inspire institutional learning in other contexts and situations, by engaging public policy towards more fair and just socio-spatial development. As these cases undoubtedly provide a rich learning platform, they can be considered good practices.

Volume 3 of this report presents a detailed analysis of all the practices studied; below a summary can be found.

GOOD INITIATIVE	SUMMARY
ENVIRONMENT	
<p>Planning for Reducing the Impact of Disaster in Surat</p>	<p>The Surat Climate resilience Strategy was developed under the Phase II of the Asian Cities Climate Change Resilience Network (ACCCRN) initiative funded by the Rockefeller Foundation. By reducing the flood hazard intensity through an end-to-end early warning system, the initiative has been able to minimize economic losses due to floods in the city. Because of the timely and accurate information on floods, the city has been able to sustain its high economic growth, which is majorly driven by its diamond and textile industries. The initiative has also led to the institutionalization of a Climate Change Resilience Strategy, by including a budget line specifically for climate change in the Surat Municipal Corporation budget for 2013-2014. The commitment and dedication of Surat Municipal Corporation towards building a resilient city led to it's to the inclusion in the Rockefeller Foundation's list of 100 Resilient Cities. This has enabled the city to receive funds for a Chief Resilience Officer to coordinate and oversee resilience-related activities.</p>
<p>Kankaria Lake Redevelopment Project, Ahmedabad</p>	<p>Built four centuries ago, Kankaria lake has always been one of Ahmedabad's most significant urban icon and landmarks. Over the years, lack of civic discipline, ignorance and haphazard planning resulted in a collective abuse of this place. With a view to stop this and to revive its lost glory, Ahmedabad Municipal Corporation (AMC) guided by the Government of Gujarat embarked upon this initiative to transform the lake front into a picturesque public place. The initiative was taken up by AMC in 2006 and completed in December 2008. It has fulfilled its objectives for the up gradation of the environment surrounding the lake, through a comprehensive and organized lakefront development project, converting the area into a good quality urban public space for recreation and leisure, showcasing Indian culture and lifestyle.</p>

## ECONOMY

### Revitalization of Bazaars, Jaipur

The walled city of Jaipur is under constant pressure due to its rampant commercialization. Lack of basic infrastructure facilities, insufficient parking, unauthorized construction and encroachments have caused the dilapidation of the historic structures and traditional urban fabric of the area. Jaipur walled city was thus identified as a special heritage zone under Jaipur Heritage Management Plan and a revitalization plan was prepared for its conservation. The plan is aimed at developing the city area as an international tourist destination with world class facilities and at providing impetus to the local economy by developing a thriving hub for local arts and crafts. The main commercial streets and bazaars were identified as significant heritage precincts within the walled city and the listing of the properties in the area was undertaken as part of the Heritage Management Plan. The revitalization of three main commercial streets – Tripoliya Bazaar, Jauhari Bazaar and Chaura Rasta, which were part of the Walled City Revitalization Plan of Jaipur, were taken up as pilot projects under JnNURM.

### Ghat Ki Guni: A Revitalisation Project For Tourism Development, Jaipur

Ghat-ki-Guni' is defined by a 2 kms long stretch of heritage structures running along either sides of the Jaipur Agra national Highway, presenting a glimpse of the refined Rajputana architecture. Planned in accordance with the heritage principles of the time, it is flanked by a series of planned gardens, havelis with stepped terrace gardens and temples. Over time, the route got converted into the National Highway connecting the two major cities of Jaipur and Agra, thus endangering the heritage value of the small yet significant stretch. Realizing the potential of Ghat-ki-Guni as a possible cultural hub for multiple activities, Jaipur Development authority decided to work out a planning strategy to conserve, revitalize and rehabilitate the stretch. As part of the revitalization process, the national highway was diverted to a tunnel constructed through the adjacent hills and the restoration work of the 37 government owned properties were taken up for restoration in the first phase. The subsequent phase aims at developing recreational and tourism related activities in the area to turn the place into a tourist destination.

## ENERGY

### Green Energy Generation from Sewerage Gas by setting up of Sewerage Gas Based Power Plant, Surat

Surat Municipal Corporation (SMC) is generating electricity through a sewage gas based power plant that uses a sewage gas based engine generator technology. This has resulted in the reduction in electricity consumption and of carbon emissions. Through captive utilization of the energy produced, SMC has been able to cover 80% of its energy demand for the Sewage Treatment Plants and has reduced the emissions of greenhouse gases. This has drastically reduced the expenditure on electricity. The success of the project has also encouraged SMC officials to further their efforts in research and development of innovative sewage treatment technologies. SMC is currently preparing the blue print for setting up a plant for generation of CNG, which has more potential for revenue generation.

**Pioneering India's  
Solar Cities  
Program, Thane**

The city of Thane a pioneer in Municipal Energy management in the country, has been working towards Renewable Energy and Energy Efficiency measures since 2000-01. In 2009, as a natural continuation of its portfolio of local energy initiatives, Thane joined the Ministry of New and Renewable Energy's Solar Cities Program. As part of the programme, in collaboration with ICLEI South Asia Thane Municipal Corporation evaluated the city's energy performance, identified areas for improvement and developed locally tailored solutions. This has resulted in greater awareness of local energy dynamics contributing to reduced consumption of energy.

**HOUSING**

**Crosscutting Agra  
Programme (CAP),  
Agra**

The Crosscutting Agra Program is a small organic project implemented by the Centre for Urban and Regional Excellence (CURE) with the financial support of the USAID since August 2005. The project was actively supported by the Agra Nagar Nigam as well. It aimed at improving the quality of lives of poor people, through better access to basic sanitation services and livelihoods. It was designed around a Heritage Trail of four lesser-known monuments in Agra linked to the TajMahal and the Agra Fort on the other side of the River Yamuna and five nearby slum communities: Katra Wazir Khan, Marwari Basti, Kachhpura, Nagla Devjeet and Yamuna Bridge. Over the one and half year of implementation, the project has grown from a small grass root level initiative to a citywide technical support project, enabling Agra to undertake citywide pro-poor urban development. The project has both widened and deepened its interventions and has provided the city with a demonstrable model for development of urban poor communities that can be replicated in other areas. In 2007 it was scaled up to a ward level slum up-gradation approach, which has led to the formulation of a city wide slum up-gradation and poverty reduction strategy in 2010. This strategy has been aligned with the Slum Free City Plan of Action.

**TRANSPORT**

**G-Auto,  
Ahmedabad**

G-Auto is the first Dial-an-Auto service in India and was started in Ahmedabad by Mr. Nirmal Kumar, a social entrepreneur who is an alumnus of the Indian Institute of Management in Ahmedabad. The G-Auto system organizes autos into a branded and marketed fleet, thus necessitating greater operational accountability leading to good quality and reliable service. These autos are driven by trained professionals who charge passengers government regulated fares on a meter basis. The system is socially and economically sustainable as passengers are ensured fair and consistent fares and auto drivers receive accident and health insurance, along with steady employment. The safe and convenient G-auto has revolutionised the Intermediate Para Transit system in the city.

**Bus Rapid  
Transit (BRT)  
System,  
Ahmedabad**

Going by the name "Janmarg" or "the people's way", the BRTS began its operation in October 2009 to provide an affordable public transport network. Janmarg is the first full BRTS system in India. 'Networks and not corridors' and 'connect busy places and avoid busy roads' have been basic principles for selecting the 90 kms long network. Currently, Janmarg BRTS is operating 86 kms of BRTS corridor. Another 5 kms of corridor is under implementation and is expected to be operational in stages by 2015.

<p>Traffic Transit &amp; Management Centers (TTMC) by Bangalore Metropolitan Transport Corporation (BMTC)</p>	<p>Traffic Transit &amp; Management Centers (TTMC) by Bangalore Metropolitan Transport Corporation (BMTC). BMTC formulated a “Vision Plan” under (JnNURM) with an outlay of 3000 crores spread over five years for the development of urban transport infrastructure in the city. The TTMCs are part of this vision plan. TTMCs aim at enhancing the efficiency of public transport through the integration of different modes of travel. BMTC has constructed ten TTMCs under this plan. These TTMCs have 34 types of passenger amenities in the categories of minimum basic passenger facilities, health related facilities, civic amenities related facilities, tax payment centers and service provider kiosks, financial related facilities, transport related facilities, bus station for bus connectivity to different places, household requirement facilities, and park and ride facilities.</p>
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**WATER SUPPLY AND SANITATION**

<p>Decentralized Waste Water Treatment (DEWAT) System in Kachhpura, Agra</p>	<p>A DEWAT system was constructed at a low income settlement called Kachhpura in Agra by the Centre for Urban and Regional Excellence (CURE), a development sector NGO, with active participation of Agra Nagar Nigam. The DEWAT treats the waste water flowing through a city level drain that passes through Kachhpura before discharging into the river Yamuna. Construction of the DEWAT began in September 2009 and the project became fully operational in June 2010. The benefits of the DEWAT have been far reaching and include not only disease prevention and the protection of natural habitats but also a boost in employment opportunities for local community and enhanced property values of the locality.</p>
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<p>Rain Water Harvesting Initiatives, Thane</p>	<p>In order to reduce the burden on the water supply department and augment the decentralized sources of water supply, Thane Municipal Corporation initiated policy reforms for large scale implementation of rain water harvesting measures. It has made rain water harvesting mandatory for all buildings constructed after 2005 and has announced 5% rebate in property tax for installing rain water harvesting system in buildings constructed prior to 2005. The initiative has led to the emergence of many successful rain water harvesting projects in all types of building use like residential, commercial, office spaces etc.</p>
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<p>Waste water recycling and reuse through four tertiary treatment plants in Bangalore</p>	<p>Bangalore’s Water Supply and Sewerage Board resorted to recycling and reuse of wastewater to cater to the no potable water demand (commercial, industrial, irrigation etc.) in the city, like the new international airport, Bidai Power Plant, gardening of the city level parks etc. The first ten MLD plant was commissioned at Yelahanka and the success of this plant prompted the establishment of three other plants at V-valley (60 MLD), LalBagh (1.5 MLD) and Cubbon Park (1.5 MLD) by 2005. The treatment, though expensive, is profitable in this water deficit city. The cost of treatment of water is INR 10 to 12 per kl, while the board sells water for INR 15 per kl for water collected at the plant and INR 25 per kl for water supplied through a pipeline.</p>
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## SOLID WASTE MANAGEMENT

### Centralized Bio-medical Waste Treatment Facility (CBWTF) on Built-Own-Operate-Transfer (BOOT) basis, Surat

Biomedical Waste (Management & Handling) Rule 1998, stipulated that occupiers of every organization generating biomedical waste (as defined in the Rule) must manage their biomedical waste as prescribed in the Rule, so as not to cause any harm to the environment. As specified in the Rule, bio-medical waste was required to be treated in a specific way which was not economically viable for an individual health care facility. Surat Municipal Corporation has thus set up, in consultation with various medical professionals and associations, a centralized bio-medical waste treatment facility, which was the only economically viable option for safe disposal of bio-medical waste. As Surat Municipal Corporation did not have the financial resource or the technical expertise for setting up and operating such plant, this was done on Built-Own-Operate-Transfer (BOOT) contract basis, which was awarded to ENVISION Enviro Engineers. The facility was commissioned on 1st January 2003. The initial concession period of seven years has been extended further for 14 years after expiry of the first concession period on 31st December 2009

### Excel Composting of Municipal solid Waste through PPP model, Ahmedabad

Ahmedabad Municipal Corporation (AMC) entered into a fifteen year agreement with EXCEL Industries Limited in 1997 for setting up a composting plant for generating organic manure from municipal solid waste. Despite the rigorous efforts of AMC, the plant has not been able to achieve economic viability. It nevertheless made AMC recognize the economic and ecological benefits of proper management of municipal solid waste. Building on the learning from this initiative, Ahmedabad is developing a road map for becoming a zero waste city.

The synthesis of the analysis and the resulting message of the good practice is presented in the following pages in two sections:

- The first section communicates a synthesized discussion on the solutions that emerged to overcome the recurring barriers or stumbling blocks, starting from the conceptual phase to the implementation.
- The second section presents “guiding principles for green growth”. The field visits carried out by the team and further discussions with the city officials have revealed that there are some cross-cutting or shared principles that have guided most of the practices. These are the most crucial requirements that need to be fulfilled in order to move on the path of green growth. The team has termed these as “guiding principles”.

### Solutions For Overcoming Recurrent Barriers Encountered

This section describes the solutions conceived by the city in the face of the challenges they experienced. Instead of adopting a standard approach and proposing some generic solutions, this section only identifies and analyses the successful approaches adopted in the fifteen selected good initiatives, in an attempt to reconcile economic growth with environmental sustainability.

The strategies adopted by a city to embark on the path of green growth will vary depending on the socio-economic circumstances and political priorities in the city. The solutions presented here may not fit all city development contexts, but they provide options that other cities can adopt depending on their local situation.



**Innovations in funding** - In the absence of adequate funds available within the ULBs, most of the initiatives garnered funds through grants, Public Private Partnerships, funding from Central Government as part of National programmes or through green taxes. The table below lists the approaches adopted in twelve of the fifteen best practices to successfully access funds.

NO.	NAME OF THE INITIATIVE	SOURCE OF FUNDING	APPROACH ADOPTED
1.	Decentralized Waste Water Treatment (DEWAT) System in Kachhpura, Agra.	CURE received the funding from Water Trust UK.	Approaching potential donor agencies already working in the city.
2.	Rain Water Harvesting Initiatives, Thane.	As rain water harvesting was made mandatory by amending the bye laws, people installed the rain water harvesting systems on their own. There was no financial liability on Thane Municipal Corporation.	Policy reforms for mandating green practices.
3.	Waste water recycling and reuse through four tertiary treatment plants in Bangalore.	Bangalore Water Supply and Sewerage Board (BWSSB) received a loan from HUDCO and Indo French protocol for setting up the plants. At present, the cost is being recovered by selling the recycled water for industrial and commercial use.	Cost recovery through appropriate marketing of the end product.
4.	Centralized Bio-medical Waste Treatment Facility (CBMWTF) on Built-Own-Operate-Transfer(BOOT) basis, Surat.	PPP project based on polluters-pay principle. A private operator provided the entire investment for the facility. At present, the cost is being recovered by collecting fees from the generators of bio-medical waste. This fee is based on the amount of waste collected by the operator.	Green tax - the generators of the waste pay for its proper treatment and disposal.
5.	Green Energy Generation from Sewerage Gas by setting up of Sewage Gas Based Power Plant, Surat.	Received funding from the Ministry of New and Renewable Energy. At present, the cost is being recovered by saving on the expenditure on energy required for running the STPs by captive utilization of sewage gas for energy generation.	Initial funding through national programme and subsequent up-scaling through revenue generated by the project.
6.	Kankaria Lake Redevelopment Project, Ahmedabad.	The city conceptualized a project for regeneration of the lake and. JnNURM provided the funding to implement it. At present, the Ahmedabad Municipal corporation is recovering the cost from the users by charging visitor's fees.	Funding through National programmes.

7.	Revitalization of Bazaars, Jaipur.	The city had a Heritage Management Plan that aimed at conserving the heritage precincts within the city in an integrated manner. JnNURM provided the city with financial assistance to take up pilot projects from the Heritage Management Plan.	Funding through National programmes.
8.	Ghat Ki Guni: A Revitalisation Project for Tourism Development, Jaipur.		
9.	G-Auto, Ahmedabad.	A successful business model developed by a young entrepreneur that sustains on the charges collected from the users and advertisements promoted through autos.	Innovative business solution.
10.	Bus Rapid Transit (BRT) System, Ahmadabad.	The city conceived a project for the BRTS. Financial support from JnNURM enabled the city to implement it on a pilot stretch. At present, the BRT system is a profit making venture that earns revenues from the sale of tickets, parking fees, advertisements and hoardings along the BRT corridor.	Initial funding through national programme and subsequent up-scaling through revenues generated by the project.
11.	Traffic Transit & Management Centers (TTMC) by Bangalore Metropolitan Transport Corporation (BMTC).	The city envisioned the project. The funding under JNNURM was garnered by the city to implement a few pilots. Presently the TTMCs are generating revenue from the leasing or renting of commercial and office spaces in the TTMC buildings, parking fees etc.	Initial funding through national programme and subsequent up-scaling through revenues generated by the project.
12.	Crosscutting Agra Programme (CAP), Agra.	The initiative was able to establish a brand identity and many future interventions started flowing through the Crosscutting Agra Programme umbrella to build upon the tourism economy of Agra and opening up avenues for the poor to tap into it. The city not only received additional funding from other donor agencies like Cities Alliance but also managed to leverage funds from the Government eg. through the Slum Free City Action Plan.	Built on and carried forward the experience gained through previous initiatives to jump start the present efforts towards green growth.

**The capacity to perform in coordination** - In a multi-stakeholder initiative, the lack of synchronization of the efforts and interests of various actors hinders the success of the initiative. In a multi-agencies environment, mechanisms for cooperation must thus be developed. The table below lists the approaches adopted in five multi-actor initiatives to ensure coordination and commitment from all for the success of the initiative.

NO.	NAME OF THE INITIATIVE	COORDINATION EFFORTS	APPROACH ADOPTED
1.	Decentralized Waste Water Treatment (DEWAT) System in Kachhpura, Agra.	In this multi-stakeholder approach, CURE (the implementing NGO) acted as the nodal agency to bring together the expertise of other organizations to Agra Nagar Nigam (ULB) to augment its capacity of taking up of such projects in future. Through continuous community consultations, CURE managed to mobilize the community and ensure their participation in the entire process starting from the site selection until its maintenance.	Approaching potential donor agencies already working in the city.
2.	Centralized Bio-medical Waste Treatment Facility (CBMWTF) on Built-Own-Operate-Transfer (BOOT) basis, Surat.	The initiative fostered a culture of coordination, trust and respect. The ULB and the private operator were highly motivated and took the risk in being a pioneer, learning to work together. They collectively toiled to achieve economic viability by gaining the commitment of all the actors in the value chain.	Urban Local body acted as a platform to reconcile the interests of both private partners and citizens.
3.	Pioneering India's Solar Cities Program, Thane.	Thane formed a "Solar City Stakeholders Committee" which acted as an advisory board and ensured public involvement and participation in the Solar City Plan. This committee provided a platform for various actors in the energy sector of the city to engage in high-level discussions, ranging from how to bring new technologies to the city, to the possibility of gaining additional funds for low carbon energy initiatives through innovative funding mechanisms.	Development of a strategy to actively and meaningfully involve actors at the local level.

4.	Planning for Reducing the Impact of Disaster in Surat.	A City Advisory Committee was established to study the impacts of climate change in the context of Surat. This Committee included the actors from all sections of urban life – academia, industry, local Government, civil society etc. The synchronized efforts of all these actors led to the creation of a Surat Climate Change Trust, a unique instrument designed to develop a Resilience Strategy for the city.	Creation of a network of local institutions and experts to assess and critically analyze working practices and learn how to transform their patterns of decision making to a greener one.
5.	Crosscutting Agra Programme (CAP), Agra.	The Crosscutting Agra Programme helped initiating a process of engagement between organizations of low-income communities and the government for inclusive planning in Agra. It successfully forged multi-stakeholder partnerships between government agencies, private sector and civil society. This brought the governance mechanism a step closer to Public-Private-People Partnership (PPPP).	The local government worked in partnership with multiple stakeholders and achieved success.

**Favorable regulatory framework:** The lack of a favorable policy or legislative framework that can stimulate green growth hinders the success of green growth initiatives. Cities need to develop a favorable regulatory framework to overcome the barriers in implementation or monitoring of green growth initiatives. Crucial interventions such as transforming citizens' behavior do not require the right technology, but the right policy. Government policies can bridge these gaps and jump start green growth in cities. The table below lists the policy modifications or legislative reforms adopted in three initiatives to ensure the success and sustainability of green growth measures.

NO.	NAME OF THE INITIATIVE	EFFORTS IN APPROPRIATE REGULATORY FRAMEWORK	APPROACH ADOPTED
1.	Rain Water Harvesting Initiatives, Thane	Thane Municipal Corporation amended the existing development control regulations to mandate the installation of rain water harvesting systems in buildings constructed after 2005.	Mandating interventions that can trigger green growth by enforcing people to adopt a green lifestyle.

2.	Centralized Bio-medical Waste Treatment Facility (CBMWTF) on Built-Own-Operate-Transfer(BOOT) basis, Surat	Surat Municipal Corporation has made it mandatory for all health care units to register with the waste treatment facility. New health care units are not allowed to operate in the city without registering with the facility.	Introducing Policy reforms that can enable the Urban Local Body to effectively monitor the initiative and stringently penalize the defaulters
3.	Green Energy Generation from Sewerage Gas by setting up of Sewage Gas Based Power Plant, Surat	The success of the pilot sewage gas based power plant has motivated Surat Municipal Corporation to incorporate a bio gas based power plant along with the construction of a sewage treatment plant so that generation of electricity can start as soon as the Sewage Treatment Plant starts operating.	Assessing the potential of the initiative through a pilot and then introduce policy reforms based on the learning from the pilot

**Motivation through incentives** –The adoption of habits that contribute to green growth through incentives helps achieve sustainability in the long-run. The table below lists the approach implemented in three initiatives to motivate people through incentives to adopt a green lifestyle.

NO.	NAME OF THE INITIATIVE	EFFORTS IN INTRODUCING INCENTIVES	APPROACH ADOPTED
1.	Rain Water Harvesting Initiatives, Thane.	Thane Municipal corporation has announced 5% rebate in property taxes for buildings existing prior to 2005 for installing rain water harvesting systems and solar water heaters.	Implementing interventions that can trigger green growth by helping people realise the need to adopt a green lifestyle
2.	Pioneering India's Solar Cities Program, Thane.		
3.	Excel Composting of Municipal Solid Waste through PPP model, Ahmedabad.	Ahmedabad Municipal Corporation has started a Wealth out of Waste Project (WoW), which aims at promoting segregation of solid dry recyclable waste at the source i.e. at the house hold Level. The segregated waste will be collected from the household level and the citizen citizens will be paid for the segregated waste like recyclable paper, plastic, metal (ferrous & nonferrous) and glass (nonhazardous to handle).	Transforming citizen behavior through appropriate policy reforms.

**Public acceptability and accountability:** Inadequate public accountability and acceptability hinders long term continuity and sustainability of green growth initiatives. Beneficiaries' contribution and participation is essential to ensure the accountability of the end users and their ownership of the project. The table below describes the efforts undertaken in four initiatives to generate public awareness and ownership for the project.

NO.	NAME OF THE INITIATIVE	EFFORTS IN GENERATING PUBLIC ACCEPTABILITY AND ACCOUNTABILITY	APPROACH ADOPTED
1.	Decentralized Waste Water Treatment (DEWAT) System in Kachhpura, Agra.	The DEWAT in Kachhpura has a strong participatory approach in all stages starting from the site selection till maintenance. Through continuous community consultation and rigorous community mobilization CURE ensured the participation of the community in the entire process. The community has taken ownership of the DEWAT. They oversee the sweeper's performance and check the chambers at regular intervals to ensure smooth flow of water through the system. In case of absence of the sweepers or clogging of the chambers, residents inform the CURE office to take immediate necessary action.	Community consultation and involvement at all stages of the initiative.
2.	Kankaria Lake Redevelopment Project, Ahmedabad.	People appreciate and value well-maintained public places. By charging an entry fee for the lake Ahmedabad Municipal Corporation has created a sustainable source of revenue for ensuring the maintenance of the lake premises. By imposing fines for littering and damaging the public property, AMC was able to change people's behaviour and indifference towards public places by making them conscious and vigilant of wrong doings.	Developing appropriate penalty mechanism.
2.	Bus Rapid Transit (BRT) System, Ahmedabad.	The pilot stretch of the BRT operated free of cost for the first three months to generate public acceptability for the new system. Ahmedabad Municipal Corporation (AMC) organised free rides for special groups like students, professors and teachers, journalists, top industrialists of Gujarat to seek suggestions and generate public	Involving people in the initiative through a feedback system and incorporating their suggestions

		acceptability. AMC responded to all suggestions and recommendations and incorporated some of them for improving the service. This attracted more public to use the BRT and generated a sense of ownership among them.	
3.	Crosscutting Agra Programme (CAP), Agra.	Rapport and confidence building activities were initiated in the selected communities with support of a group of trained community animators. A team of local young boys and girls from project settlements was identified to work as local community facilitators. The local facilitators were trained in Participatory Learning and Action tools and skills in community mobilization and organization. Baseline data for project communities was also collected using Participatory Learning and Action tools) by the trained local field facilitators.	Selecting and training leaders from the community and mobilize the rest of the community through them

**Policy awareness and knowledge-** The establishment of a policy alone cannot steer a city towards a green growth path, until its significance is appreciated by the people. Awareness on policies and how they can be best used to the advantage of the citizens facilitates green growth. The table below describes efforts undertaken in three initiatives to generate public awareness and foster public participation in the various energy conservation measures.

NO.	NAME OF THE INITIATIVE	EFFORTS IN GENERATING POLICY AWARENESS AND KNOWLEDGE	APPROACH ADOPTED
1.	Rain Water Harvesting Initiatives, Thane.	Thane Municipal Corporation (TMC) undertook a number of awareness generation activities for motivating people to adopt the rain water harvesting system. To generate public awareness TMC widely circulated pamphlets describing the advantages of rain water harvesting and also made attractive floats during the Gudi Padva (Marathi New Year) celebration.	Awareness generation through mass media, exhibitions.

2.	Bus Rapid Transit (BRT) System, Ahmedabad.	Ahmedabad Municipal Corporation held regular press briefings on the planning and designing process, public exhibitions and presentations. The city organized special rides for people from mass media to make them understand the benefits of the system and promote this system through their news.	Awareness generation through mass media, exhibitions.
3.	Pioneering India's Solar Cities Program, Thane.	Thane is in the process of opening a 'Solar City Cell' which will serve as a demonstration space and knowledge hub for providing information and resources on energy conservation and renewable technologies. The Cell will generate public awareness and foster public participation in the various energy conservation measures.	Developing platforms for knowledge dissemination and awareness generation.

**Enhanced capacity of the Urban Local Body:** Fostering the development of the city on the green growth path of requires additional capacity building of the existing work force in the Urban Local Body (ULB) to envision and implement green growth initiatives. Implementing the project in partnership with a private body or garnering technical assistance from academic institutes can help overcome such issues. The table below lists the approach adapted in five initiatives to augment capacity and expertise required for implementing green growth initiatives.

NO.	NAME OF THE INITIATIVE	EFFORTS IN CAPACITY BUILDING	APPROACH ADOPTED
1.	Decentralized Waste Water Treatment (DEWAT) System in Kachhpura, Agra.	CURE collaborated with Vijay Vigyan foundation, an NGO actively promoting DEWAT system in Northern India, for the design and construction of the DEWAT at Kachhpura.	Collaborating with organizations having expertise in the sector.
2.	Waste water recycling and reuse through four tertiary treatment plants in Bangalore.	In order to find an alternative source of water and decide on technology and safeguards, the Bangalore Water Supply and Sewerage Board signed a Memorandum of Understanding with Singapore Cooperation Enterprise and Temasek Foundation, an investment arm of the Singapore government, to share technical expertise in reusing waste water for potable purposes, stakeholder engagement and public acceptance.	Learning from international best practices and bringing in international expertise.



3.	Centralized Bio-medical Waste Treatment Facility (CBMWTF) on Built-Own-Operate-Transfer(BOOT) basis, Surat.	Surat Municipal Corporation involved a private partner to bridge the skill gap in handling biomedical waste and address the financial inadequacies by bringing in new investments.	Opening up avenues for private sector investment.
4.	Green Energy Generation from Sewerage Gas by setting up of Sewage Gas Based Power Plant, Surat.	To assess the techno-financial viability of the project, Surat Municipal Corporation, the Ministry of New and Renewable Energy and the Indian Institute of Science, Bangalore, signed a Memorandum of Understanding for preparing the detailed project report for setting up of the sewage gas based power plant at the two existing Sewage Treatment Plants.	Collaborating with organizations having expertise in the sector.
5.	Bus Rapid Transit (BRT) System, Ahmedabad.	Ahmedabad Municipal Corporation partnered with CEPT University to implement the BRT project. CEPT University is the Principal Consultant to Ahmedabad Municipal Corporation for preparing tenders, detailed design drawings for all elements of construction including pavement, junctions and geometric road design, bus shelters, depots and terminals, ITS, etc.	Collaborating with local academic institutes who have expertise in the sector and better understanding of the local context.

**Skilled work force:** Green growth initiatives have not yet been mainstreamed. They therefore require explicit and operational knowledge among the workforce. Garnering such skilled work force for the implementation of innovative and non-conventional green growth initiatives is a crucial barrier for Indian Cities. This can be overcome by providing onsite training to the local workforce or developing a training framework for the appropriate education and orientation of the people involved in the implementation of such green initiatives. The table below lists the approach adopted in three initiatives to develop the skills and capacities needed for implementing green growth.

NO.	GOOD INITIATIVE	APPROACH ADAPTED	EMERGING SOLUTIONS
1.	Decentralized Waste Water Treatment (DEWAT) System in Kachhpura, Agra.	In Agra, CURE was unable to find suitable labour for the construction of the DEWAT as the project was the first of its kind in the city and most contractors were reluctant to take up the job. The local contractor who had worked with CURE for the construction of toilets under the Cross Cutting Agra Programme was selected and trained for DEWATS construction by Vigyan Vijay Foundation, a technical partner. CURE supervisor, masons, plumbers and labor were also trained on the job by Vigyan Vijay Foundation.	Involving local community and building appropriate skill by experts.
2.	Ghat Ki Guni: A Revitalisation Project For Tourism Development, Jaipur.	Amber Development and Management Authority, the implementing agency for the initiative, organized training programmes for the craftsmen involved in the project.	Capacity building of local workforce.
3.	Centralized Bio-medical Waste Treatment Facility (CBMWTF) on Built-Own-Operate-Transfer (BOOT) basis, Surat.	The private partner for the initiative provides training to the health workers in the hospital regarding proper segregation of waste.	Development of mechanisms for the training of people involved.

### Guiding Principles For Green Growth In Indian Cities

Green growth initiatives are not completely unique approaches. Nevertheless, they foster a paradigm shift with regard to diverse areas ranging from policy, technology, administrative decision making mechanisms to life style and behavior. This section identifies key principles that form the basis for implementing green growth in Indian cities. The guiding principles listed below are some pivotal areas of policy intervention that cities need to consider for successfully implementing green growth initiatives.

**Stable and strong leadership:** If development has to move towards green growth, it requires strong leadership and political commitment. This is essential for moving beyond ad hoc decision making to a more research based and process driven approach that will encourage cities to change for the better. It has been observed that often change in leadership slows down the transition of a city towards a green growth path, because the process of convincing leaders and mobilizing teams has to be started again from the beginning.

**Decentralization of power:** As discussed in the preceding sections, fostering a paradigm shift towards green growth requires able leadership and skilled workforce. However, these crucial features will not yield results if the system is not decentralized and people at the middle tiers of governance are not empowered to take decisions, thus hindering a swift implementation. The political and administrative leadership in the city will have to push itself and others beyond the comfort zone of existing decision making frameworks to create a second tier of leaders. The decentralization of power will assign autonomy to the officials without compromising the democratic process, and enable them to bring in innovation and implement initiatives that can drive the city on the path of green growth. The reduction of the lengthy decision making process through the creation of a second tier of leaders will allow officials to implement green growth initiatives on a priority basis.

**ULB's Ownership of the project:** The Urban Local Body must take ownership of the green growth initiative to ensure sustainability and up-scaling of innovative initiatives that can foster the development of the city on the green growth path. In the long run, when the city has arrived at a green economy, green growth will be driven by the private sector and by markets. In the short and medium term however green growth requires the local government to drive the process and manage the transition.

**Appropriate role sharing:** Green growth requires collective action and collaboration among different actors from all segments of urban life – decision makers, citizen, private players, NGOs, civil society and academia. A collective action from all actors is essential for a city to fully realize its green growth potential. The successful implementation of any green growth initiative will require synchronized coordination and strong commitment of all the actors involved.

**Public outreach and involvement:** The public at large needs to support the paradigm shift by responding with positive acceptance. Great technological advancements supported through huge investments are not enough to ensure the success of green growth initiatives unless beneficiaries and end-users participate in the initiative or accept the change. Public outreach and involvement is imperative for the acceptance of even a very well planned and techno financially feasible green growth initiative. Cities must develop a mechanism for mandatory enforcement and stringent monitoring to ensure the success of any initiative that aims to motivate people to adopt a green lifestyle.

**Community mobilization:** The political leadership or local government must influence and mobilize the community to support the system change required for a city to fully realize its green growth potential. Green growth requires promoting strong public views and a sense of common purpose to mobilize the local community to support the system change and be part of the transformation process required to foster green growth.

**Community inclusion:** For a city to achieve inclusive green growth it is absolutely critical that the system change towards green growth is supplemented by inclusive social policies that ensure fair distribution of the benefits of green growth. In the long run, green economy can

have great impacts on poverty reduction because it increases growth prospects and reduces vulnerability. People at the 'Bottom of the Pyramid' are important actors in building the city economy and can work with the private sector. The system change required to achieve the inclusive green growth can only be made possible through a participatory process.

**An exit strategy:** Ultimately it is the local government who is responsible for ensuring the development of the city in the efficient and transformative trajectories of green growth. Cities may need initial handholding to build the capacity required to achieve green growth. In any case, a well-planned exit strategy of partners involved in the handholding of an initiative is an important aspect for a seamless transfer of a project or programme to those whom it belongs. Green growth initiatives that have been induced in the city with the support of external agencies like multi- and bilateral donor agencies, NGOs etc. need to have an exit strategy embedded in the programme and implemented with full commitment to ensure long term sustainability.

# Conclusions

○ Volume 1



# Conclusions

## 5.1 Summary of Main Findings

Green Growth Strategies for Indian Cities is a project aimed at developing a framework for actions that exemplify the 'Green Growth' approach to understand and achieve sustainability.

The Indian Urban system consists of over 7000 towns and cities, the majority of which fall under the medium and small category. While due to economies of scale large cities will witness a considerable growth, the majority of it is expected to happen in medium and small towns. The Green Growth approach is very relevant for these cities as they are at an early stage of growth where the majority of systems and infrastructure have not been put in place yet.

A few premises were established before commencing the field research:

(i) that the strategies would be locally derived and locally applicable; (ii) that it would be applied to Tier II and Tier III cities spread across India; and (iii) that the framework would cover eight critical sectors: land use and density, ecosystem and biodiversity, energy, economy and business, buildings and housing, transport, water and sanitation and solid waste management.

The scope of covering ten cities in nine months has meant that the collection of data to profile the city, the consultation with stakeholders and the collection of secondary information about the urban sector in India, all had to happen simultaneously and to be conducted by small teams. For a sector starved for data, the strategies had to be descriptive rather than prescriptive. However, at an early stage, the analysis of basic data on each city was able to support some key observations about each sector, such as:

- 7 of 10 cities had their land use master plans revised in the last decade; however, none of them have been reviewed or revised since their formulation
- None of the 10 cities have a state of the environment report or action plan for environment and biodiversity
- 7 of 10 cities have local renewable energy plans; however none of them have initiated implementation
- None of the 10 cities have a local economic plan or have a documented status of their city's economy
- None of the 10 cities have an understanding of their total future housing demand while 4 of the cities did assess the housing gap for poor in the city
- 4 of 10 cities have a poor public transport system while 3 do not have any
- 7 of 10 cities have low coverage of sewerage network while 1 does not have a network at all
- None of the 10 cities practice segregation at source for solid waste

The project analyzed the status and emerging trends in the 8 key sectors of each city. This analysis looked at the past and current status including the future plans of the city. The analysis revealed that the critical path towards Green Growth followed the identification of local barriers and opportunities to overcome those barriers.

The analysis of sectors was combined with a concurrent exercise: the documentation of good practices in each sector that exemplify Green Growth thinking. These 15 good practices provide the real examples to illustrate the potential in each sector of each city to achieve some gains that then lead to incremental gains. Thus, the approach to Green Growth allows for the creative production of solutions that aim to make incremental change.

The documentation of good practices is the foundation of the Green Growth approach, which rests faith in the power of good examples to change mindsets and create the consensus that can dismantle the barriers to Green Growth.

It should be recalled that from the outset the endeavor has been to identify solutions that help to deflect a trend or trajectory away from the 'business as usual' scenario to an 'efficient Green Growth (incremental)' scenario, with the explicit understanding that Green Growth strategies can lead to 'transformative growth'.

The strategies per sector have been documented in the Table A (*find at the end of the chapter*), containing a list of recommended strategies for walking the Green Growth path. It is notable that in most cities, the status of specific sectors such as transport, water and solid waste is known to the city and plans also exist; however, it is only for solid waste management that the required policy exists to support the necessary implementation. Incidentally, in almost all sectors and to varying degrees, most cities do not have current status of each sector mapped in detail. The list of strategies is based on the understanding that no vision can be realized without the right policy atmosphere, citizens' involvement and partnership from private sector. It is understood that successful transformation in all of these sectors would rest on the availability of detailed data.

The project has relied heavily on the interactions and consultations with key officials in the project cities. In Table B (*find at the end of the chapter*), priority sectors have been identified for action. These are seen as initial steps on the Green Growth path, and each specific initiative or solutions is described in greater detail in the city profiles contained in Volume 2.

The review of 15 good practices across Indian cities in the 8 sectors has shown that initiatives that can be called 'Green Growth examples' are currently not many and are dependent on various local factors such as leadership, resource availability and a lot of positive communication that stimulates people's participation and private sector involvement. The team also identified a number of barriers that exist in the way to leverage the opportunities and realize the potential. These may be commonly known barriers in cities that hinder any type of positive development or very specific barriers, such as poor perception of a green initiative due to earlier failed pilot attempts that thus calls for sustained and repeated efforts over time.

Acknowledging the current expectations for positive change and growth, cities in India and their local leadership can take advantage of the national government's push for urban development that is smart, i.e. focuses on sustainability, competitiveness and quality of life. A Green Growth approach and the Framework proposed in this report can thus assist Indian cities to actively grow in the same direction as the vision of Smart Development proposed by the national government.

The sectors chosen for the analysis were identified as the sectors where the Green Growth potential is the highest, with the further assumption that these are sectors in which economic benefits can be realized, which offer the most current and significant opportunities.

## 5.2 Governing Green Growth

It should be noted that the project has not viewed the prospects for Green Growth through a specific lens called 'governance'. It is understood that governance is not a separate category through which to view the growth of cities, but the key implementer of the potential changes that have been identified for Green Growth solutions. As strategies are recommended for the urban sector for an entire city, it is natural that the audience or reader for these strategies would be the Government and governments in the Centre, the States and the ULBs in India. The strategies are quite explicitly directed at informing the policies and practices of urban governance.

The Green Growth pathways entail two basic activities that are essential activities of urban governance: 'fixing' activities, which can remove the distortions or inefficiencies that have become a barrier, especially in the sectors of 'Land use and density', 'Ecosystem' and biodiversity, 'Energy', 'Economy and Businesses'. These sectors tend to need greater policy initiatives and planning imperatives. There are sectors in which 'fixing' as well as 'providing' is necessary, such as 'buildings and housing', 'transportation', 'water & sanitation', and 'solid waste management'. It is notable that in the understanding of Green Growth, these basic infrastructure sectors require simultaneous attention to the activities of fixing, through policy or regulation, and the activity of provision, the commitment to ensure supply. Neither can be neglected.

Each city has its unique challenges and barriers and thus as a result of overcoming these barriers, its Green Growth strategy comprises a distinct set of actions and initiatives.

### **5.3 Green Growth as Smart Growth?**

The Green Growth approach analyzes the transformative potential in Indian cities and is committed to achieving small victories in a number of sectors simultaneously, to initiate a broader transformation of the city. It is not possible to predict which initiative or action will harness the greatest public attention and generate maximum momentum; however, it is clear that the administrators and others who are involved in urban governance activities would have to view their cities on a larger canvas and in broader perspective. The incremental nature of change, and the compounded benefits of a number of specific actions and initiatives, should give confidence to administrators that they can indeed improve their cities through the use of knowledge, observation and participation.

Given that all the Green Growth strategies are dependent on responsive and responsible governance, it would be fair to surmise that the idea of Green Growth can be conflated with the idea of smart cities. This aspect also highlights the importance of governance in smart cities. The initiatives and actions that have been listed in the Green Growth strategies for each city are mostly directed towards the most efficient use of existing resources or infrastructure that are already in place. Even if a city has new infrastructure, the efficient operation & maintenance of that infrastructure is highlighted as a Green Growth imperative. In this regard, the smart city solutions are recalled. While there are recommendations for most of the eight sectors in each city, the critical path is different, therefore each city would have its own unique development towards common objectives: achieving sustainability, competitiveness and growth. This is fundamentally a smart approach to city development. NIUA, ICLEI and GGGI plan to take this approach further to 2-4 cities for a detailed engagement phase, identifying priority sectors, carrying out more detailed assessments and developing action plans and projects that achieve Green Growth and smart city objectives together.





Table A:

STRATEGIES	SECTORS		
	Land Use and Density	Ecosystem and Biodiversity	Energy
Mapping	Collect accurate data	Document status of environment and biodiversity	Map city level energy supply and consumption status by sectors
Planning and Prioritizing	Master plan on GIS, with Regular updates	Planning and eco budgeting processes	Incorporate energy into Master Planning process
Implementation Policy	<b>TOD, Mixed use, TDR,</b> Conservation regulations, fines and charges in public domain	Guidelines to protect local <b>greenery and biodiversity</b> in new development	<b>Energy cell</b> in city, develop <b>energy use regulations, incentives for clean technologies</b>
Implementation Citizens	Involve citizens to <b>monitor implementation, e-governance systems</b>	<b>Involve citizens , groups, children, to document status</b>	Carry out awareness activities, build local knowledge base
Implementation-Private	Involve builders and developers to <b>implement plan in partnership</b>	Involve business and institutions to implement the plan – <b>green areas, forests, lakes rivers conservation</b> etc.	Encourage <b>green technologies, energy systems</b> eg. <b>ESCO based projects</b> on street lighting, pumping etc.

SECTORS				
Economy and Businesses	Buildings and Housing	Transport	Water	Solid Waste Management
Document existing status in the city	Document status of buildings and housing in city	Known	Known	Known
Incorporate green businesses and economy in Master Plan	Identify pockets for densification, rejuvenation, conservation in Master Plan	Plan Exist	Plan Exist	Plan Exist
Local guidelines, taxation, procurement policy for <b>green business</b> including approvals	Develop city specific <b>green DCRs, codes and Byelaws, incentives for green buildings</b>	City parking, <b>mixed use and TOD policy, emission norms</b> for vehicles, restricted movement corridors	Develop city <b>water protocol</b> , bylaws for <b>RWH, GW use and recycling</b> , Charge for high usage	Policy and rules exist
Carry out awareness activities	<b>Carry out awareness activities, involve young and youth</b>	<b>Carry out awareness. Involve citizens to check implementation/enforcement</b>	Carry out awareness. Involve citizens to implement recycling of waste water	Involve citizens to segregate waste at source, compost organics locally
Organize businesses and economic community into <b>registered groups</b> with the local government, partners in action	<b>Encourage</b> green buildings, city level <b>competitions</b> involving owners, architects, designers etc.	Involve local transporters to practice <b>green mobility</b> Encourage companies to <b>incentivize public transport and NMT</b>	Involve large establishments to <b>reduce</b> water use, <b>recycle</b> waste water.	Involve private players to <b>segregate and process waste</b> locally in groups

Table B:

Sectors / Cities	Agartala	Agra	Dehradun	Cochin	Kota
Land use and density			<ul style="list-style-type: none"> <li>Promote development in satellite areas</li> <li>Identify pockets for vertical growth</li> </ul>	<ul style="list-style-type: none"> <li>GIS based Master Plan</li> <li>TOD principles</li> </ul>	<ul style="list-style-type: none"> <li>GIS based Master Plan</li> <li>TOD principles</li> <li>Rationalised land usability</li> </ul>
Ecosystem and biodiversity	<ul style="list-style-type: none"> <li>Conserve &amp; develop water bodies as public space</li> </ul>			<ul style="list-style-type: none"> <li>Restoration of water bodies</li> <li>Waterfront development</li> </ul>	
Energy		<ul style="list-style-type: none"> <li>SWHS &amp; solar cookers in hotels &amp; households</li> <li>EE in small scale household industries</li> </ul>	<ul style="list-style-type: none"> <li>SWHS in institutional and academic buildings</li> <li>Street lighting retrofits</li> <li>Awareness in academic institutions</li> </ul>		
Economy and businesses	<ul style="list-style-type: none"> <li>Promote local forest resource based industries</li> <li>Promote eco-tourism</li> </ul>	<ul style="list-style-type: none"> <li>Develop local tourism circuit</li> <li>Organize household industries</li> </ul>			<ul style="list-style-type: none"> <li>Develop strategic industrial clusters</li> <li>Promote local products</li> </ul>
Buildings and Housing		<ul style="list-style-type: none"> <li>Map heritage buildings</li> <li>Heritage conservation plan</li> </ul>		<ul style="list-style-type: none"> <li>Map and promote heritage structures</li> <li>Property tax on vacant buildings</li> </ul>	
Transportation	<ul style="list-style-type: none"> <li>Integrate IPT (e-rickshaws) with public transport</li> <li>Develop public transport system</li> </ul>		<ul style="list-style-type: none"> <li>Infrastructure for inter-city buses and IPT</li> <li>CNG mini bus service</li> <li>Provide bye-pass routes</li> </ul>		<ul style="list-style-type: none"> <li>CNG city bus service on PPP</li> <li>Promote Non-motorised transport (NMT)</li> </ul>
Water and sanitation	<ul style="list-style-type: none"> <li>Integrated urban water management</li> <li>Decentralized waste water treatment (DEWATS)</li> </ul>			<ul style="list-style-type: none"> <li>Centralized &amp; decentralized sewage treatment systems</li> <li>Economic &amp; regulatory instruments to prevent discharge from commercial &amp; trade activity</li> </ul>	
Solid waste management		<ul style="list-style-type: none"> <li>Separate collection of waste from household industries</li> <li>Promote 3R (Reduce, Reuse &amp; Recycle)</li> </ul>	<ul style="list-style-type: none"> <li>Community level composting &amp; biogas plants</li> <li>Waste management and recycling in academic &amp; government institutions</li> </ul>		<ul style="list-style-type: none"> <li>PPP for door-step collection</li> <li>Decentralized waste management</li> </ul>

Ludhiana	Nadiad	PCMC	Shimla	Vijayawada
		<ul style="list-style-type: none"> <li>• GIS based Master Plan</li> <li>• TOD principles</li> <li>• Rationalised land usability</li> </ul>	<ul style="list-style-type: none"> <li>• GIS based Master Plan</li> <li>• TOD principles</li> <li>• Periodic Master Plan revision</li> </ul>	<ul style="list-style-type: none"> <li>• Integration of water, agriculture and energy into LU planning</li> </ul>
<ul style="list-style-type: none"> <li>• Relocation of industrial clusters</li> <li>• Decentralized clean recycling solutions for industries</li> </ul>		<ul style="list-style-type: none"> <li>• Clean-up water bodies</li> <li>• Prevent encroachments near water bodies</li> </ul>	<ul style="list-style-type: none"> <li>• Reserving green areas</li> <li>• Restricting development on hill slopes</li> </ul>	
<ul style="list-style-type: none"> <li>• Industrial technology upgradation</li> <li>• SWHS in textiles / electroplating units</li> </ul>		<ul style="list-style-type: none"> <li>• Audits &amp; equipment retrofits for industries</li> <li>• ESCO projects for municipal services</li> <li>• City wide energy plan</li> </ul>	<ul style="list-style-type: none"> <li>• SWHS &amp; solar space heating systems</li> <li>• Efficient wood fired boilers and cookstoves</li> </ul>	
	<ul style="list-style-type: none"> <li>• Demarcate land &amp; build infrastructure for industrial development</li> </ul>			<ul style="list-style-type: none"> <li>• Promote agro based industry &amp; storage facilities</li> </ul>
<ul style="list-style-type: none"> <li>• Short-term homes for migrant labour</li> <li>• Incentivize construction of affordable housing</li> </ul>	<ul style="list-style-type: none"> <li>• Incentivize construction of affordable housing</li> <li>• Map &amp; promote heritage buildings</li> </ul>			<ul style="list-style-type: none"> <li>• Affordable &amp; rental housing for EWS / LIG</li> </ul>
<ul style="list-style-type: none"> <li>• Promoting NMT &amp; pedestrian movement</li> <li>• Restrict vehicular entry to decongest core city</li> </ul>	<ul style="list-style-type: none"> <li>• Organize city bus service</li> <li>• Route rationalization of IPT</li> </ul>		<ul style="list-style-type: none"> <li>• Rope ways &amp; CNG or electric mini buses</li> <li>• Parking facilities</li> </ul>	
<ul style="list-style-type: none"> <li>• Protect natural drainage channels</li> <li>• Leakage mapping studies</li> <li>• Metering of water connections</li> </ul>			<ul style="list-style-type: none"> <li>• Water audits and leak detection</li> <li>• Promote RWH &amp; waste water recycling</li> <li>• Incremental water tariff</li> </ul>	
				<ul style="list-style-type: none"> <li>• Waste segregation at source</li> <li>• Community level composting &amp; biogas plants</li> </ul>

