

SUSTAINABLE URBAN NETWORKS FOR DYNAMIC AND RESILIENT (SUNDAR) INDIA



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JULY 2022

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KEYWORDS

Integrated urban planning
Electricity distribution
Resilient cities
Convergence of utility services

ABSTRACT

The accelerated pace of urbanization will add 2.5 billion people to the cities of the world in the next three decades. Rapid urbanization offers opportunities and presents challenges, particularly in the context of economic development, energy use and environmental sustainability. In the context of India, the challenges are much larger. Indian cities lag on the quality-of-life metrics compared to their global peers. While infrastructure development will be central to building livable cities, energy use is at the heart of keeping the city running. Achieving sustainable urbanization will require high-quality electricity as cities expand vertically, 24X7 operations are routine, electric vehicles become the norm and digitization accelerates rapidly with 5G networks.

Indian cities have traditionally ignored sustainability considerations. Further, fractured mandates across multiple agencies, lack of coordination across departments and a short-term approach to infrastructure development have all led to suboptimal outcomes. This report examines the proposition that restructuring the arrangements under which city utilities operate their mandates, their spatial responsibilities, and their scale of operations, can deliver benefits of efficiency enhancement through integrated planning and implementation of infrastructure development.

The case of sustainable electricity is chosen as a proxy for the kind of improvements possible across the entire set of city management functions. This choice reflects the future reality that the supply of good quality and reliable low carbon electricity, at reasonable rates, will be at the heart of utility service improvements across the board - reducing the air pollution in cities, providing “green” public transport, improved tele-connectivity and internet services, high quality electricity, water and waste management, ensuring 24X7 digi-intelligent public safety.

The evidence from this research points to a significant upside potential in implementing integrated urban planning. Different models are available of which many have been tried, though at limited scale and in special settings. Learning from these experiences and scaling up the effort to integrate infrastructure (electricity, transport, water, IT, telecom etc.) more systematically in urban planning and delivery of services can enable higher efficiencies, improved quality of life and transition to clean energy.



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ACRONYMS

AMRUT	Atal Mission for Rejuvenation and Urban Transformation	DDUGJY	DeenDayal Upadhyaya Gram Jyoti Yojana
APDRP	Accelerated Power Development & Reforms Program	DG	Diesel Generator
APEPDCL	Andhra Pradesh Eastern Power Distribution Company Limited	DI-LRMP	Digital India Land Records Modernization Programme
APTRANSCO	Transmission Corporation of Andhra Pradesh	DJB	Delhi Jal Board
AQI	Air Quality Index	DMRC	Delhi Metro Rail Corporation
AT&C	Aggregate Technical and Commercial	DPC	District Planning Committee
CAA	Constitution Amendment Act	ECBC	Energy Conservation Building Code
CAGR	Compound Annual Growth Rate	EoL	Ease of Living Index
CASS	Chinese Academy of Social Sciences	EUDC	Electricity Urban Distribution Circle
CAT	Climate Action Tracker	EWEDC	The Electricity Wing of Engineering Department of UT Administration of Chandigarh
CDP	City Development Plan	EWS	Economically Weaker Section
CED	Chandigarh Electricity Department	FSI	Floor Space Index
CERC	Central Electricity Regulatory Commission	GENCO	Generation company
CESL	Convergence Energy Services Ltd	GIFTCL	Gujarat International Finance Tec-City Company Limited
CFC	Central Finance Commissions	GII	Global Innovation Index
CREST	Chandigarh Renewal Energy and Science & Technology Promotion Society	GIS	Geographic Information System
CRRID	Centre for Research in Rural and Industrial Development	GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
CSCCL	Chandigarh Smart City Corporation Ltd	GSDP	Gross State Domestic Product
DCR	Development Control Regulations	GUCR	Global Urban Competitiveness Report
DDA	Delhi Development Authority	GUDA	Gandhinagar Urban Development Authority

GUDC	Gujarat Urban Development Company Limited	MML	Model Municipal Law
GVMC	Greater Visakhapatnam Municipal Corporation	MNRE	Ministry of New and Renewable Energy
GVSCCL	Greater Visakhapatnam Smart City Corporation Limited	MoHUA	Ministry of Housing and Urban Affairs
ICLEI	Local Governments for Sustainability	MoUD	Ministry of Urban Development
ICT	Information and communications technology	MPC	Metropolitan Planning Committee
IEA	International Energy Agency	MPI	Municipal Performance Index
IFSC	International Financial Services Centre	MVVNL	Madhyanchal Vidyut Vitranm Nigam Ltd
IL&FS	Infrastructure Leasing & Financial Services Limited	NCR	National Capital Region
IoT	Internet of Things	NDA	Noida Development Authority
IPDS	Integrated Power Development Scheme	NDMC	New Delhi Municipal Corporation
IPTC	International Petroleum Technology Conference	NGDRS	National Generic Document Registration System
JJM	Jal Jeevan Mission	NIMBY	Not in My Backyard Phenomenon
JNNURM	Jawaharlal Nehru National Urban Renewal Mission	NOIDA	New Okhla Industrial Development Authority
JUSCO	Jamshedpur Utility Services Company Limited	NREL	National Renewable Energy Laboratory
LESA	Lucknow Electricity Supply Administration	NUPF	National Urban Policy Framework
LIG	Low Income Group	PGCIL	Power Grid Corporation Of India Limited
MCC	Municipal Corporation Chandigarh	PLF	Plant Load Factor
MCP	Market Clearing Price	PM	Particulate Matter
MDP	Metropolitan Development Plan	PPP	Public Private Partnership
		PSEB	Punjab State Electricity Board
		PSPCL	Punjab State Power Corporation Limited

PVVNL	Pashimanchal Vidyut Vtiranm Nigam Ltd	TCPO	Town and Country Planning Organisation
PWD	Public Works Department	TOD	Transit Oriented Development
R&D	Research and Development	UDA	Urban Development Authority
R-APDRP	Restructured Accelerated Power Development & Reforms Program	UDAY	Ujwal DISCOM Assurance Yojana
RGGVY	Rajiv Gandhi Grameen Vidyutikaran Yojana	UPAVP	Uttar Pradesh Awas Evam Vikas Parishad
RLDC	Regional Load Despatch Centre	UPERC	Uttar Pradesh Electricity Regulatory Commission
RTC	Round The Clock	UPPCL	Uttar Pradesh Power Corporation Ltd
SAIDI	System Average Interruption Duration Index	UPSEB	Uttar Pradesh State Electricity Board
SAIFI	System Average Interruption Frequency Index	VCF	Value Capture Finance
SBA	Swachh Bharat Abhiyan	VIWSCO	Visakhapatnam Industrial Water Supply Company
SCADA	Supervisory Control and Data Acquisition	VMR	Visakhapatnam Metropolitan Region
SCM	Supply Chain Management	VMRDA	Visakhapatnam Metropolitan Region Development Authority
SCM	Smart Cities Mission	VUDA	Visakhapatnam Urban Development Authority
SDG	Sustainable Development Goals	RTC	Round The Clock
SERC	State Electricity Regulatory Commission	MCP	Market Clearing Price
SEZ	Special Economic Zone		
SFC	State Finance Commissions		
SLDC	State Load Dispatch Centre		
SME	Small and Mid-size Enterprise		
SPV	Special Purpose Vehicle		
STU	State Transport Undertaking		



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By far the greatest and most admirable form of wisdom is that needed to plan and beautify cities and human communities"

- Socrates

City: Visakhapatnam
Source: RTI

I INTRODUCTION

Urbanization is accelerating and the next three decades are expected to witness an inflow of 2.5 billion new urban dwellers, more than the current combined population of India and China (World Economic Forum, 2016). This growth is expected to be concentrated in Asia. Eleven of the fifteen most populated cities in the world are in Asia. Three Indian cities - Delhi, Mumbai and Kolkata - are expected to have a population exceeding 30 million by 2030. Rapid urbanization offers opportunities and presents challenges, particularly in the context of economic development, energy use and environmental sustainability.

A full-fledged ministry - Ministry of Housing and Urban Affairs (erstwhile Ministry of Urban Development) - at the central level was established in the mid-1980s. The 74th Constitutional Amendment to recognize the Urban Local Bodies was enacted in 1992. More recently, a series of programs such as JNNURM, SCM, AMRUT, JJM and SBA were implemented to address the challenges of inadequate infrastructure and institutional capacity. Given the neglect in the initial decade, and the rapid pace of urbanization, these initiatives can be considered the beginning of a journey. While presenting the Union Budget FY23, the finance minister emphasized

Figure 1.1: Chandigarh city



India was traditionally reluctant and hesitant to urbanize. Public policies in the initial decades after independence were designed to limit the urban areas and restrict migration. A significant part of India's urbanization is thus informal in nature. The informal and unorganized urbanization results in inadequate, uncoordinated planning and gaps in infrastructure, leading to a low quality of life and loss of economic opportunities. It also imposes significant cost in terms of health and social outcomes.

In recent decades a more realistic assessment of the urban setting, its needs, and challenges have been undertaken.

the need to reimagine cities into centers of sustainable living, proposing a paradigm shift in urban planning by addressing urban issues strategically.

A strategic approach to urbanization presents a large opportunity for India as global evidence suggests a positive and significant correlation between per capita income and urbanization (Bloom, et al., 2008). Within India as well, there is a strong relationship between per capita income and urbanization rates at the State level (Tumbe, 2016). In addition, there is evidence that urbanization rates affect economic growth at the sub-national level (Tripathi & Mahey, 2016).

Figure 1.2: Vienna ranked best city to live in 2019



Source: unsplash.com

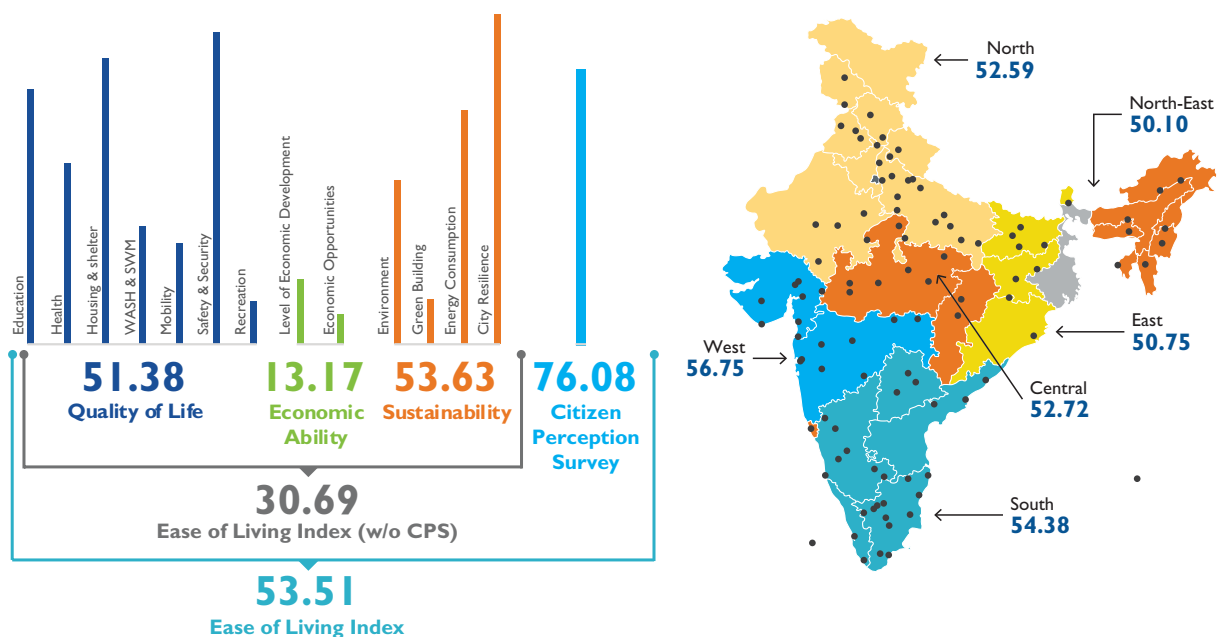
1.1 Quality of Life

According to the World Bank (2012), the quality and extent of infrastructure play an essential role in building cities. Cities with excellent infrastructure enable economic clusters that attract investments and provide a vibrant ecosystem for innovation and entrepreneurship by providing the high quality of life.

Indian cities lag on the quality-of-life metrics compared to their global peers. The Mercer’s Quality of Living Ranking 2019, ranks 231 cities on a variety of parameters. It evaluates living conditions across cities and highlights that the quality of living is an essential component of a city’s attractiveness for families and businesses.

Vienna was ranked the highest (refer to Figure 1.2) and Baghdad the lowest. The first quartile (58 cities) is dominated by advanced economies of which 52 percent of the cities are from Europe, 26 percent from North America and 22 percent from the Asia Pacific region (Australia, Japan, New Zealand and Singapore). India has seven cities listed, all in the third quartile of the index. Hyderabad was the highest-ranked Indian city at 143, followed by Pune at 144, Chennai at 151, Mumbai at 154, Kolkata at 160 and New Delhi at 162 (Mercer, 2019). The state of Indian cities is almost the same across different indices and rankings. Further, most Indian cities have significant gaps in the implementation of SDGs.

Figure 1.3: Below par Quality of Life in Indian Cities



Source: Based on Ease of Living Report 2020, MoHUA

The relative underperformance results in a consequent economic and development deadweight, imposing social and economic costs on individuals, families, society, and businesses. The additional cost is imposed in direct as well as indirect ways such as by increasing the cost of living, reducing demand in the local economy and competitiveness in the international markets.

A similar initiative for evaluating the quality of life in cities was launched by MoHUA with an objective to measure the outcome of the various government programs and to verify their impact on urban development in the country. The two indices - Ease of Living Index (EoL) and Municipal Performance Index (MPI) - assess 111 cities categorized into million+ population and less than million categories.

The aggregate EoL score of the 111 cities for 2020 was 53.5 on a scale of 100 (refer to Figure 1.3). This reflects that overall ease of living in Indian cities was low to middling, with a significant scope of improvement. Bengaluru (66.7) emerged as the top performer in the first category (million+), followed by Pune (66.2), and Ahmedabad (64.8). Shimla (60.9) was ranked the highest in the second category, followed by Bhubaneswar (59.8) and Silvassa (58.4) (refer to Figure 1.4).

Indore (66.0) was the top performer followed by Surat (60.8) in the category of million+ cities. New Delhi (NDMC) (52.9) topped the second category, followed by Tirupati (51.6).

On the “quality of life pillar”, the national average is 51.3, with 33 cities above this level. Panaji (62.4), a city with a less than a million population, scores the highest in this pillar, followed by Chennai (60.8), and Coimbatore (60.3). Most of the cities in the northern region have attained moderate scores in Quality of Life and Sustainability. While some of the western region cities such as Pune, Ahmedabad, Surat, Navi Mumbai, Vadodara, Thane and other have performed well in both the pillars.

1.2 Towards Sustainable and Vibrant Urbanization

Cities consume 60-80 percent of energy and generate 70-75 percent of GHG emissions (UN Environmental Program). Therefore, it is critical that the cities are designed, planned, and managed to improve sustainability and reduce the negative externalities of growth and development. Institutionally as well, the United Nations has placed a strong emphasis on sustainable development in cities through the SDG 11

Figure 1.4: Ease of Living and Municipal Performance Index 2020

Rank	Category I (One million plus)		Rank	Category II (< 1 million)	
	Ease of Living Index	Score		Ease of Living Index	Score
1	Bangalore	66.7	1	Shimla	60.9
2	Pune	66.2	2	Bhubaneswar	59.8
3	Ahmedabad	64.8	3	Silvassa	58.4
4	Chennai	62.6	4	Kakinada	56.8
5	Surat	61.7	5	Salem	56.4
	Municipal Performance Index	Score		Municipal Performance Index	Score
1	Indore	66.0	1	New Delhi (NDMC)	52.9
2	Surat	60.8	2	Tirupati	51.6
3	Bhopal	59.0	3	Gandhinagar	51.5
4	Pimpri Chinchwad	59.0	4	Karnal	51.3
5	Pune	58.7	5	Salem	49.0

Source: Ministry of Housing and Urban Affairs

MPI, on the other hand, was launched to assess the performance of municipalities through certain performance indicators that “enable” a better quality of life (input indicators). These indices examine, evaluate, and highlight the complexities of ULB practices in addressing urban challenges.

“Making cities and human settlements inclusive, safe, resilient and sustainable”. Improved planning, integrated policies and recognition of sustainable urbanization as a transformative force in making cities economically viable, environmentally sustainable and socially vibrant are at the heart of SDG 11.

Jan Eliasson, the former Deputy Director-General of the United Nations, has articulated that the battle for sustainable development will be won or lost in the cities.

1.3 Integrating Energy Use, Transport and Urban Planning

While infrastructure development is the key component to building livable and sustainable cities, energy is the fuel to keep the city running. From telecommunication systems, freight railroads, hospitals, schools, transportation, water and sewage network, buildings and parks, energy is a fundamental pillar of any economy.

Electricity is the most commonly used form of energy in residential, commercial and industrial sectors. The International Energy Agency (IEA) has called electricity “crucial to human development” and “one of the clearest and undistorted indications of a country’s energy poverty status.” Experience from the recent pandemic further demonstrates the importance of electricity to all economic activity, prosperity, livelihoods and human well-being.

Further, there is a desire and ambition to transition to “Net Zero” as articulated by the Government and private sector. Net-zero refers to a state in which the amount of carbon emitted by a country into the atmosphere is offset by absorbing an equivalent amount of greenhouse gases from the atmosphere. At the 26th Conference of Parties (COP26), India committed to a net-zero carbon emissions target by 2070. Given that India will continue to urbanize rapidly, it is possible for the Indian cities to adopt sustainability targets including the “Net Zero” goal well ahead of the national target by 2070. Achieving “Net Zero” by 2070 will require cities to take lead and adopt ambitious targets.

India has transitioned from an electricity deficient economy to a one with significant surplus and exports. However, the transition to Net Zero will require significant investments and institutional capacity to deploy clean energy projects, and strengthen the electricity grid. Downstream investments in the distribution systems will be crucial even though the grid has expanded to connect most households. The recent supply-side constraints due to fuel-related challenges, however, highlight the need for further reforms in the sector.

The increase in electricity coverage has however not been accompanied by improvement in the quality of power supply. India ranks 80 out of 137 countries on the quality of electricity supply (World Economic Forum, 2018). High losses and tariff below costs mean that distribution companies (Discoms) are unable to invest in network upgrades and maintenance.

Achieving sustainable urbanization will require high-quality electricity as cities expand vertically, 24x7 operations become the norm and the digitalization levels expand with 5G networks. These trends will further accelerate with wider adoption of the Internet of Things (IoT), digital security systems and integrated utility management platforms (on the Integrated Resource Management principle).

Cities thrive on movement - it enables interactions, trade, and livelihoods. Transport is thus a key enabler for the cities. Traditional urban planning in India often ignored this critical dimension, though transport started to feature prominently in the urban discussions over the last two decades. Despite several interventions, the implementation of reforms has been challenging, resulting in a significant gap in the provision of safe and sustainable public transport. Advancements in the electric drive train and battery storage in the last few years mean that electric vehicles are increasingly available and economical, especially for public transport. The recent tender floated by Convergence Energy Services Ltd (CESL) for 5,450 electric buses, discovered very competitive prices, close to the operational cost of diesel buses. Therefore, the interlinkages between transport and electricity are expected to increase. The imminent electrification of the transport sector and centrality of electricity in the urban development and sustainability means that the integration of energy in policies and planning for cities is an unrealized opportunity.

Indian cities have till now not placed due emphasis on sustainability. Further, fractured mandates across multiple agencies, lack of coordination across departments and a short-term “bandage approach” to infrastructure development have led to suboptimal outcomes. This approach has undermined sustainability, and compromised resilience and the quality of life. Limited budgets and the lack of financial autonomy at the municipal level have also been a barrier to high-quality infrastructure development and adequate focus on sustainability.

1.4 The Proposition

This study examines the proposition that restructuring the arrangements under which city utilities operate

their mandates can deliver benefits of efficiency enhancement, improved quality of life and sustainable development through integrated planning and infrastructure development. The case of sustainable electricity is chosen as a proxy for the kind of improvements possible across the entire set of city management functions. This study seeks to address the following aspects:

- i. Identify policy, regulatory and institutional mechanisms that are best suited to improve electricity supply, urban infrastructure, and development in cities.
- ii. Provide evidence that integration, or closer collaboration with the electricity utilities, will aid the process of embedding sustainability into the functioning of city management.
- iii. Present possible options to enable better integration of energy and infrastructure as part of the urban planning, operation and management of utility services.
- iv. Identify governance and management options to enable cities to enhance finances for leveraging technological advances and to ensure viability.
- v. Suggest strategies for enhancing consumer or citizen engagement in planning and delivery of utility services.

1.5 Methodology

This study is based on a combination of approaches. First, a detailed desktop review of recent literature on the benefits of integrating utility services, adhering to the principle that most development problems in the coming decades will cut across vertical levels of

government. Second, fieldwork was undertaken in five Indian cities. These cities included two reference cities and three aspiring cities. The two reference cities, i.e., Chandigarh and GIFT City (a township) were chosen for relatively higher levels of achievements in urban planning, infrastructure, management, quality of electricity supply and productive linkage mechanisms with urban development cadres and institutions. The three aspiring cities, i.e., Vishakhapatnam, Lucknow and Noida were selected for geographic representativeness and multipolarity of development level across states.

In-depth interviews with city managements and utilities in all five cities were conducted between August–November 2021, which provided rich material for identifying constraints, opportunities for improving urban planning and integration across functional mandates. These discussions also highlighted practical difficulties faced in implementing standards-based development projects and the pressures on the city managers. Third, a perceptions-based consumer survey was conducted in these cities to assess the level of satisfaction with electricity supply services and the willingness to pay for better services.

Further, a set of senior experts in urban planning, infrastructure development, electricity distribution and economic development were consulted across India and abroad.

The report bases its recommendations on evidenced analysis and triangulation of opinions with data. Where evidence is insufficient to detail specific recommendations, it advises additional work necessary to evaluate the available options.



City: Noida
Source: GreenTree



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What's different about the information age that has been ushered in by personal computers, mobile phones and the Internet is its ability to reshape the social organization of cities and empower everyday citizens with the knowledge and tools to actively participate in the policy, planning and management of cities."

- Christian Madera

Source: unsplash.com

2 URBANIZATION

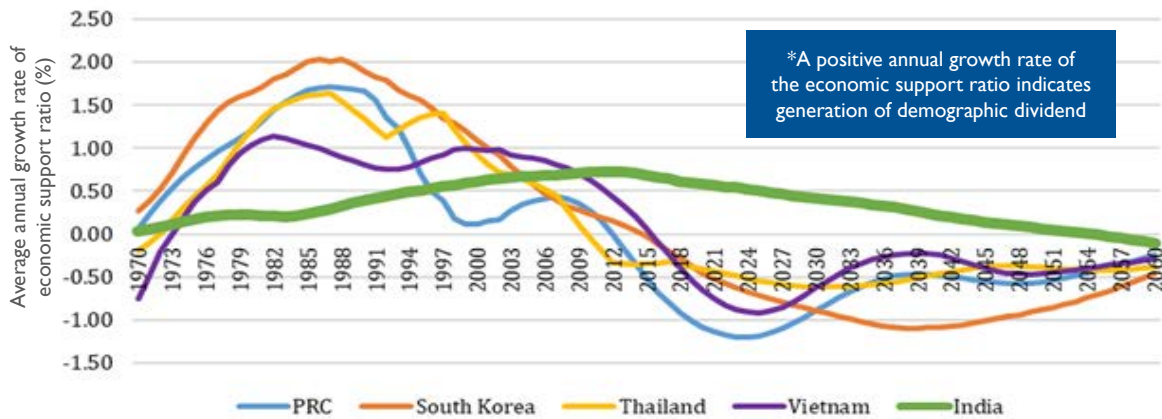
2.1 Demographics and Urbanization

India is undergoing a major demographic shift (refer to Figure 2.1*). Over the next three decades, the working-age population (15 to 63 years) is expected to increase by 280 million. The transition towards a younger population, with an average age of 29 years, is expected to propel India's economic growth (UNFPA, 2022). It is therefore critical that opportunities and infrastructure are actively developed to take advantage

demographic dividend can thus be a key driver for increasing investments and improving governance in our cities.

There is an increasing realization that India is more urban than is recognized by the official statistics (31 percent) as people living on the periphery, slum dwellers and informal settlements (refer to Figure 2.2) are often not counted. For instance, of the 7,933 'urban' settlements, half are classified as census town, and

Figure 2.1: Comparison of Demographic Dividend for India with Other Countries

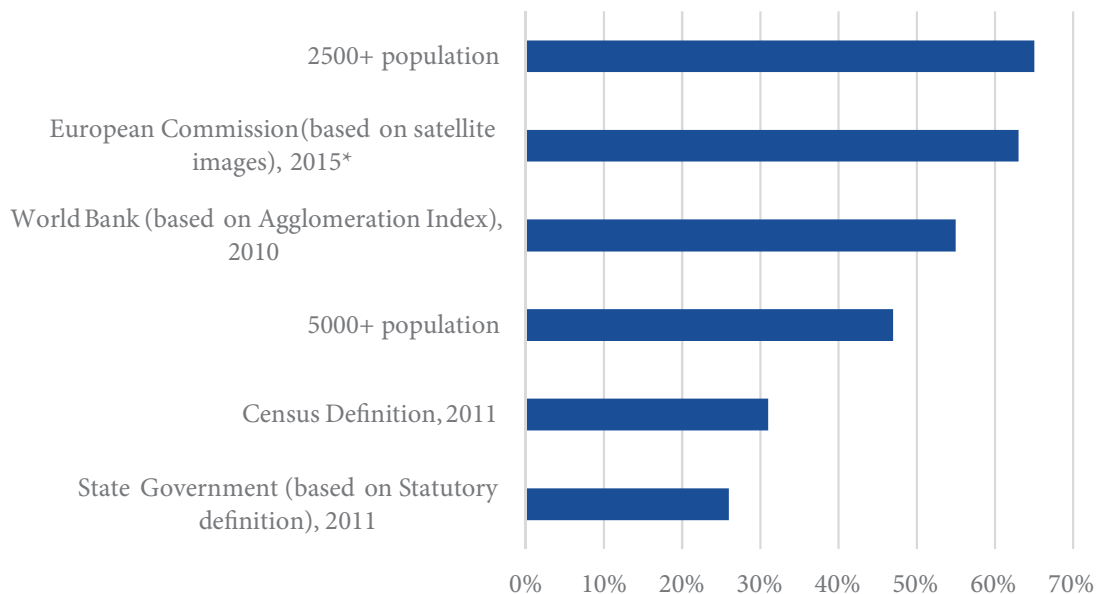


Source: UNFPA, 2022

of the demographic dividend. Given the trend towards urbanization, a large fraction of youth will continue to be attracted to the cities. Taking advantage of the

continue to be governed as 'rural' entities (NITI Aayog, 2021). Therefore, many urban areas are misclassified as rural and planned, governed as such.

Figure 2.2: Urbanization Rate in India According to Various Definitions



Source: ORF Issue Brief on Measuring Urbanization in India 2017, IDFC Institute report on Reforming Urban India, 2019

India’s urbanization is also fairly informal, as can be seen on a drive through various metros, such as Delhi, Mumbai, and Bangalore. Economic immigrants move to a location where the incremental income to cost ratio is favourable. Many follow the flow of public and private investment. An analysis by the High-Powered Expert Committee on Urban Infrastructure and Committee noted that between 1971 to 2001, the population growth was fastest in mid-sized cities between 50,000 to 1 million population. During the subsequent decade 2001-2011, the number of census towns (large villages which qualify as cities but are not formally classified as such) increased from 1362 to 3894 - an increase of 2.6 times compared to the marginal increase of 6 percent in the number of formally recognized cities, from 3799 in 2001 to 4041 in 2011.

The demographic transformation in the context of emerging social, political, economic and technological trends is a significant opportunity as several greenfield cities will need to be developed. Several existing cities, that are aging, will also be redeveloped. According to the 1901 census, there were 1,830 urban centers in the country, suggesting that these cities are over 100 years old. Their age has started to reflect in the form of physical deterioration of the buildings, inadequate infrastructure, congestion, long commutes to new commercial developments, water logging and social disharmony such as road rage.

This rejuvenation can be leveraged to redesign cities to create an environment for innovation and entrepreneurship.

2.2 Economy and Innovation

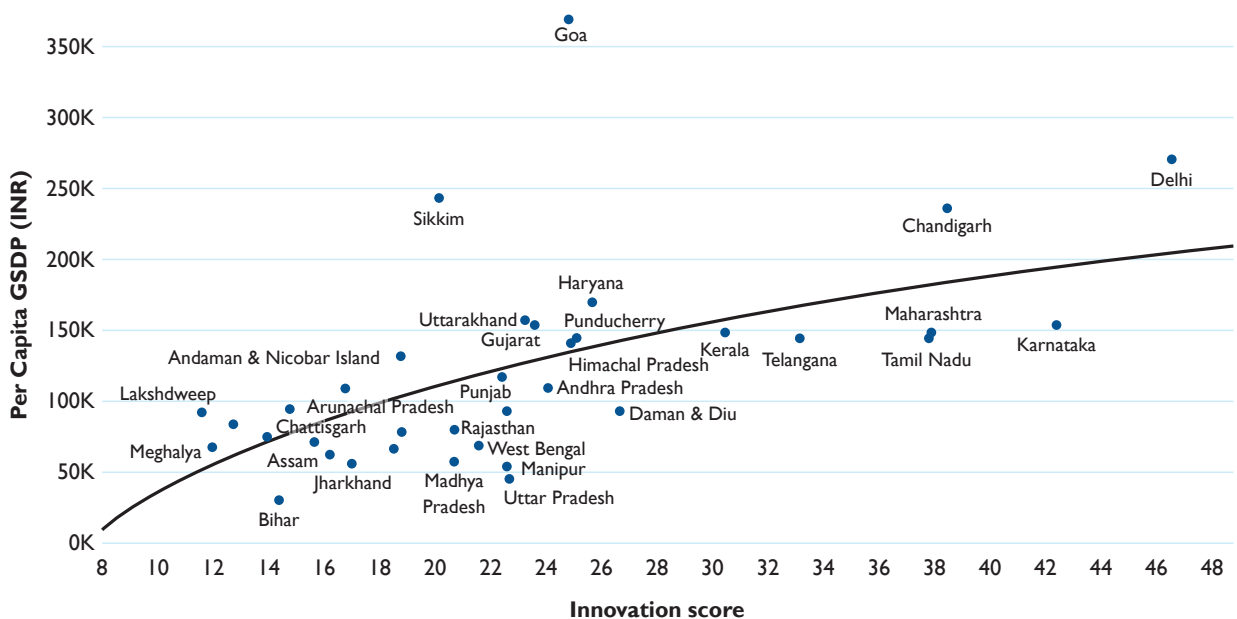
It is useful to think of innovation as a driver of economic growth, given conducive institutions and policies,

rather than the outcome of high-income status. It (innovation) has become more pertinent to economic development amid the recent pandemic.

The current world view of innovation is influenced by Joseph Schumpeter who conceptualized it as “the introduction of new or significantly improved products, processes, organization methods, and marketing methods in internal business practices or the marketplace.” He brought “innovation” to the center of debate on economic growth and industrialization. Innovation is one of the key “proprietary” outcomes of cities, courtesy of the agglomeration or network effects of collaborative learning, and high-density living which fosters affordable access to the best education, health facilities and infrastructure to link into global supply chains.

One of the important measures of innovative capabilities is the Global Innovation Index (GII). It is based on the quality of institutions, human capital research, infrastructure, market and business

Figure 2.3: Correlation between GDP and Innovation



Source: India Innovation Index 2020, NITI Aayog

sophistication, knowledge and technology outputs and creative outputs. Based on the lines of GII, NITI Aayog, along with the Institute of Competitiveness has developed India Innovation Index that examines the existing innovation landscape in India. It determines state-level performance on innovation through the two pillars of knowledge output (R&D investments, new business registrations, patents, scientific articles, grassroots innovations, etc.) and knowledge diffusion (ICT exports, hi-tech manufacturing entities, etc.). Overall, Delhi scores the highest at 46.6 while Lakshadweep finishes last with a score of 11.7.

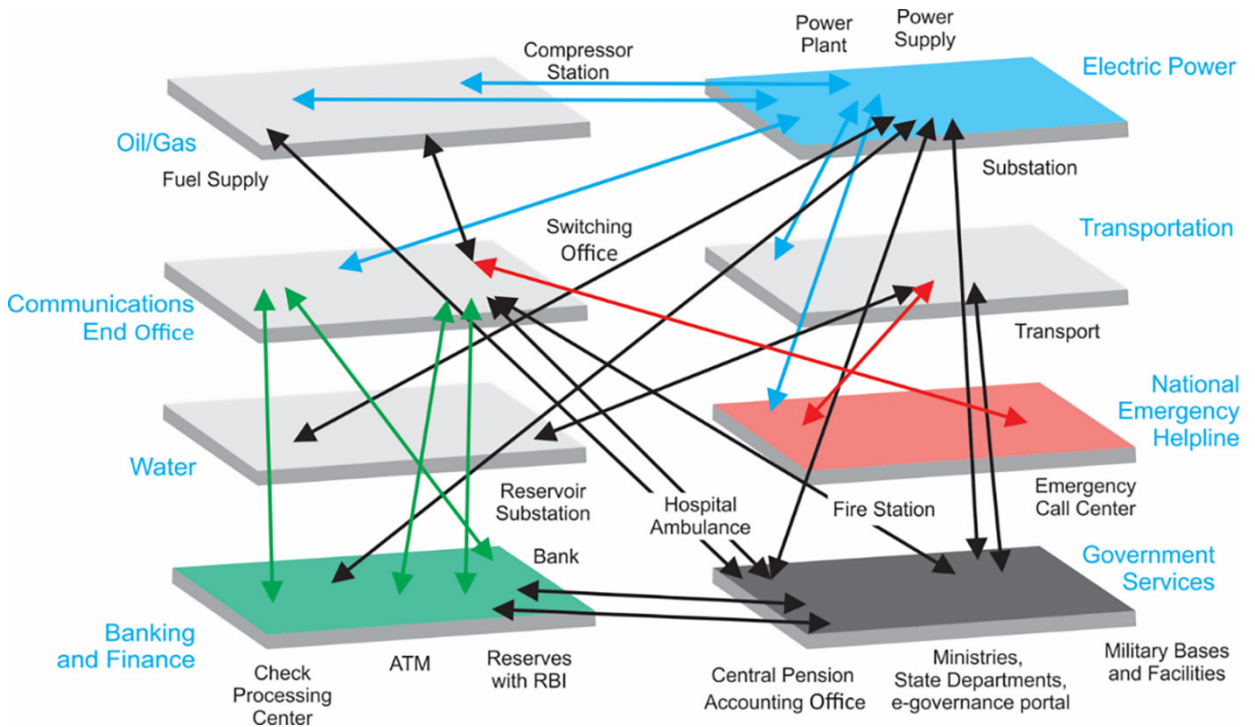
Most of the states fall below the national average of 18.2 in the “knowledge output” indicator. Economically prosperous states in the southern and western parts have relatively higher scores. The indicator “knowledge diffusion” reflects the degree to which a state can develop and apply knowledge to move toward an innovation-driven economy. Many states, concentrated mostly in the north-eastern and central parts of the country lie below the national average of 17.6. The Index also shows that higher economic growth often leads to more innovation and vice-versa (refer to figure 2.3).

2.3 Role of Energy and Urban Infrastructure

The changes in demography driving urbanization are also transforming the way energy is used. Advances in technology are removing vertical barriers across industries. For example, sectors such as buildings, roads and mobility, telecom, gas supply, water, sewage and drainage, and public spaces – that were operating in silos – are now able to connect to each other. Further, sensors and analytics is enabling the prediction of the future course using artificial intelligence. These systems are providing valuable information, for example, customer needs, in a granular manner, differentiated by the time of use, volume and frequency of use.

Electricity is increasingly the energy form used for driving technology and applications in industry, transport, services and applications. The provision of high-quality electricity (24x7) is central to the efficient functioning of modern economies and to enabling high quality of life in cities. The share of electricity is set to increase with growing urbanization and rising demand for services. It is evident that electricity drives economic growth, it is also clear that greater wealth results in higher demand for electricity.

Figure 2.4: Interlinkages between Critical Infrastructure



Source: Ehlen Mark A., Multi-hazard, multi-infrastructure, economic scenario analysis, 2013

Figure 2.4 represents the interconnectedness of the various critical infrastructures, thus pointing at a systems approach for a better understanding of the gaps that might come up due to various integral issues within this system itself. It points out the criticality of the electric power sector in comparison to the other sectors. It is evident that the functioning of electrical power is the service most linked to other services, and its failure is detrimental to the functioning of the other services.

Electricity has transformed urban life like no other invention. It has changed how we live, communicate, learn, and eat. It has become critical to ensure habitability, security and safety in a city. Well-lit streets and public spaces, functional monitoring cameras and traffic density coordinated traffic lights are necessary to provide secure mobility, and reduce congestion and travel time. Public transport systems talking to each other, continuous running of hospitals, imparting education in every corner of the

country, and digital metaverse as a primary source of engagement has been made possible by a continuous power supply.

Electrification has not only shaped cities but also their natural environment. Tall buildings fueled by electricity allow cities to have greater population density and reduce the land required to support a given population. A case in point is New York, the world’s most vertical city. It has changed the way economists determine the worth of land - from the actual cost to “what can be built above it”.

Figure 2.5: Challenges of Electricity Distribution in India



Source: Based on *Turning Around the Power Distribution Sector*, NITI Aayog and RMI, 2021

It is posited that India's urbanization has remained shallow and incomplete because of gaps in infrastructure such as severe electricity shortages till very recently (refer to Figure 2.5). Further, the lack of affordable and quality power has been detrimental to the growth of Indian industry, especially SMEs. A study by the World Bank in 2006 indicated an almost 7 percent loss in production or merchandise value due to power outages or surges from the public grid.

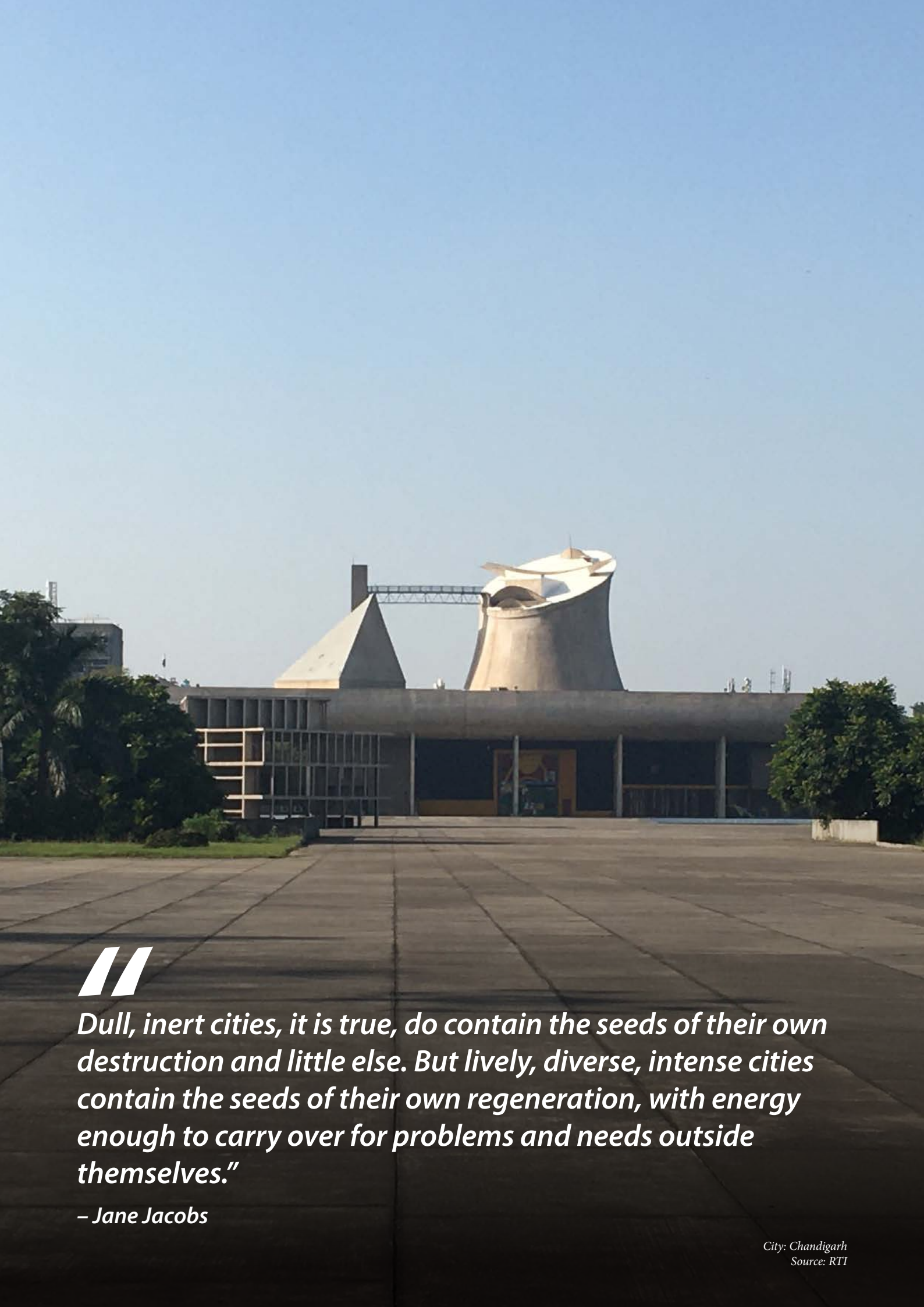
Most of the firms surveyed in the World Bank study were willing to pay more for reliable and uninterrupted power. Diesel power, the most common backup, is more expensive (INR12.0-16.0 per kWh) than grid electricity

(INR 5.0–8.5 per kWh) (World Bank, 2014). Lack of reliable electricity imposes an additional cost of self-generation and backup power in homes, establishments, and industries, making businesses less competitive and reducing the disposal income of households.

India has successfully eliminated capacity shortages by expanding power generation. Over 200 GW of new capacity was added during the last decade. Further, almost all households have been connected. The primary factor leading to low quality of supply is the inadequate progress on distribution modernization and up-gradation, which has been a work-in-progress for over two decades.



City: Visakhapatnam
Source: RTI



“

Dull, inert cities, it is true, do contain the seeds of their own destruction and little else. But lively, diverse, intense cities contain the seeds of their own regeneration, with energy enough to carry over for problems and needs outside themselves.”

– Jane Jacobs

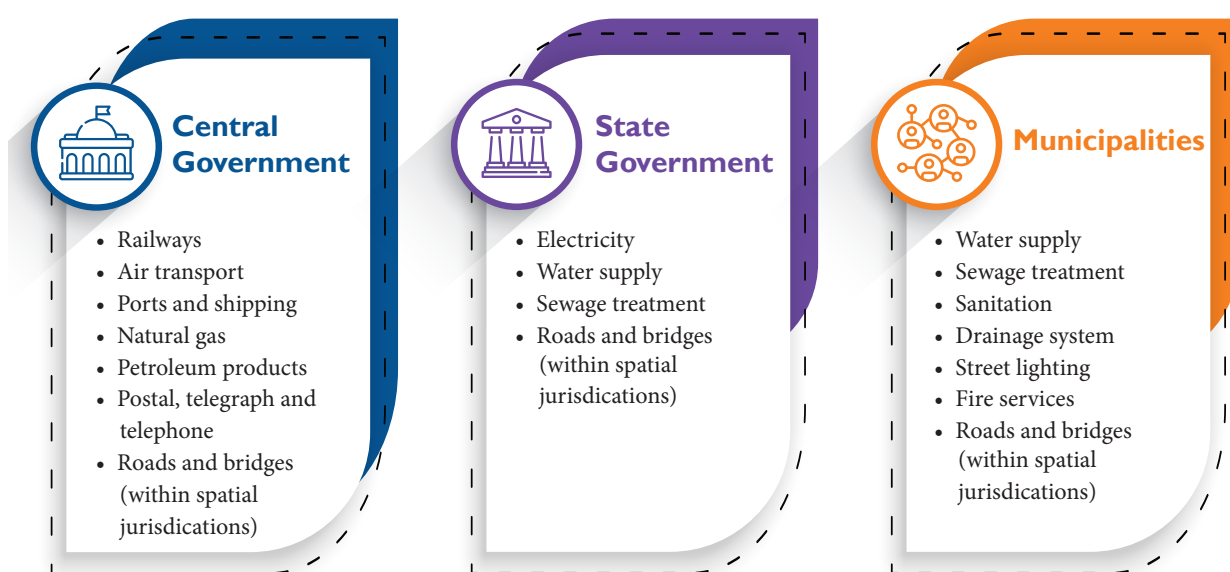
3 UTILITY SERVICES IN INDIA

Provision of utility services is distributed across the three levels of government i.e., Centre, State and Local (refer to Figure 3.1). Since the onset of central planning in the 1950s, capital intensive projects in water supply, road construction, fire services, electricity, and waste management, have typically been undertaken by state governments. These sectors are operated and managed through state-level utilities, particularly

State Finance Commissions. However, the regularity with which State Commissions are constituted varies significantly. Further, the recommendations of the Commissions do not necessarily convert into actual monies for ULBs.

Characterized by a poor resource base, the ULBs have limited ability to implement capital-intensive projects.

Figure 3.1: Distribution of Mandates for Utility Services in India



electricity and water, and in many states transport as well. These utilities provide services in urban and rural areas, thereby serving a heterogeneous customer base with varying expectations of service quality and willingness to pay. Other services in cities and urban conglomerates are delivered through ULBs. This fragmented structure has made the challenge of planning and delivering high-quality services even more complex. While the municipalities have a long history in India, their empowerment and accountability remain incomplete.

Within this centralized architecture, it is not surprising that the Municipal Governments have not developed in form or substance to the same extent as the State Governments. Besides, the partial devolution of powers, the paucity of municipal finances has been another key challenge. State Governments devolve finances to ULBs from their revenues based on the advice of

Their poor financial health and lack of authority have led to major gaps in service delivery, both in terms of access and quality of services. Electricity is one such utility service where the responsibility is with the Centre and State. Unlike other countries, most electric utilities have a footprint much larger than one or two cities.

3.1 Policy, Regulatory and Institutional Framework of Power supply

Electricity is a concurrent subject under the constitution of India, both the Parliament and the State legislatures can frame laws. The sector has gone through a series of reforms and restructuring over the last three decades. A key initiative was the enactment of the Electricity Act, 2003, which enabled independent regulation in the sector by establishing

regulatory bodies (CERC and SERCs) and introduced power trading, open access and enabled tariff reform. This process was carried forward by the National Electricity Policy 2005, National Tariff Policy, 2006 and regulations issued by CERC and SERCs. Several schemes such as APDRP, RGGVY, DDUGJY and UDAY provided financial and programmatic support to the legislative policy and regulatory enablers. Figure 3.2 provides a schematic representation of the policy-making, regulatory architecture of the sector.

demand is a result of a combination of factors, i.e., deceleration in the economic activity, energy efficiency measures and more recently due to pandemic. It is premature to conclude if this is a structural long-term trend since a similar slowdown has been observed in the past.

Total installed capacity increased from 194 GW in 2011 to 382 GW in 2021, recording a CAGR of 9.6 percent. The share of renewables in the energy mix increased

Figure 3.2: Roles and Mandates of Various Ministries and Government Agencies

	Policy	Regulation	Generation	Transmission	System Operation	Distribution	Trading
Central/ Inter-state	Ministry of Power, MNRE	Central Electricity Regulatory Commission	Central Gencos, IPPs	PGCIL (CTU), IPTCs	POSCO (NLDC & 5 RLDCs) REMC	UT Discoms	Inter-state Tradecos, Power Exchanges
State/ Inter-state	Power Dept. of States (29) & Uts (7)	State ERCs (25) & Joint ERCs (2)	State Gencos, IPPs, CPPs	State Transcos (STU), IPTCs	SLDCs (33)	State & private Discoms, Distribution franchisees	Discoms, Intra-state Tradecos

The reform in the sector enabled private sector investments, which increased rapidly during the last decade. Approximately one-half of the generation capacity is now owned by the private sector.

3.2 Electricity Demand-Supply Analysis

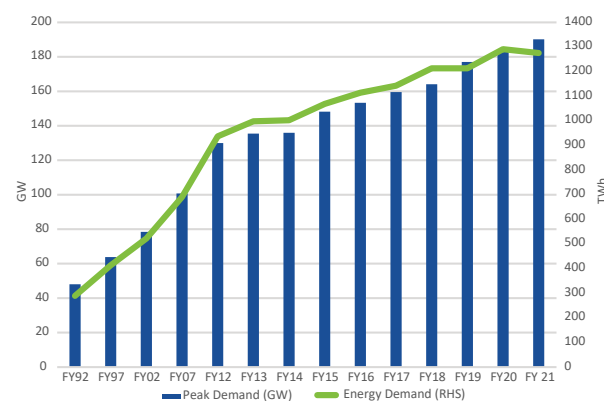
India’s power demand growth has tapered over the last few years due to a variety of factors. It grew at a CAGR of 9.5 percent during FY 1991-2002, relative to 7.9 percent during the previous 10-year period ending FY 12 and 3.6 percent till 2021 (refer to Figure 3.3). The subdued

from 25 GW (19.14 percent) in 2011 to over 99GW (26 percent) in 2021. Rapid capacity expansion coupled with deceleration in demand growth has resulted in declining utilization of thermal power plants (refer to Figure 3.4). Plant Load Factor (PLF) for thermal power plants have been declining over the last several years and for FY 17, the aggregate PLF declined to 60 percent, a level not observed since the mid-1990s. It further fell to below 53 percent by December 2021.

Along with the increase in grid-connected utility capacity, a rapid increase in captive generation

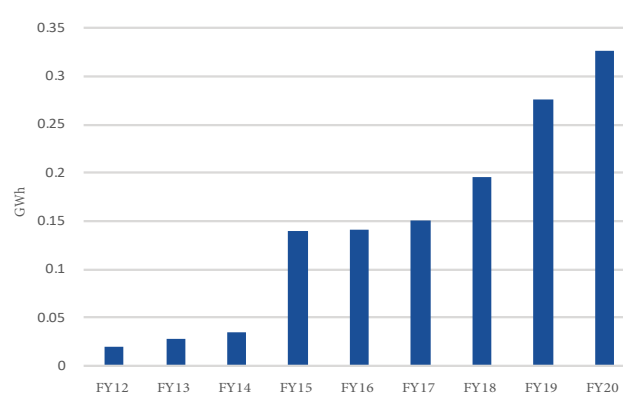
Figure 3.3: Energy Demand and Savings

a) Energy and Peak Demand



Source: Central Electricity Authority

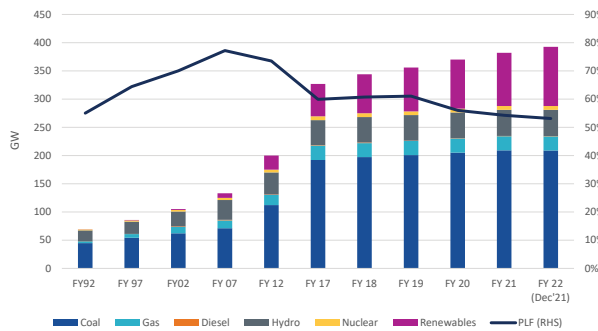
b) Energy Savings



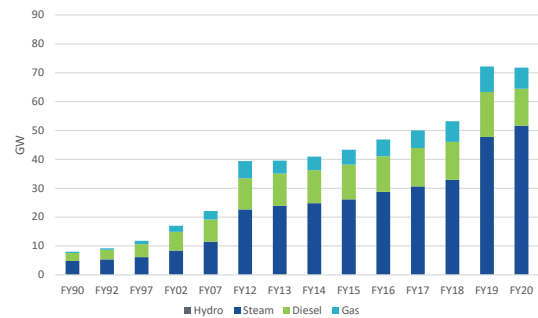
Source: Bureau of Energy Efficiency

Figure 3.4: Installed Capacity and PLF

a) Installed Capacity



b) Captive Generation Capacity



Source: Central Electricity Authority

(refer to Figure 3.4) by large commercial and industrial (C&I) customers is also evident. This growth has been driven by high industrial tariffs and aided by the gradual opening of the coal market, particularly for captive users. Captive capacity increased from approximately 22 GW by end of FY 07 to over 50 GW by end of FY 17 and to over 71 GW by the end of FY 20. This does not include the medium-sized generators, owned by C&I as backup and small generators and inverters owned by individual homes. Limited data is available, but one report estimates the medium sized C&I market, on a conservative basis, to be 15 GW annually (Phillip Capital, 2014). No data is available for small generators, inverters, and UPS.

The overall demand-supply balance has improved dramatically with both peak and energy demand deficit

declining to negligible levels. Some regions of the country can be termed as technically surplus because the transmission constraints restrict the transfer of power to regions short in supply. Even the Ministry of Power (PIB release March 23, 2021) declared that the country has achieved a power surplus status with a total installed capacity of 382 GW, against a peak demand of 190 GW in FY 21.

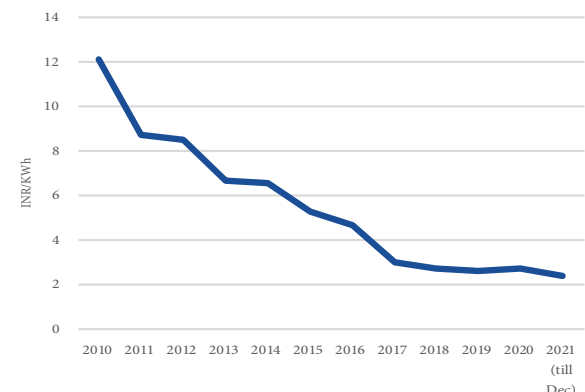
Prices in the day-ahead market have structurally tended lower with the reduction of the demand-supply gap. Technology and business model innovation has led to a decline in renewable energy tariffs such as the Solar PV tariff declining from INR 17.91 in FY 11 to INR 5.68 per unit in FY 17 and further to INR 2.36 per unit in FY 21 (refer to Figure 3.5).

Figure 3.5: Spot Electricity Prices and Solar Tariffs

a) RTC (MCP) and Peak (Evening)



b) Solar Tariff

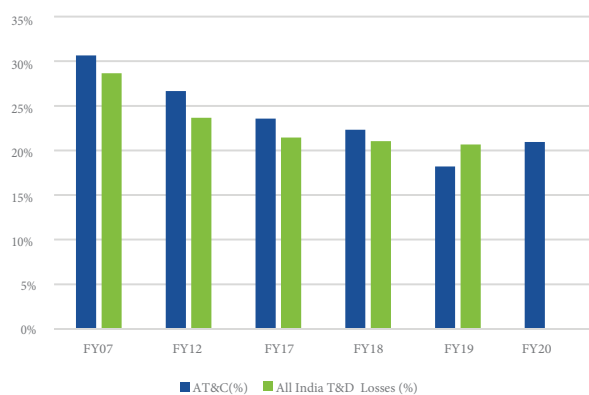


Source: Indian Energy Exchange

Source: Multiple -Care Ratings, News articles, BTI, India Infrastructure

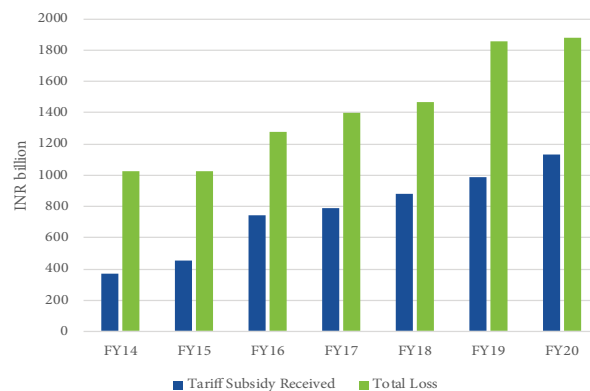
Figure 3.6: AT&C Losses and Financial Losses

a) AT&C Losses and All India T&D Losses



Source: Central Electricity Authority

b) Profit/(Loss) without Tariff Subsidy Received Excluding Revenue Grant under UDAY and Regulatory Income



Source: PFC reports

3.3 Power Transmission and Distribution

India’s transmission line network has grown rapidly, and the transmission capacity has increased during the same period. The interlinking of regional grids and building up of higher transmission capacities by PGCIL and private players have reduced interstate power transmission bottlenecks.

However, inadequate sub-transmission capacity (132 KV, 66KV and 33 KV) is a bottleneck for efficient transfer of power at the state level. In fact, many states have limited ‘Total Transformation Capacity’, which means that the power available at the periphery of the state cannot be transferred to distribution companies or consumers due to bottlenecks. This limitation constrains the full utilization of renewable energy projects connected to the state transmission network.

The most critical and weakest link in the value chain is the distribution or the last mile of the network. The average AT&C losses for distribution utilities at the national level continue to be high, although gradually reducing. Losses reduced from over 30 percent in FY 07 to 21 percent in FY 20 (refer to Figure 3.6).

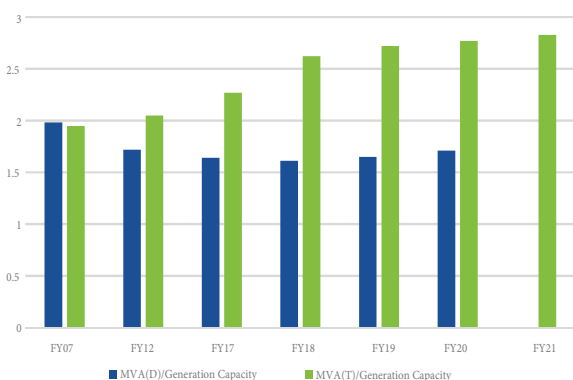
While progress in reducing AT&C losses is evident, two key challenges remain. First, the overall ATC loss levels remain high by international standards. Second, some states have exceptionally high losses such as J&K, Arunachal Pradesh, etc.

Even more disconcerting is the financial situation of Discoms. According to the PFC report on the performance of power utilities, total financial loss (excluding subsidy) increased from just over INR 1 trillion to almost 1.9 trillion. Simultaneously, the subsidy received escalated from INR 990.1 billion in FY 19 to INR 1135 billion in FY 20 (refer to Figure 3.6). Financial losses have increased, notwithstanding a reduction in AT&C loss from 26 percent in FY 09 to 20.9 percent in FY 20, and interventions such as APDRP, R-APDRP and UDAY.

Another challenge is the relatively slow growth of the distribution network at ~6 percent CAGR while the generation capacity and transmission systems grew at 9 percent and 11 percent CAGR, respectively. This has resulted in declining distribution capacity per unit of available generation capacity (refer to Figure 3.7).

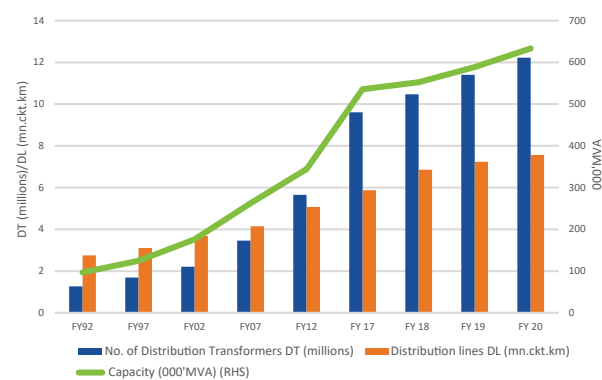
Figure 3.7: Transmission Capacity and Distribution Infrastructure

a) MVA/Generation Capacity Ratio



Source: Central Electricity Authority

b) Snapshot of Distribution Infrastructure



Source: All India Electricity Statistics

Figure 3.8: DT Failure Rates of select DISCOMs

DISCOM	2015-16	2016-17	2017-18	2018-19
BRPL	<1	<1	<1	<1
PGVCL	11.97	10.85	11.51	8.55
APSPDCL	10.27	8.74	8.83	5.54
KESCO	21.89	18.76	14.46	NA
JBVNL	6.8	7.2	5.7	5.9
GESCOM	NA	12.67	13.21	12.96
APEPDCL	3.8	6.8	6.67	6.43

Source: Compiled from Regulatory orders and Discom reports

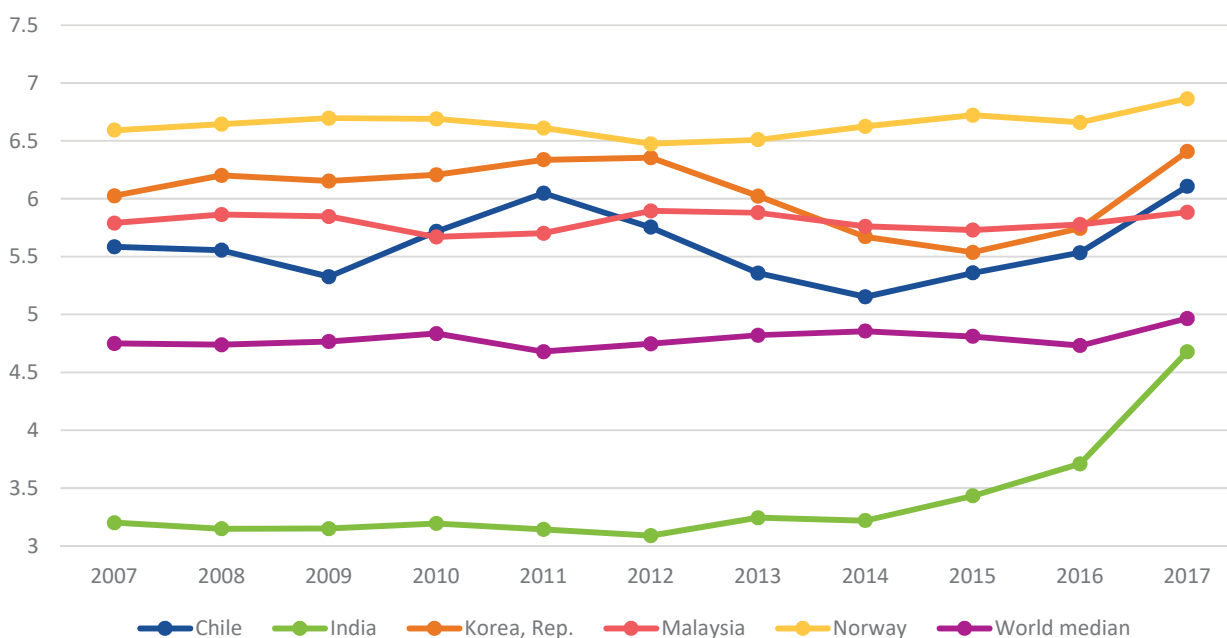
Further, the existing infrastructure (33KV and below, 66 KV in some cases) is extremely poor in many areas in almost all states. There are several instances of distribution transformer failures due to overloading and inadequate maintenance at the distribution grid level.

DT failure rate remains high, in the range of 12-17 percent, compared to 1-2 percent for well-run utilities in developed countries (refer to Figure 3.8).

High DT failure rate leads to revenue loss due to downtime, financial loss in repair and replacement and failure in meeting reliability indices i.e., poor quality supply to consumers.

The overall quality of power, because of poor distribution, is significantly below the best practice. India's Quality of Electricity Supply Index is lower than the world average and lower than comparable economies (refer to Figure 3.9).

Figure 3.9: Quality of Electricity Supply Index, 1.0=Lowest, 7.0=Best



Source: World Bank

The poor quality is also evident from the SAIDI data. The average duration of interruptions per consumer varies from state to state and Discom to Discom (refer to Figure 3.10) but is generally below the international standards.

At this stage, a clear trend toward improving the performance of distribution utilities is not evident. Strengthening the distribution network is a time-consuming process even if there were no financial constraints. Since access in rural areas

Figure 3.10: System Average Interruption Duration Index (SAIDI)

a) Top Five Discoms on the basis of SAIDI

State	Discom	SAIDI (Hrs)	Rank
Gujarat	MGVCL	16:04:00	1
Telangana	TSSPDCL	30:38:40	2
Gujarat	DGVCL	31:53:20	3
Gujarat	UGVCL	35:01:20	4
Uttar Pradesh	KESCO	38:44:34	5

b) Bottom Five Discoms on the basis of SAIDI

State	Discom	SAIDI (Hrs)	Rank
Haryana	DHBVNL	1122:12:00	26
Uttar Pradesh	DVVNL	1280:54:53	27
Haryana	UHBVNL	1423:24:00	28
Uttar Pradesh	MVVNL	2342:18:03	29
Uttar Pradesh	PVVNL	2527:07:14	30

Source: CERC, SERCs and state Discoms

Over the past few years, several measures and reforms have been introduced to help in course correction for the distribution sector. Programs including R-APDRP, APDRP, DDUGJY, UDAY, IPDS, etc. have helped to some extent. Different states have followed different reform trajectories and thus have had varied impacts on their operational and financial performance. Enhanced implementation of reforms is critical for achieving desired improvements. Continued disruptions in power supply and overall low quality of power have led to the existence of a large market for generators and inverters, even in tier II and III cities.

is a recent development, the improvement in power distribution networks is most relevant in the urban areas. It is also evident that the urban areas are a key driver for the demand growth, particularly the peak demand. Urban areas also have a higher capacity to pay for improved service. Given the significant infrastructure build-out in various sectors such as transport, water and gas, an opportunity to plan and integrate upgrades in distribution along with some of the other utilities will reduce cost, enhance viability, and improve the quality of services for customers.



City: Chandigarh
Source: RTI



City: Lucknow
Source: GreenTree



City: Chandigarh
Source: RTI



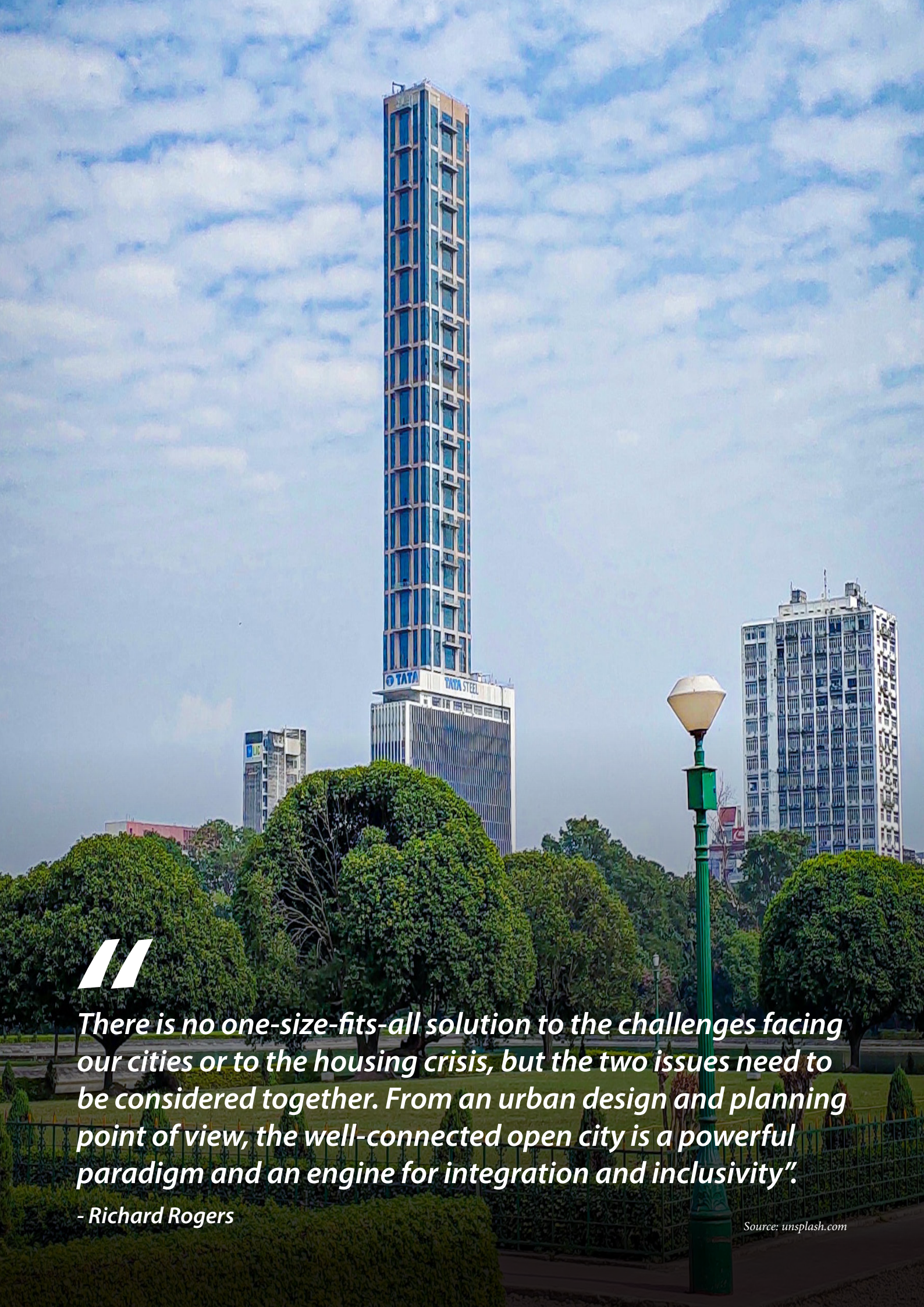
City: Chandigarh
Source: RTI



City: Noida
Source: GreenTree



City: Chandigarh
Source: RTI



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There is no one-size-fits-all solution to the challenges facing our cities or to the housing crisis, but the two issues need to be considered together. From an urban design and planning point of view, the well-connected open city is a powerful paradigm and an engine for integration and inclusivity”.

- Richard Rogers

Source: unsplash.com

4 URBAN PLANNING IN INDIA

Urban planning and governance in India have evolved over years. The first few Five-year plans had advocated urban reforms like fixing basic standards for housing, institutionalizing State Housing Finance Boards, addressing the issue of increasing cost of land acquisition by advocating controlled rates, and a specific allocation for “Town Planning and Preparation of Master Plans”, etc. The Ministry for Urban Development was established during the 7th Five Year Plan (1985-90). The 8th Five Year Plan (1993-97) coincided with the landmark 74th Amendment Act to the Constitution of India, which incorporated ULBs as the third level of government. The 9th Five Year Plan (1998-2002) identified the lack of integrated planning as a key failure. The 11th Five Year Plan (2008-12) recognized the Master Plan concept and highlighted the need to improve outcomes in the provision of services like water supply, public transport etc.

4.1 Legal, Policy and Institutional Framework

Even after the Planning Commission was dissolved, the central government continues to play an important role and exercises a significant influence in shaping the policies and programs with respect to urban affairs. The center also allocates resources to the state governments through various centrally sponsored schemes, provides finances through national financial institutions and supports various external assistance programs for urban development.

In addition, the legislative framework consists of State Town and Country Planning Acts, Municipal Corporation Acts, Municipalities Acts, and Urban Areas Development Acts for urban areas and Panchayat Raj Acts for the rural areas. At the regional and local levels, there are several legislations that play an important role in planning. For example, the National Capital Region Planning Board Act 1985, Delhi Development Act 1957, and Hyderabad Metropolitan Development Authority Act 2008. Other Acts related to land housing, infrastructure and environment, such as Registration Act 1908, Environment (Protection) Act 1986, Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act 2013, Real Estate (Regulation and Development Act) 2016, Land Acquisition (Amendment) Bill, 2007, Rehabilitation and Resettlement Bill, 2007,

etc., provide a framework for urban planning, development, and management.

The Government of India developed a Model Municipal Law (MML) in 2003 to guide States to enact municipal legislation. The basic objectives of the Model Law were to implement the provisions of the 74th CAA in totality for the empowerment of the ULBs and provide the legislative framework for the implementation of urban sector reforms. It was expected that this initiative will not only enhance the capacity of ULBs to leverage public funds for infrastructure development but also create a conducive environment for their functioning to improve service delivery. Four states, namely Rajasthan, Bihar, Orissa and Sikkim have prepared their municipal laws on lines of MML, and many others are in the process of amending their laws (Vaidya, 2009).

By 1992, the economic liberalization and the 74th Amendment Act establishing ULBs were sought to be empowered as autonomous centers of decision making. The 74th CAA provided for the institutionalization of ULBs (including municipal corporations) as the third layer i.e., form of local self-government. It also empowered state governments to devolve certain functions, authority, and power to collect revenue to ULBs and made periodic elections for them compulsory. The Act expected the ULBs to assume responsibilities for urban planning, water supply, social and economic planning, slum up-gradation, public health, etc. However, it did not lay down a mechanism for the financial sustainability of the ULBs and this power rested with state governments.

There is a detailed institutional framework for urban affairs in the country. The primary functions of various hierarchical levels are as follows: -

- i. The central government performs an important role in shaping the policies and programs, coordinating the activities of various Central Ministries, State Governments and other nodal authorities and allocating resources to the state governments through various centrally sponsored schemes.
- ii. The state governments have been bestowed with the responsibility of land, housing, urban development, and provision of civic infrastructure by the Constitution of India. It plays a role in providing an enabling environment to the ULBs through legislative and institutional reform and transferring functions, funds, and functionaries.

- iii. The State town and country planning departments/ directorates oversee planning of urban and rural areas. Their main functions include preparation of master plans, providing technical approval of infrastructure layouts, developing schemes and advising state government departments on matters related to planning etc. Metropolitan/District Planning committees (MPCs) are constituted for a city/urban agglomeration of 10 lakh or more (Delhi is exempted). These committees are set up to prepare a 'draft development plan' on matters of mutual interest between the municipalities and the panchayats.
- iv. Lack of technical and financial autonomy resulted in weak ULBs, which led to the creation of many parastatals at the state level, including development authorities, water supply and sewerage boards, slum housing and development boards, PWD, etc. These bodies are directly appointed by the state governments and operate in all cities within a state. They are established as the nodal agencies for the purpose of planning, infrastructure development and service delivery. They have been performing various functions that could have been vested with the ULBs as per the 74th CAA 1992. The presence of these parastatals has led to a multiplicity of agencies at the city level leading to a complex and confusing institutional framework.
- v. The 74th CAA provided for the constitution of three types of ULBs: Nagar panchayats for a 'transitional area', municipal councils for a 'smaller urban area' and municipal corporations for a 'larger urban area'. The CAA listed 18 functions that were to be devolved by the State Governments to the municipal governments, 'Urban Planning' (including town planning) is one of the key functions. However, the devolution of these functions was left at the discretion of the respective States. The 14th Finance Commission reviewed the status of the transfer of 12th Schedule functions from state governments to ULBs. Only three states viz., Karnataka, Kerala and Tripura transferred all 18 functions, Andhra Pradesh and West Bengal transferred 17 functions and Odisha 16 functions (refer to Figure 4.1). In Assam, the municipal Acts were amended in 2011 to transfer all 18 functions, but only eight are being performed by the ULBs. In many states, although the functions were incorporated in the Municipal Laws, these were performed by the state departments or parastatals (The Fourteenth Finance Commission & ASCI, 2014).

A study of implementation of the 74th CAA in various states reveals that some states have performed better in delegating these functions and concurrent authority. There has been compliance with the constitution of ULBs and SFCs, but the same cannot be said about other provisions, namely the constitution of Wards Committees, DPCs and MPCs (Vaidya, 2009).

Since the ULBs are closer to the people, it was hoped that active participation of the public in local decision-making would cut through many of the governance problems which bedevil top-down governance. However, this did not materialize because of three major reasons.

- i. First, because of the top-down use of fiscal and political power focused on planning as a tool to eliminate the most visible outcomes of poor regulation in cities, the proliferation of informal settlements or slums.
- ii. Second, the transformative impact of the 74th Amendment Act was unrealized by leaving it to the state governments to decide the extent of devolution. State governments have chosen to adhere to the letter of the law, rather than the spirit, by devolving few functions. They have limited the role, functioning and autonomy of the ULBs by retaining the financial and administrative control.
- iii. Third, the five-year cycle of elections has led to impatience with strategic and long-term institutional development, resulting in limited capacity-building efforts to enhance skill and take on more responsibility at the municipal level. Consequently, the Union and State governments prefer to "work around" municipalities through creation of state government-owned parastatals which plan and implement specific municipal services - water supply, sanitation, city transport, sanitation and affordable housing. In other cases, green field developments like new industrial and residential towns are governed by state-run Development Authorities. In some cases, states have developed a special cadre of municipal officials which are transferable all over the state. Whilst such measures are "quick fixes" to show results, they undermine the autonomy of ULBs.

Subsequent reforms such as the National Urban Policy Framework (NUPF) outline an integrated and coherent approach to the future of urban planning. It recognizes that solutions for most urban issues need to be customized to the local context, and that imposition of a standardized, tightly codified prescription is not desirable. The policy prescribed ten sutras (philosophical principles) applied to ten functional areas of urban

Figure 4.1: Devolution of 12th Schedule Functions under The Constitution to ULBs

#	State	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	AP & Telangana	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
2	Arunachal Pradesh*																		
3	Assam	P	P**	P	P***	Y	N	P	Y	N	P	Y	N	N	N	N	N	N	-
4	Gujarat	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5	Haryana***																		
6	Himachal Pradesh	N	-	N	N	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Karnataka	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
8	Kerala	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
9	Madhya Pradesh	-	-	Y	-	-	-	-	-	-	-	-	-	Y	Y	Y	-	Y	-
10	Manipur	Y	-	-	-	-	-	Y	-	-	Y	-	-	-	-	-	-	-	-
11	Odisha	Y	Y	Y	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	-
12	Punjab	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	Rajasthan	-	-	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	Sikkim	-	-	-	Y	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	Tamil Nadu	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y
16	Tripura	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
17	Uttar Pradesh	-	-	Y	Y	N	-	Y	Y	Y	Y	Y	Y	-	N	N	N	-	Y
18	Uttarakhand	-	Y	-	Y	Y	Y	Y	Y	Y	Y	Y	-	-	-	Y	Y	Y	Y
19	West Bengal	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y

Source: Statements Submitted by State Governments to the 14FC

Notes: 1. Regulation of land use and construction of buildings, 2. Roads and bridges, 3. Water supply, 4. Public health, sanitation, conservancy and SWM, 5. Slum improvement and up-gradation, 6. Urban poverty alleviation program, 7. Provision of Urban amenities and facilities, 8. Cattle pounds, prevention of cruelty on animals, 9. Vital statistics: registration of birth and deaths, 10. Street lighting, parking, bus stops and public convenience, 11. Regulation of slaughter houses and tanneries, 12. Urban Planning including town planning, 13. Planning of Economic and Social Development, 14. Fire Services, 15. Urban forestry, protection of environment, 16. Safeguarding interest of weaker sections, handicapped, etc. 17. Promotion of cultural, educational and aesthetic aspects, 18. Burial grounds, cremation grounds and electronic crematoriums. Y: Transferred; N: Not Transferred; P: Partially Transferred; (-): Not Available. Bihar, Chhattisgarh, Goa, J&K, Jharkhand, Maharashtra, Meghalaya and Mizoram did not provide any data. *Municipal election was held on May 16, 2013, and to date no function or staff have been transferred to ULBs, **Main Roads and Bridged under PWD, ***Public Health with State Department, ****Functions/services of ULBs already stood identified which were being performed by them even before the constitutional amendments. Hence no additional functions/ services were transferred to ULBs subsequent to constitutional amendments and award of 1st, 2nd and 3rd SFC.

space and management. It encouraged states to develop their own urban policies including implementation plans based on the national framework. One of the key functions of NUPF is “urban planning”, with an objective to equip cities to manage the growing demand. Another key policy reform in 2017 was the introduction of a framework to enhance revenues of ULBs through Value Capture Financing by encouraging states and UTs to adopt different VCF tools and methods.

However, most ULBs continue to be dependent on state governments for finances. As a result of weak financial autonomy, they are unable to undertake activities and perform functions as provided under the 74th CAA. Only about 1 percent of the ULBs have investment-grade credit ratings of A- and above (MoHUA, 2018). The dependency on grants increased from 44 percent in 2007-08 to 51 percent of ULB’s revenue share in 2017-18 (MoHUA, 2020).

The 74th CAA required states to constitute SFCs to decide the sharing of the revenue of state Governments with the local Governments, both urban and rural. The CAA required that every state should have constituted 5 SFC by the year 2014-15, beginning with the first SFC by 1994. But as per Ministry of Panchayati Raj's Devolution Report, only 22 percent (7 out of 32) of the eligible States and Union Territories had constituted all possible SFCs till 2015. With the amendment to Article 280 in 1992, it was under CFC's mandate to address the issue of municipal finances. The Eleventh Finance Commission (FC) recommended annual supplementary support of Rs 4 billion for improving the core services of municipalities, and the creation of appropriate databases and standardization of budgetary classification and practices. The Twelfth FC provided Rs 10 billion annually for ULBs as grant-in-aid and 50 percent of this grant was earmarked for solid waste management schemes (Vaidya, 2009).

The CFC can strengthen decentralization in two ways. First, it can incentivize the States to decentralize through its recommendations. The States may decentralize more on two accounts (i) by transferring more resources to the local governments and (ii) by handing over more revenue sources (taxation powers) to the local Government. Additionally, to strengthen decentralization, transfer of funds to the local bodies that represent a quantum jump from the past and hence increase the local government size may be considered. Though there have always been doubts regarding the absorptive capacity as well as the governance at the local level, however, there is a good argument in favor of devolving funds with faith, that the capacity will be created.

4.2 Urban Planning Process - Gaps and Challenges

The primary objective of urban planning is to equip cities to meet the needs and demands of a rapidly growing population through a people-centered development approach. It should assist cities in realizing their economic potential while protecting the environment and promoting inclusion. However, modernist urban planning theories in the twentieth century, including Howard's utopia, Wright's Broadacres City and Le Corbusier's Radiant City, adopted a physical view of urban planning (Mohanty, 2019). They did not consider the economic fundamentals of cities: people at the center of development; co-location of households, firms, and institutions to enable development; external economies of agglomeration and networking; localization of innovation and economic growth; employment in both formal as well as informal sectors, etc. The models ignored the basic premise that cities are the products of processes, shaped by economic interactions and social relations.

Citizen engagement in the planning and design of urban infrastructure and services is often limited, despite the requirement of establishing the ward committees. The public participation process has not been institutionalized and therefore there is widespread dissatisfaction and increasing "NIMBY" syndrome in cities across the country.

Jane Jacobs (1961) phrased this as "the kind of problem a city is," thus introducing the notion that cities are systems, but systems with very different structures and dynamics from those we are familiar with in the machines we use in everyday life. It is extremely difficult to try and build cities from the top-down, imposing inflexible master plans that always run out of steam due to our inability to provide the organization to implement them and the control to ensure individuals do not undermine them.

She also pointed out that local and man-on-the-spot knowledge is the most important resource for good planning. Decentralized planning helps and maintains the spontaneous order that makes urban life work, and this can be a result of the voluntary activities of individuals and not that is created by the government. This contrasted with what the modernists advocated "that cities require extensive central planning to save them from impending chaos." In India, for instance, most states have entrusted urban development authorities with the preparation of master plans. It often does not consider the needs of the majority in cities, comprising the poor and LIGs. Further, many of these authorities are parastatals, not accountable to the people.

In his recent book "Inventing Future Cities", Michael Batty (2018) argues that social systems and cities are more like organisms than they are like machines. In this sense, they are the product of countless individual and group decisions that do not conform to any grand plan. This notion of cities evolving is quite consistent with the idea that they are unpredictable, the product of our inventions.

Urban planning, thus, enables cities to perform their fundamental role as drivers of structural and spatial transformation. The master planning paradigm in India combines elements of the comprehensive planning approach in the United Kingdom and the exclusionary zoning model in the United States (Mohanty, 2019). They are statutory instruments that guide and regulate the present and future utilization of land, expansion, and zoning of cities and typically cover a horizon of 20-25 years. They have failed to deliver the desired outcomes of creating economically efficient, socially equitable, environmentally sustainable, and financially viable cities.

First, the master plans have failed to present a coherent strategy to finance infrastructure and development projects. They have borrowed the planning model from the UK but have not followed the plan financing system of the country that included grants from the Central Government, 'planning obligations,' 'community infrastructure levy' etc. By keeping financing of development outside the model of spatial planning, the master plans have neglected the economic forces that drive growth, regional specialization, knowledge externalities and innovation.

“A conspicuous failure of urban planning in India is that while the master plans present a grand vision of city development, they narrowly focus on land use and development control regulations (DCRs) to realize the vision. They do not provide robust instruments to finance core urban infrastructure facilities needed for economic growth, especially transportation. The result is an enormous backlog in the capital expenditure required by cities.”

-Prasanna K. Mohanty (Planning and Economics of Cities)

Second, land use planning and infrastructure (such as electricity and transport) delivery have been pursued as a disjointed exercises by separate agencies, forgoing the benefits of land use integration with the spatial, social, and economic context of cities as they evolve. The mobility needs of the urban poor and LIGs, constituting the majority have generally been neglected. According

to many experts, integration of transport and more widely infrastructure, with land use is perhaps the single-most-important instrument available to planners in developing countries to incorporate the goals of sustainability and inclusion in urban development strategy (Mohanty, 2019).

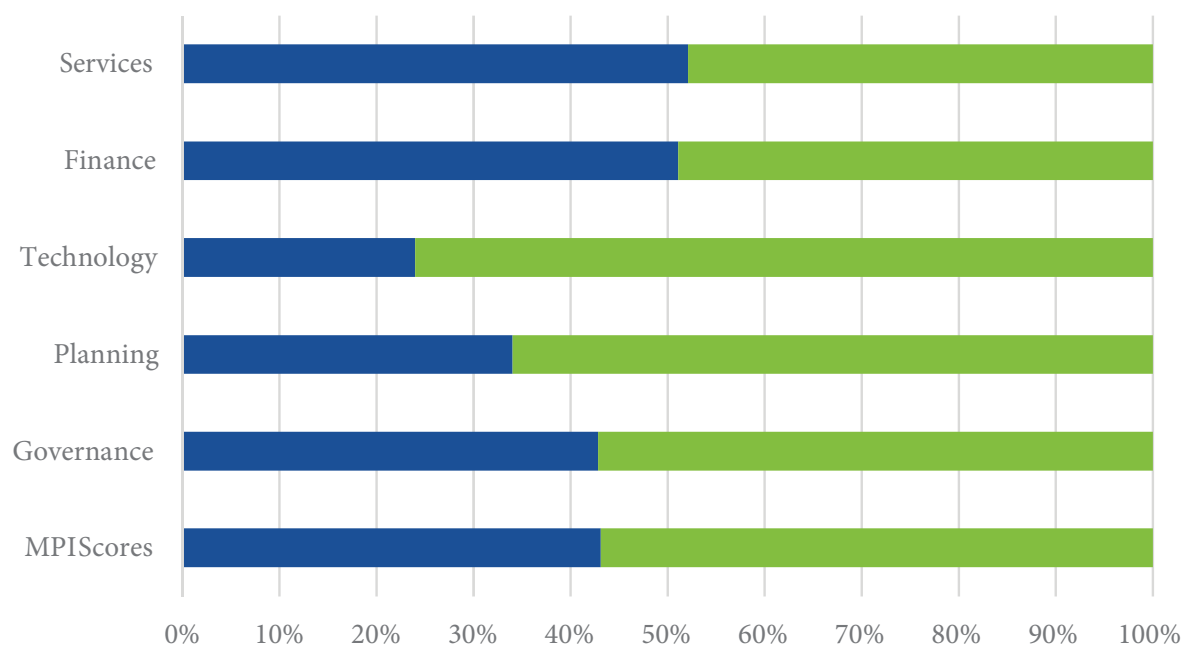
Third, master plans tend to be rigid and restrictive, rendering them inappropriate for addressing the needs of rapidly evolving requirements. They are confined to planning and development of land on a horizontal dimension, ignoring the vertical dimension represented by the floor space index. FSIs in Indian cities are low by global standards and do not reflect differential accessibility on account of proximity to public transportation or other city-level assets (Ahluwalia, 2015).

Fourth, plan formulation in India has taken longer than the actual plan period because of the inordinately long process. For example, the first Master Plan of Hyderabad started in 1965 but came into force in 1975. The second Master Plan of Mumbai began in 1977 but was completed in 1994 (Mohanty, 2019). Additionally, about half of our statutory towns are expanding without any master plan to guide their growth and infrastructural investments, as per the data provided by TCPO to the Advisory Committee (NITI Aayog, 2021). As a result, new constructions are haphazard, and development interventions are on a piecemeal basis, resulting in pollution and congestion.

Fifth, the lack of integration between different plans and authorities has led to fragmented planning and implementation. With several agencies involved in urban planning, implementation and infrastructure development, the framework and process have become cumbersome. This led to ambiguity, lack of accountability and coordination, delays in timelines, wastage of resources, and even discord over the division of functions and responsibilities. Cities have several different urban plans such as city investment plan, heritage conservation plan, environmental conservation plan, district development plan, perspective plan, city sanitation plan, etc., each having a specific purpose, but failing to make an impact on ground. A case in point is Delhi, where multiple authorities are responsible for planning and development. These include DDA, DJB, NDMC, DMRC, National Capital Region Planning Board, Delhi Urban Art Commission, and others.

Last but not the least, Indian cities lack technical, institutional, and organizational capacity to undertake planning. Urban planning primarily focuses on plan formulation and development control, ignoring the vital aspects of project implementation, financing strategy, monitoring of outputs, and measuring of impacts. India has about 4,500 town

Figure 4.2: Significant Gaps in Urban Planning, Municipal Governance and Services



Source: Municipal performance report 2020 MOHUA

and country planners. With more than 7,900 cities and towns, 53 metropolitans requiring MDPS and 650 district requiring DDPS, the planning resources are grossly inadequate (refer Figure 4.2).

All of the above challenges have resulted in poor quality of services and dissatisfaction. For a long time even the standards were not specified. The first attempt at setting urban service norms and standards was made in 1963 by the Zakaria Committee, which laid down the physical norms and corresponding expenditure norms for five services, i.e., water supply, sewerage, stormwater drainage, urban roads, and street lighting. Subsequently, other government agencies and institutions have proposed norms for different services. Rising aspirations in a rapidly growing economy also call for a new look at the norms for public service delivery. A consultative process with state governments and other stakeholders was initiated in 2006, which culminated in the issue of SLBs for services in December 2008. The benchmarks are important for shifting focus from the creation of physical infrastructure to service delivery.

4.3 Role of Energy in the Urban Planning Process

A related challenge that urban planners often face is the integration of smart energy solutions within the urban architecture to manage energy consumption and reduce energy-related carbon emissions. Given that

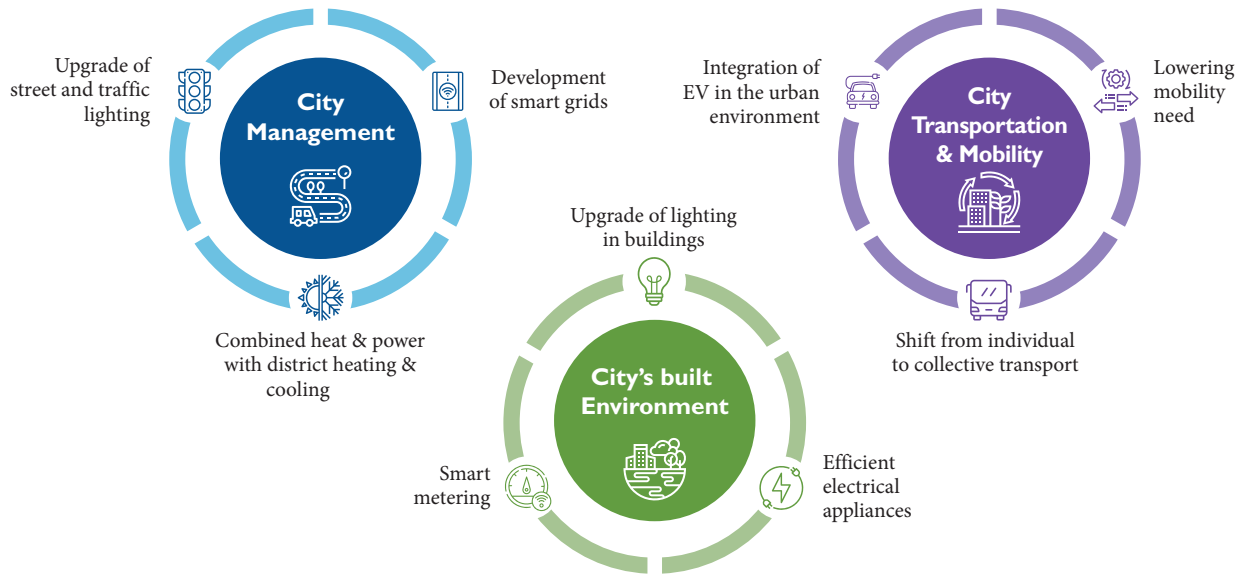
most urban activities - urban design, transport, water, waste, IT infrastructure, and security and resilience - are strongly dependent on energy, integration of energy actions in urban and spatial planning becomes important for climate action, sustainability, and better quality of life. India has an additional challenge of a heavily skewed energy mix towards use of fossil fuels such as coal. Figure 4.3 points out some of the energy actions that can help achieve sustainable development goals.

Energy management has traditionally been a part of either national or state government policy while urban planning and services were under the purview of state and ULBs. Changes in urban form have a direct relation with the energy sector. The physical form of cities may facilitate or hinder the changes needed for the energy transition, which in some places will have to be redesigned to accommodate the transition (Asarpota & Nadin, 2020).

Energy planning can be brought on the radar of urban planning by considering the following aspects:

- i. the way an area and its buildings are defined in terms of density, volume, surface and use,
- ii. the way buildings and infrastructure are constructed,
- iii. the way constructed buildings/areas are supplied with energy, and
- iv. the way transportation in an area is planned and realized.

Figure 4.3: Energy Actions along with Possible Barriers in City's Transportation and City Management



Source: *Smart Sustainable Cities: An Integrated Planning Approach towards Sustainable Urban Energy Systems*, (Ramamurthy & Devadas, 2013)

Traditional urban planning has generally not given due attention to integrating energy and sustainability considerations. Given the increasing risk from rising global temperature due to climate change, cities will be expected to consider, adopt, and lead the transition to

net-zero. Therefore, planning, supply and use of energy will emerge as a key consideration and determinant of urban planning. Progressive cities are already working on this subject as energy and urban development (including transportation) is becoming inextricably intertwined.





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Given the reality of limited time and resources, best practices provide a valuable, low risk, default starting point."

-Chad White

Source: unsplash.com

5 INTERNATIONAL EXPERIENCE

International experience suggests that the integration of infrastructure within the rubric of urban planning improves a city’s liveability and quality of life. Further, Net zero and carbon-free city missions have begun to emerge in progressive cities and those directly impacted by climate change. Internationally, the land use and environmental factors, master plans, regulations, and institutional structuring have started to include energy as a part of urban planning.

5.1 International Experience in Integrating Energy and Urban Planning

Cities around the world are using different tools, techniques, and practices to transform them into sustainable eco spaces and prepare for cleaner future. This section provides an overview of some of the best practices adopted by leading cities around the world (refer to Figure 5.1). These experiences provide a broad direction and guidance that can be adopted by others based on their context.

Figure 5.1: Best Practices Template in Urban Planning

Practice/technique/tool	Contribution to sustainable development	City case
Preparedness for future growth	Climate change, Disaster management, environment	Amsterdam, Copenhagen, Singapore
Switch to green energy	To become carbon neutral cities	Copenhagen, Amsterdam, New York, Seoul, Shanghai, Vienna
High quality of public and green spaces	Improves quality of life	Amsterdam
Energy and spatial planning	Integration of Energy into master planning process, Land use and management of built-up	New York, Seoul, Singapore, Vienna
Making transport central	Conversion into green transport, up-gradation and integration of different modes of transportation	Amsterdam, New York, Shanghai
Collaboration with authorities	Enhanced coordination	Bogota
Integrated utility system	Investments to upgrade the infrastructure that integrated with the city profile	Toronto, London
Participative planning	Role of citizens in planning	New York

Singapore



Source: unsplash.com

In 2007, the city of London developed a Climate Change Action Plan with an objective to achieve a 60 percent cut in CO₂ emissions by 2025 (UNEP & ICLEI, 2009). It also plans to implement a sustainable energy management system that will integrate city infrastructure (including electric vehicle charging) and optimize energy supply with the aim of reducing local energy consumption (Greater London Authority, 2018).

Likewise, as part of the CPH 2025 Climate Plan, the city of Copenhagen captures and maintains data on energy consumption, energy savings, tariff details and other utility networks at building level. It is the first city in the world to have a completely centralized building monitoring system that collects remote data from heat, water, and electricity meters on an hourly basis to help identify places with the highest energy usage and potential problem areas.

The city of Seoul brought the issues of energy conservation, energy efficiency, responses to climate change and renewable energy development to center stage in 2007 by setting up the first Department of Energy (Byrne, 2008). In 2008, Amsterdam municipal council made it mandatory for all construction projects (post-2015) to be climate neutral.

Streetlighting, an important consumer of electricity, is being made energy efficient in many cities. Smart streetlighting can reduce electricity use by up to 80 percent. Buenos Aires, Argentina, started a replacement program in 2013, and in 2019 became the first metropolis in Latin America to use 100 percent LED lights for streetlighting. Similarly, in 2019 India's Ministry of Power announced it had installed 10 million smart LED streetlights under the street lighting National Programme, helping India avoid almost 1,161 MW of peak energy demand and reduce annual CO₂ emissions by 4.8 million tonnes.

Further, a number of cities have issued guidelines through policies and programs to break down strategic energy approaches for the operative procedures. Vienna, for example, has announced its Urban Development Plan 2025 (STEP, 2025) which directly refers to integrative energy planning. New buildings are planned to be built only if they have a climate-friendly energy system. Building codes and regulations were specially designed for heating and hot water provision in new buildings within climate protection areas. The city has also recognized the importance of expanding the approach beyond the administrative borders, on a regional level. It is focused on the development of a regional energy strategy together with the surrounding provinces lower Austria and Burgenland and coordinating issues of the Renewable Action Plan, which would be a win-win situation for the whole region.

Optimization of energy use through careful land-use planning is one of the key approaches adopted by many cities. The city of Amsterdam, for example, has introduced land-use regulations that include mixed-use residential communities, redeveloping industrial riverfronts and building more high-rises, wind farms and public transport networks, and a structural vision to densify the city core, creating public spaces and greenery with accompanying amenities to make the city attractive and livable (Parvinder, 2015). Similarly in Singapore, urban land is preserved and utilized at a high productive rate.

One important prerequisite to successfully integrating energy within the urban planning process in close cooperation within and beyond the administration. Elements of this cooperation include sharing of data and strategies to understand the energy system, develop scenarios to reach the climate goals; analyze and define integrated solutions for each area together; evaluate the optimal choice for an energy system to increase planning security and enable public participation wherever possible. For example, London is considering a formal arrangement whereby the Mayor, utility companies and regulators have statutory duties to consult with each other and formulate the London Plan (Mayor of London). On the same lines, collaborative planning across sectors requires extensive governance reforms. Cities like London and Berlin decided to coordinate across spatial planning, city design, and urban transport, allowing them to achieve better outcomes on mobility, emissions, and managing their overall footprint.

The urbanization process will require synergizing with the urgent need to decarbonize the energy systems. Hence, integrating renewable energy technologies into local energy systems has become a part of the transformative action needed to realize such potential. Cities like Seattle, Washington, and British Columbia, have tapped into wind, solar, biomass, and hydro to replace fossil fuels for a cleaner environment. Cocody, Ivory Coast, has put in place a reforestation and carbon sequestration program, under which more green spaces will be created and 2 million mangrove trees will be planted or restored (World Economic Forum, 2021). A study of German and Swiss energy co-operatives showcases how private individuals, municipalities, farmers, banks, enterprises, energy utilities and other city actors facilitate the installation of renewable energy sources. The study highlights the role of municipalities in encouraging these initiatives by capitalizing on political support and employing their financial capacity, public relations competence, and authority on land rights.

Another case is the city of Oslo. It is giving priority to pedestrian infrastructure, improving, extending, and aligning public transit with TOD planning and aiming at environmentally differentiated tolls and having a

Singapore



separate lane for efficient vehicles. Similarly, Hong Kong has an extensive and robust public transport system and a high proportion of active travel (walking).

The city of Seoul also plans to deliver 270,000 EVs for public transportation by 2025 (a mix of cars, taxis, buses and motorbikes) in an endeavor to reduce the city's GHG emissions. Another example is Vancouver where electrification is extended to existing car-sharing schemes which are encouraged to take up the new technology. Even Oslo and Hong Kong are supporting this switch through regulatory and fiscal measures. In addition, Hong Kong provides tax reductions on the registration of new electric cars with zero emissions (Energies, 2020). Similarly, Shanghai's 14th Five Year Plan and a separate five-year plan EVs aim to enable all buses, government vehicles and city-center goods vehicles electric and almost 50 percent of all private vehicles to transition to electric vehicles.

“Automobiles are often conveniently tagged as the villains responsible for the ills of cities and the disappointments and futilities of city planning. But the destructive effect of automobiles are much less a cause than a symptom of our incompetence at city building.”

- Jane Jacobs, The Death and Life of Great American Cities

Another area to reduce high energy consumption is heating and cooling systems. In Hong Kong, for example, the benchmarking of buildings and requirements for retrofitting are stringently applied and revised every three years. Sophisticated meters are used to monitor energy consumption and the mechanical cooling and lighting systems are retrofitted as per the standards set in the building code (Energies, 2020). Similarly, the district cooling system in the Gujarat International Finance Tec-City (GIFT City) in the Indian state of Gujarat provides reliable cooling to residential, commercial, and industrial buildings. Its advanced metering and supervisory control and data acquisition (SCADA) systems are expected to reduce energy consumption by 15 to 45 versus conventional air conditioning.

Many cities are also focusing on integrating renewable energy in urban planning. The Shanghai city has planned the available space (due to land shortage) in a manner to integrate solar power on all rooftops of the buildings to produce green energy. Copenhagen's 5 Finger Plan was centered around offering green structures and public transportation. Some of the other cities which are increasing renewable energy supply in their overall energy mix are Vancouver, Hong Kong, Oslo and Oakland.

The important step, however, is to build strong linkages between energy aspects and the urban design and planning process. This will include all regulations, activities, and instruments to steer the local energy supply and the transformation of the energy sources. There are three main criteria for the integration of energy planning and urban planning (Schmid, 2018). These include:

New York



Switzerland



- i. Planning criteria, such as heat demand and heat density considerably depend on land use or building density of an area, energy performance standards for buildings, etc. that can be factored in during the planning stage
- ii. Use of local resources, and availability of the energy source (renewables) can be sufficiently answered during the planning stage
- iii. Timing, considerations of energy supply options, particularly if grid-connected and/or using local resources, should be considered in the early stages of the planning process

5.2 Benchmarking of Indian Cities on Sustainability

A comparison of Indian cities with some of the top international cities presents at an early stage of

The sustainability competitiveness also measures progress towards the UN SDG, especially SDG11. The average score of cities globally in the progress towards SDG11 is 0.69. Among the 1,006 sample cities, 1.8 percent are close to achieving SDG11, 44.33 percent are relatively close to achieving SDG11, 47.51 percent are quite a distance from achieving the goal, and 6.36 percent are far from achieving the goal. At present, the average score of cities globally in the progress towards SDG11 is 0.69, which means they are “quite a distance away from achieving the goal” but is about to enter the “relatively close to achieving the goal” stage. Most of the Indian cities are also in this stage, with a few exceptions of those who are relatively closer to meet SDG 11 such as Bangalore, Kochi, Coimbatore, Kollam, Pune, etc.

Most of the Indian cities are at a significant distance from achieving the sustainability goal. Some of them have however taken initial steps. This is considered to

Figure 5.2: Sustainability Competitiveness (SC): Comparison between International and Indian Cities

	City	Country	SC Score	SC Ranking
Top International Cities	New York	United States	0.935	3
	Singapore	Singapore	0.959	2
	Tokyo	Japan	1	1
	London	United Kingdom	0.901	5
	Munich	Germany	0.785	18
Top Indian Cities	Delhi	India	0.449	268
	Mumbai	India	0.387	352
	Bangalore	India	0.4	330
	Chennai	India	0.356	412
	Kochi	India	0.338	450
SUNDAR Cities	Visakhapatnam	India	0.209	795
	Lucknow	India	0.203	808
	Chandigarh	India	0.141	935

Source: GUCR (UN Habitat and the Chinese Academy of Social Sciences (CASS), 2020)

evolution with respect to sustainable development and competitiveness. According to the GUCR 2020, cooperative research conducted by CASS and UN-Habitat, Tokyo holds the top rank in sustainability competitiveness, followed by Singapore and New York at the second and third positions (refer to Figure 5.2).

Global urban sustainable competitiveness refers to the ability of a city to enhance its advantages in economy, society, ecology, innovation, global connection, and other aspects, and to seek systematic optimization to continuously meet the complex and advanced welfare utility of citizens. Indian cities are far behind. Delhi is the top scorer in Indian cities at 268th position; SUNDAR cities in comparison are further down the list.

be the beginning of a long journey. Most actions taken till now appear in narrow silos such as solar cities, building codes etc. and these are not integrated with the urban planning. A more comprehensive planning and integration of these actions with other utility services will enable cities to become resilient and sustainable.

The key to sustainability is building strong linkages between energy aspects and urban design and planning process. As many global cities prepare for the future, efficient, robust and comprehensive planning will need to consider energy integration. Several elements of the urban planning process and institutions are evolving in cities to internalize and enable the transformation.



“

A city isn't so unlike a person. They both have the marks to show they have many stories to tell. They see many faces. They tear things down and make new again.”

-Rasmenia Massoud

City: Chandigarh
Source: RTI

6 EVIDENCE FROM CITIES SELECTED FOR THE STUDY

Fieldwork was undertaken in five Indian cities. These cities included two reference cities and three aspiring cities. The two reference cities, i.e., Chandigarh and GIFT City (not a full-blown city) were chosen for relatively higher levels of achievements in urban planning, infrastructure, management and quality of electricity supply and productive linkage mechanisms with urban development cadres and institutions. The three aspiring cities, i.e., Vishakhapatnam, Lucknow and Noida were selected for geographic representativeness and multipolarity of development levels across states.

Each city was individually profiled. The profile includes a brief introduction to the case city, current level of service quality (with a focus on electricity), level of integration between the departments, key challenges and gaps observed during the site visit and some of the suggestions and recommendations.

6.1 Chandigarh

It is an example of a modern, planned city in India, and is internationally acclaimed for its urban planning and architecture. The city has a population of 1.05 million (Census 2011) with a total area of 114 sq. km (refer to Figure 6.1).

6.1.1 Institutions and processes

In 1966, Chandigarh was made a Union Territory, governed by an advisory council of Administrators (UT). At present, the infrastructural services (water supply, sewerage system, solid waste management,

drainage facilities, street lighting, fire wing) are being maintained by the Municipal Corporation while development is undertaken by the Engineering Department. Planning of the urban areas is done by the Town planning department. Chandigarh Electricity Department is currently responsible for the transmission and distribution of power supply in the city. There are four Electricity Operation divisions serving 2,49,391 consumers, with sales of 1,589 GWh as of 31st March 2020. In addition, Chandigarh Smart City Corporation Ltd (CSCCL) was established in 2016 to implement smart city projects including heritage restoration and up-gradation of infrastructure projects.

6.1.2 Current level of service quality

Chandigarh enjoys a relatively better position among other urban areas, particularly in infrastructure provision (refer to Figure 6.2). It has achieved 100 percent metering and the billing efficiency is high. However, discussions with key authorities and stakeholders reveal that key reliability indicators and DT failure are relatively high at ~7 percent (though less than all India's average) and have not changed significantly in the recent years. The SAIDI and SAIFI figures for Chandigarh are 7.3 hours and 5.8 respectively, which are better than the national average but are not as good as some of the leading cities such as Mumbai or Delhi. The AT&C losses have remained below 20 percent with some variations. From 9.5 percent in FY 18 (one of the best years), it increased to 13.6 percent in FY 19, and further to 18.2 percent in FY 20 before reducing to 11.9 in FY 21.

Figure 6.1: Landmarks in Chandigarh

a) Legislative Assembly of Punjab and Haryana



b) Rock Garden, Chandigarh



Figure 6.2: Urban Infrastructure in Chandigarh city

a) Separate cycle track on roads



b) Commercial center in Chandigarh



The dip-stick consumer survey undertaken in the city indicates the quality of power is a concern and points to areas of possible improvement. About 79.2 percent of the consumers surveyed face power cuts, of which 30 percent experience power cuts 1-3 times per month. The duration of power cuts ranges from less than an hour to more than 3 hours. As many as 81.7 percent of consumers experience voltage fluctuations. Of those surveyed, 44.2 percent of the consumers are paying more than INR 3000 for electricity per month and 78.3 percent are paying almost double the amount - nearly INR 6000. Many customers indicated that their spending on and usage of power back-ups have increased due to power cuts. Close to 70 percent of the consumers are willing to pay more than the current price to have a better, reliable, and continuous supply. While 28.3 percent of consumers have installed solar panels, 24.1 percent have inverters and 21.6 percent use DG sets for backup.

6.1.3 Current level of integration

Currently, the Urban Planning and Energy divisions operate separately, although they are part of the same department. Some cooperation between departments takes place as part of discussions on resource allocation, funding, consultation for capital works initiation, permissions, and coordination. There is however no

specific mandate or mechanism to coordinate energy aspects at the building level or community level. Similarly, the smart city works such as street light up-gradation and creation of GIS-based distribution network data monitoring systems are being executed independently by the Chandigarh Smart City Corporation Ltd (CSCCL).

6.1.4 Insights from the site visit - Challenges and Suggestions

The study team met with several departments to collect data and understand the processes, the integration, the challenges, and the key initiatives undertaken by them. It was found that in areas like dense informal market areas, industrial phases outside the limits and slums, the electricity service levels are low. Notified slums and rehabilitated villages are equipped with reasonable power supply, provided with bulk metering. The MCC undertakes about 20 percent of the electrical works that involve metering and billing (street lighting and pole to meter household power connections). Rest of the electrical works vest with the Engineering department (EWEDC) which executes major works including laying power lines. EWEDC appears to be making significant efforts to improve the energy sector including energy efficiency measures and the development of solar power projects.

Figure 6.3: Power Infrastructure in Chandigarh

a) HT lines in Industrial Phase II, Chandigarh



b) Bicycle station, sector 17, Chandigarh



Figure 6.4: Illegal occupancy around the Electrical Transformer (Sector 37)



Source: RTI

Stakeholders such as CRRID suggested that the city will need more energy as the demand is increasing. CREST is making efforts to increase the use of renewable energy in the city and thereby reduce CO₂ emissions. In its perception, the power sector can be upgraded to meet residents' expectations by integrating with other sectors and involving it in the city development plan or a separate document guiding institutions on coordination and covering the citizens' requirement. A separate cell may help in coordinating activities with the renewable energy department and the electricity department.

Overall feedback from the consumer survey shows some dissatisfaction with the quality of utility services. In the case of electricity, main challenges are power cuts, both scheduled and unscheduled, and voltage fluctuations. Energy consumption has increased, and the peak demand particularly during the summer season is the key reason. Overloading of the last mile infrastructure such as the distribution transformers is a major contributor. This is the biggest challenge listed by the electricity department. Also, there's a mismatch between the capital expenditure required and released for the electrical works. Common duct policy, underground and above head policies are needed for improving the quality of supply. This will also avoid repeating the same process every time new infrastructure is required.

Some areas have major safety concerns as the land around the transformers, mainly in the commercial areas, industrial layouts and slum pockets have been illegally occupied (refer to Figure 6.4). The Town planning department expressed concern about lack of integration between the departments at a functional level.

To summarize, though the city showcases some scalable solutions related to urban infrastructure and planning, it has to deal with the growing power demand and have to align its policies to climate mitigation strategy. Chandigarh is already undertaking renewable energy projects through government schemes and subsidies for installing solar panels on the rooftop of the buildings. The master plan of Chandigarh also encourages the adoption of the green building rating system and design concepts in line with the Energy Conservation Building Code (ECBC), 2007.

6.2 Gujarat International Finance Tec City

GIFT city, an aspirational project in the state of Gujarat, is being developed as a Global Financial Hub with world-class infrastructure. The project is a business district with two zones: GIFT city and GIFT IFSC. An IFSC is legally a foreign jurisdiction that enjoys tax exemptions and facilitates the smooth flow of finance, financial products and services across the border. It is India's first such center. The 886-acre estate will have office spaces, residential apartments, schools, a hospital, hotels, clubs and other amenities (refer to Figure 6.5). Started in 2011, it is still a work in progress. Many financial services, law and consultancy firms have established a presence within it only with a token office for now (Mint, 2022).

6.2.1 Institutions and processes

The State Government declared GIFT City as Industrial Township in 2012 under proviso to Clause (1) of Article 243 Q of the Constitution of India. The city was taken out of the Village Panchayat jurisdiction which enabled prompt decision-making and faster permissions.

Figure 6.5: GIFT city



Source: LinkedIn.com

To provide an enabling ecosystem for developing the city, the Government of Gujarat has taken bold and forward-looking initiatives. This includes a PPP arrangement with a 50 percent equity contribution each between GUDC and IL&FS Ltd. This is the only city planned to be built without any capital investment by the government. The project is financed by leveraging land and built-up area (FSI), an innovative financing model which many Indian cities have not been able to leverage to date. In 2020, the State Government acquired 50 percent stake of IL&FS, as a part of debt restructuring and insolvency of the latter. A separate GIFT Urban Development Authority was constituted for the GIFT City Area which helped in fast-tracking and regulating development in the city. It has given the required autonomy and flexibility to implement projects.

The GIFT City model supports business operations with 100 percent tax exemption, 9 percent minimum alternate tax, GST and customs duty for imports in SEZ exempt, 4 percent TDS on interest in overseas borrowing and long-term capital gains tax and stamp duty exempt. In addition, several economic and fiscal advantages are proposed to attract foreign investors and institutions aiming to be on par with other leading financial centers such as Dubai, Singapore, and London.

6.2.2 Current level of service quality

The city is equipped with state-of-the-art internal infrastructure encompassing all basic urban infrastructure elements. It also has excellent external connectivity by roads, metro rail and Bus Rapid Transport Service. The buildings use an energy-efficient district cooling system instead of air-conditioning and an automated waste collection system that evacuates garbage from the buildings at high speed. However, it will take sometime for GIFT city to catch-up with international IFSCs. As of now, there is a need to set up more infrastructure, especially in the IFSC section. Moreover, professionals working in IFSC say they live either in Gandhinagar or Ahmedabad because of the lack of basics, such as places to eat and socialize (Mint, 2022).

With respect to power supply, the current power consumption was found to be 8-10 MW whereas the design capacity is 400 MW, indicating the futuristic planning approach. The infrastructure setup will be able to meet the growing demand with ease. Power is sourced through Grid (99.9 percent) and alternatives or backups have typically been used for 25-30 minutes in a year. GIFT Power Company provides backup power through DG sets (central level) in case of a requirement.

Figure 6.6: Underground Infrastructure in GIFT

a) District Cooling System



b) Vacuum based Automated Waste Handling System



Losses are very low, 3.2 percent, and primarily technical in nature. As the utilization improves, the loss is expected to reduce to 2 percent. DT failure is nil so far. The underground utility tunnels have helped in keeping the losses very low and accidents at zero. The revenue collection is fully automated, equipped with RF meters, access mobile apps, maintenance of GIS data system and presence of SCADA system. The GIFT power company has a small workforce of around 10 people, and additionally about 15-18 field staff. Overall service quality is high though some concerns regarding overcapacity have been expressed, particularly because it results in higher prices. This is partly due to delays in progress on implementation of some of the commercial and residential buildings and because such a process of planning infrastructure ahead of development has not been implemented in the past.

6.2.3 Current level of integration

The land for the GIFT City was provided by the State Government with the condition to share profits and

act as a resource for the project. The State Government developed the trunk peripheral infrastructure required for this project, which includes external connectivity, approach roads, bridges, water supply, domestic gas, power supply, etc. The government declared GIFT City as Industrial Township and proposed Notified Committee as an Urban Local Body for professional management of all utilities. GIFT UDA was formed for quick decision-making in the approval of building plans and other statutory requirements. Clearances for the entire projects (environmental clearance, height clearance, etc.) were taken in advance. Online Development Approval System was adopted. A separate power company was established to ensure an uninterrupted power supply.

The entire infrastructure for the GIFT City was planned in an integrated manner and a dedicated Underground utility tunnel was developed for the district cooling system, power supply, domestic gas, water and wastewater, reuse of treated water, an automated waste collection system, etc. (refer Figure 6.6 and 6.7).

Figure 6.7: Underground Utility Tunnel in GIFT city



6.2.4 Insights from the site visit - Challenges and Suggestions

A set of institutions and eminent experts were interviewed in October 2021 to obtain feedback on GIFT city development. Those consulted included the GIFT City Company Limited, former Chairman of Gujarat Electricity Regulatory Commission, GIFT Club, and IIT Gandhinagar. During interactions, some suggestions regarding planning and energy systems integration issues were made and some positives were also highlighted. These are briefly described below:

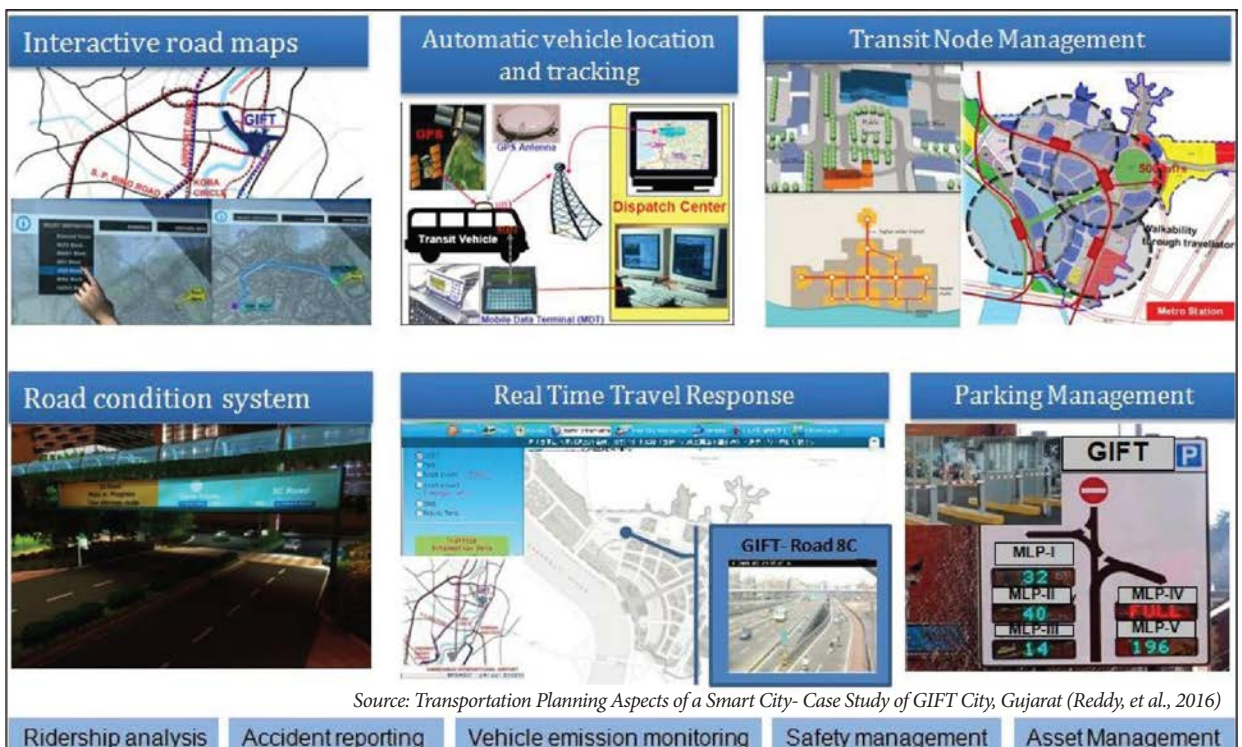
- i. The GIFT City is a greenfield development that offers more flexibility in planning and development in comparison to brownfield projects. However, most Indian cities will require retrofitting and redevelopment.
- ii. In GIFT City, the provisioning of dedicated space and built-up area for energy systems, outside the permissible FSI, is an added advantage, like the underground infrastructure (DCS, provisions sub-station, etc.). Incentives can be offered to group housing and commercial-institutional buildings to adhere to design and operate energy-efficient systems.

Figure 6.8: Proposed metro station in GIFT city



Source: Transportation Planning Aspects of a Smart City- Case Study of GIFT City, Gujarat (Reddy, et al., 2016)

Figure 6.9: GIFT city Smart Transport



Source: Transportation Planning Aspects of a Smart City- Case Study of GIFT City, Gujarat (Reddy, et al., 2016)

- iii. GIFT Power Company is better placed relative to typical Discoms that are mandated to provide power to individual units under EA, 2003. Most Discoms do not plan for or provide backup services. This clearly reflects the gap between planning and provisioning of important services such as power, which needs to be provided 24X7.
- iv. The GIFT Company Limited was able to integrate planning and land use within its domain (refer to Figure 6.8).
- v. The GIFT City Company expressed limited potential for solar rooftops, given the area is a high-intensity SEZ. As a result, the solar and wind hybrid plants are proposed to be installed elsewhere.

Being a newly planned hi-tech city, GIFT city enjoys ultra-modern infrastructure (refer to Figure 6.9) with no major challenges or gaps. At this point, this is also because it is currently functioning well below the design capacity. The city has been benchmarked as a light-house city for the Government of India's National Mission of Smart Cities covering 100 urban areas because of its socio-economic sustainability aspects. However, it is challenging to replicate such a model elsewhere, due to high upfront costs. The technology adopted for infrastructure development is cost-efficient when compared with the conventional model on a life cycle basis. A similar approach can be easily adopted in other greenfield developments. Further, large redevelopment projects, particularly in metros and Tier 1 cities, will likely benefit from a similar model. A more detailed cost-benefit analysis may be performed for GIFT when it is operating closer to the design capacity and used for other cities as well. Further, the institutional arrangement adopted in GIFT is relatively easier to replicate and may be adopted or experimented by other cities and states.

6.3 Visakhapatnam

Vizag is Andhra Pradesh's largest city, both by the population of 1.72 million (Census 2011) and by size of its economy. Overall, it is the ninth-largest contributor (by cities) to the GDP of the country (refer to Figure 6.10).

6.3.1 Institutions and processes

Greater Visakhapatnam Municipal Corporation (GVMC) is the civic body that oversees the civic needs of the city. Its obligatory functions include water supply, street cleaning, drainage improvements, lighting, reclamation of localities, prevention of infectious diseases etc. Visakhapatnam Urban Development Authority (VUDA), having six operational wings for Planning and headed by Chief Urban Planner, is responsible for the preparation and implementation of master plans, layout approvals, concern for EWS categories and other regulatory functions. APEPDCL is responsible for the installation of power infrastructures such as transmission substations and towers, while GVMC's role is the acquisition and allocation of land.

6.3.2 Current level of service quality

The total electricity consumption of Vishakhapatnam in the year 2018-19 was 4556 GWh with 3.8 percent T&D losses. The peak demand of the city was 834 MW. During the last five years (2013-14 to 2018-19), the city has observed a CAGR of 7.4 percent and a 14.4 percent increase in energy requirement and peak demand, respectively. The reliability of the power supply is improving with SAIFI and SAIDI levels of 5 and ~3 hours, respectively. However, the city is still below the global standards. The DT failure rate is 5.4 percent (FY 20), lower than most other cities, barring Delhi and Mumbai. A key factor relates to the major damage of DT in the adjoining semi-urban and rural areas within the municipal limits. AT&C losses are close to 11 percent.

Figure 6.10: Vishakhapatnam Fishing Harbour



Figure 6.11: Urban Infrastructure in Vishakhapatnam

a) Jagdamba Commercial center



b) Slum settlement in Port Area



The dipstick consumer survey undertaken in Visakhapatnam city indicates a somewhat unreliable quality of power particularly as compared to official statistics and points out certain areas of possible improvement. About 69.7 percent of the consumers reportedly faced power cuts. The duration of the power cut ranged from less than an hour to more than 3 hours. About 36.5 percent of consumers experience voltage fluctuations. 40.9 percent of the consumers are paying more than INR 3000 for electricity per month. Close to 75 percent of the consumers are willing to pay more than the current price to have a better, reliable, and continued supply of power. About 85.6 percent of the consumers are using power backups at their homes and workplaces (52 percent are using inverters while 48 percent have DG sets).

6.3.3 Current level of integration

GVMC and APEPDCL work as two different entities where APEPDCL acts as the main responsible authority to provide power supply in the city. The integration between GVMC and APEPDCL is limited and takes place as per the statutory and regulatory provisions based on the city development plan requirement. Area level-based developments are carried out in specific areas as per the plans or power requirements with the

coordination and inputs from both parties. Growing demands of increased urbanization and sustainability considerations would require higher levels of integration between the two.

6.3.4 Insights from the site visit – Challenges and Suggestions

The discussions highlighted that the lack of land is impacting infrastructure development and service maintenance. It was also found that the integration between the master plans and the execution on the ground is limited. The Planning and Engineering department discussed about the weak inter-departmental linkages that have led to unsatisfactory coordination with stakeholders like APEPDCL, VIWSCO (Visakhapatnam Industrial Water Supply Company Limited), and GVSCCL (Greater Visakhapatnam Smart City Corporation Limited) etc., often resulting in issues like delays. Also, development plans and activities originating from the smart city needs to be integrated with the City Development Plan (CDP), Master plans and regional plans.

During the site visit, it was found that due to a shortage of land, especially in core commercial areas, space for installing the electrical poles is allotted on the footpaths (refer to Figure 6.12), restricting the pedestrian flow,

Figure 6.12: Power Infrastructure in Visakhapatnam

a) Electric pole on the footpath, Jagadamba Junction



b) Illegal Occupancy in port area



Figure 6.13: Solar Energy Installations in Visakhapatnam

a) Solar Panels installed at GVMC Parking area



b) Solar Power at Visakhapatnam Port



and constraining commercial activities. In slums and outer areas, major concerns include the condition and maintenance of the power infrastructure, violation of safety norms and Illegal connections in a non-notified slum, etc.

To improve integration between departments, the formation of a new department in the municipal corporation for the electricity division of APEPDCL was suggested. Smart city SPVs are also a potential channel to integrate urban and distribution network planning and operations. Another area of opportunity is in higher integration of renewable energy usage (refer to Figure 6.13). Reportedly, unauthorized power usage has increased in the last 5 years, which needs to

be curbed to reduce revenue loss. Besides, the status of energy consumption needs to be monitored. Forming a separate body consisting of the GVMC Electricity department and a nodal officer from APEPDCL to bring more integration in the process was also suggested in the discussions.

6.4 Noida

Established in 1976, Noida is known as one of the largest planned industrial townships in Asia. It is a hub for economic growth and attracts the large number of young professionals, particularly in the IT and industrial sectors (refer to Figure 6.14).

Figure 6.14: Landmarks in Noida

a) Supertech Supernova building



b) IT Hub in Noida



Figure 6.15: Urban infrastructure in Noida



6.4.1 Institutions and processes

NOIDA Development Authority (NDA) comes under the Infrastructure and Industrial Development Department of the Uttar Pradesh Government. It is responsible for infrastructural and industrial development, maintenance of civic amenities, building of integrated townships, with smooth and wide roads, well-developed land, uninterrupted power supply, clean and safe drinking water, traffic, solid waste management, sewage-related facilities. UPPCL is responsible for the Transmission and Distribution of power in the State, have four Discoms. Of these, Pashchimanchal Vidyut Vitran Nigam Limited (PVVNL established in July 2003) is responsible for power distribution in Noida.

6.4.2 Current level of service quality

The present demand for electrical load in the township is 200 MVA. To address the frequent outages due to overhead cable breakages during thunderstorms and wind speed, PVVNL-Noida has initiated the process of placing underground power lines in about 196 locations across five divisions. PVVNL-Noida has initiated the process of placing underground power lines in about 196 locations across five divisions.

Data for Noida suggests high quality of supply. SAIDI and SAIFI values are ~1 hour and 0.5, respectively. AT&C is high at 18 percent. However, since the data could not be validated from independent sources and pertains to a very short period, it cannot be treated as representative. Further, the dip-stick survey results do not correlate with the data.

The consumer survey undertaken in the Noida city indicates the unreliable quality of power and points out certain areas of possible improvement.

About 53.6 percent of the consumers have reported power cuts and 33.8 percent have experienced voltage fluctuations. 31.8 percent of the consumers reported that it takes more than 8 hours to resolve power issues due to the mismanagement of power infrastructure. About 35.5 percent of the consumers are paying between INR 1000-2000 for electricity per month. More than 50 percent of the consumers are willing to pay more than the current price to have a better, reliable, and continued supply of power. This will also reduce the usage of power backups. About 54.5 percent are using inverters and 37.3 percent have DG sets.

6.4.3 Current level of integration

Noida Development Authority (NDA) works in a company-based organization structure. Many issues related to resource allocation, funding, and consultation for capital works initiation are directly handled with the involvement of the CEO of Noida Authority, thus communication is fairly streamlined. The city-level reduction in the aggregate technical and commercial loss is a function of works and maintenance by the state Discom with corresponding responsibilities at each level.

6.4.4 Insights from the site visit – Challenges and Suggestions

The study team met the Planning and Electrical Department, Noida Development Authority and PVVNL. Discussion with the Electrical Department of Noida Development Authority highlighted the challenge of land acquisition in the implementation of infrastructure projects. It was also brought to notice that the Discom lacks interest in implementing the strategies as there is no asset monetization.

Figure 6.16: Power Infrastructure in Noida

a) Loose hanging power lines entwined in trees and open panel boxes



b) Underground power cables



Additionally, Noida Master Plan, 2031 doesn't deliberate on the utilization of advanced technologies. Acquiring land for establishing electrical infrastructure is a big challenge. Inadequate staff in operations and maintenance of services are also visible gaps highlighting the challenges in city functioning from the administrative perspective.

A few suggestions were arrived at during and after discussions with stakeholders including:

i. The new integrated statutory body focusing on inter-departmental synergies for controlled and

result-oriented action can also evaluate the land allocation criteria for Noida, as a higher percentage of land is reserved for the Industrial and commercial zones.

ii. To overcome the power outages in various parts of Noida, authorities must encourage the industrial and commercial zones to adopt renewable energy sources to reduce the overload.

iii. Real-estate developers must be motivated to install solar roof top units.

Figure 6.17: Power infrastructure in Noida

a) Substation



b) Roof-top Solar panel installation



c) Metro connecting Noida city center with Delhi



6.5 Lucknow

Lucknow is the capital of Uttar Pradesh (refer to Figure 6.18). It provides significant employment opportunities to its neighboring districts. It also has a thriving handicrafts sector, which over the years has grown into a robust MSME industry.

6.5.1 Institutions and processes

The administration and government structure in Lucknow includes several institutions like Lucknow Jal Sansthan (LJS), Lucknow Development Authority (LDA), District Urban Development Authority (DUDA), and many other agencies at the State-level, along with Lucknow Nagar Nigam (LNN) alternatively known as Lucknow Municipal Corporation.

Uttar Pradesh Power Corporation Limited (UPPCL) is vested with the function of Transmission and Distribution within the State. It has four Discoms of which Madhyanchal Vidyut Vitran Nigam Limited (MVVNL) is responsible for carrying out the business of distribution of electricity in several districts of the state, including Lucknow district.

For the city of Lucknow, a separate body has been created under MVVNL, named Lucknow Electricity Supply Administration (LESA), which is responsible for power supply, revenue collection and resolution of administrative issues in the city. LESA has been further divided into two separate administrative units namely, Zone 1 (LESA CIS GOMTI- Old Lucknow) and Zone 2 (LESA TRANS GOMTI- New Lucknow). The Chief Engineers of these two zones report directly to the MD of MVVNL.

6.5.2 Current level of service quality

It was found that the power outages frequency of Zone 2 was 10 times that of Zone 1. Similarly, in terms of power outage duration (between May 2021 – Sep 2021) Zone 1 performed better than Zone 2 with figures of ~2:18 hours and ~4:00 hours per Avg. Month per feeder, respectively. However, since the data could not be validated from independent sources and pertains to a very short period, it cannot be treated as representative. At the city level, the AT&C loss for the Lucknow was identified to be ~20.2 percent for the year 2018-19, much above the baseline of ~8-11 percent which needs to be addressed urgently.

The consumer survey undertaken in Lucknow city indicates the unreliable quality of power and points out certain areas of possible improvement. More than 85 percent of the consumers reported power cuts, with a duration range of fewer than 3 hours. About 66 percent of consumers experience voltage fluctuations never or once in a month. In Lucknow city, the time taken to resolve any infrastructure damage or power outage issue is less than 3 hours. However, 27.3 percent of the consumers reported their dissatisfaction on the time taken to resolve the issues and 50 percent of them reported delays of more than 3 hours. The survey results suggest that 32 percent of the consumers are paying more than INR 3000 for electricity per month. More than 40 percent of the consumers are willing to pay up to 10 percent more for a better, reliable and continued supply of power. This will reduce the usage of power backups. Approximately, 80 percent of the consumers are using inverters and 19 percent are dependent on DG sets for backup.

Figure 6.18: Landmarks in Lucknow city

a) Bara Imambara in Lucknow



b) Lucknow metro



Figure 6.19: Urban infrastructure in Lucknow

a) Road and metro infrastructure



b) Public toilet



6.5.3 Current level of integration

The current level of integration is limited to the initiatives under the Smart City Mission. The SPV Lucknow Smart City Limited (LSCL) formed for the implementation of smart city projects carries end-to-end responsibility for vendor selection, implementation, and operationalization of various Smart City projects. LSCL comprises different stakeholders and includes citizens' involvement in different areas.

6.5.4 Insights from the site visit – Challenges and Suggestions

The study team interacted with the Town and Country Planning Department, Housing and Urban Planning Department and Lucknow Development Authority (LDA). LDA is currently working on a Vision Document 2050 to take infrastructure up-gradation on priority. The housing department is working closely with the Smart City SPV to implement the housing projects.

The UPPCL along with LESA is making efforts to reduce losses through new electrical connections,

underground cabling and the use of better efficiency equipment. Accordingly, LESA has prepared a five-year plan (2019-24) of ₹10 billion to improve power supply in Lucknow. Other than the installation of new sub-stations and transformers, LESA would lay underground cables in 340 km area and change low tension lines in a 1,200 km area of the city. It would also replace conventional lines with Aerial Bunch Conductors (ABC) to minimise power theft and make supply safe in densely populated areas. The new infrastructure, however, would be developed mostly on the city outskirts while the existing infrastructure would be strengthened (Hindustan Times, 2019). As of 2022, LESA has started the survey of markets to remove overhead wire mesh and planning to start the underground laying of wires in certain areas soon (Hindustan Times, 2022).

It was found that the dilapidated condition of the existing infrastructure is a challenge (refer to Figure 6.20). Most existing infrastructure is old, worn and run-down with a needs to upgrade and retrofit. Power outages, voltage fluctuation, poor power quality, load unbalancing and

Figure 6.20: Status of Electrical Infrastructure in Lucknow



PT (minor) cum DT failure (major) result in customer dissatisfaction particularly in view of relatively high electricity bills. There is limited coordination between various agencies, especially at the planning stage. Increasing coverage of infrastructure does not appear to match with the improvement of the service level. Transparency of data is not maintained on regular basis. Upon discussion with the stakeholder (CTCP and Lucknow Development Authority Office), it was identified that during the planning stage of the Lucknow Master Plan, no Discoms official is required to be involved during the land allocation for the electrical sub-stations.

- iv. Retrofitting of old, worn and over-exploited residential or commercial (non-religious) building infrastructure (i.e., building with more than 100 years age) and reallocation.

6.6 Summary

Overall, a few trends are evident from the research and analysis of cities studied under the project.

First, in most cases, the current level of infrastructure service and quality of supply is low, particularly in the aspiring cities. Even reference cities do not

Figure 6.21: Road Congestion in Lucknow city



A few suggestions were arrived at during and after discussions with stakeholders include:

- i. Coordination across departments for an effective solution to address encroachment, pollution, cleanliness, water supply, street lighting, drainage, building regulations, and public transportation was emphasized.
- ii. Implementation of the Gati Shakti Scheme in full spirit to break the departmental silos and engage in institutional holistic planning among major stakeholders.
- iii. Construction of 33/ 11 kV S/s. and installation of DTs at the consumer load end along with underground laying of power cables will reduce the power interruption, losses and theft.

match the best in class within the country. GIFT is an exception but is strictly not comparable. While this research focused on electricity, the case of other services is similar and, in some cases, even worse.

Second, the disconnect between delivery and customer expectation is stark. Most customers thus rely on personal backups or alternatives to cope with unreliable and poor quality supply. Similar backup arrangements exist for other services such as private vehicles for lack of public transport and bottled water or tankers for lack of piped water supply.

Third, urban planning and infrastructure delivery are not well integrated. This results in avoidable costs and inconvenience for consumers. Since urbanization is expected to continue and significant infrastructure

development is planned, integration is an unrealized opportunity.

Fourth, many services including electricity are delivered by state-level entities and therefore ULBs have a limited role. They often view state-level entities as independent entities with interests not well aligned with the local agenda and expectations.

Fifth, infrastructure development follows habitation with the consequent burden of living through the ongoing construction of roads, pipelines, and bridges as well as coping with poor quality of life. GIFT city is unique

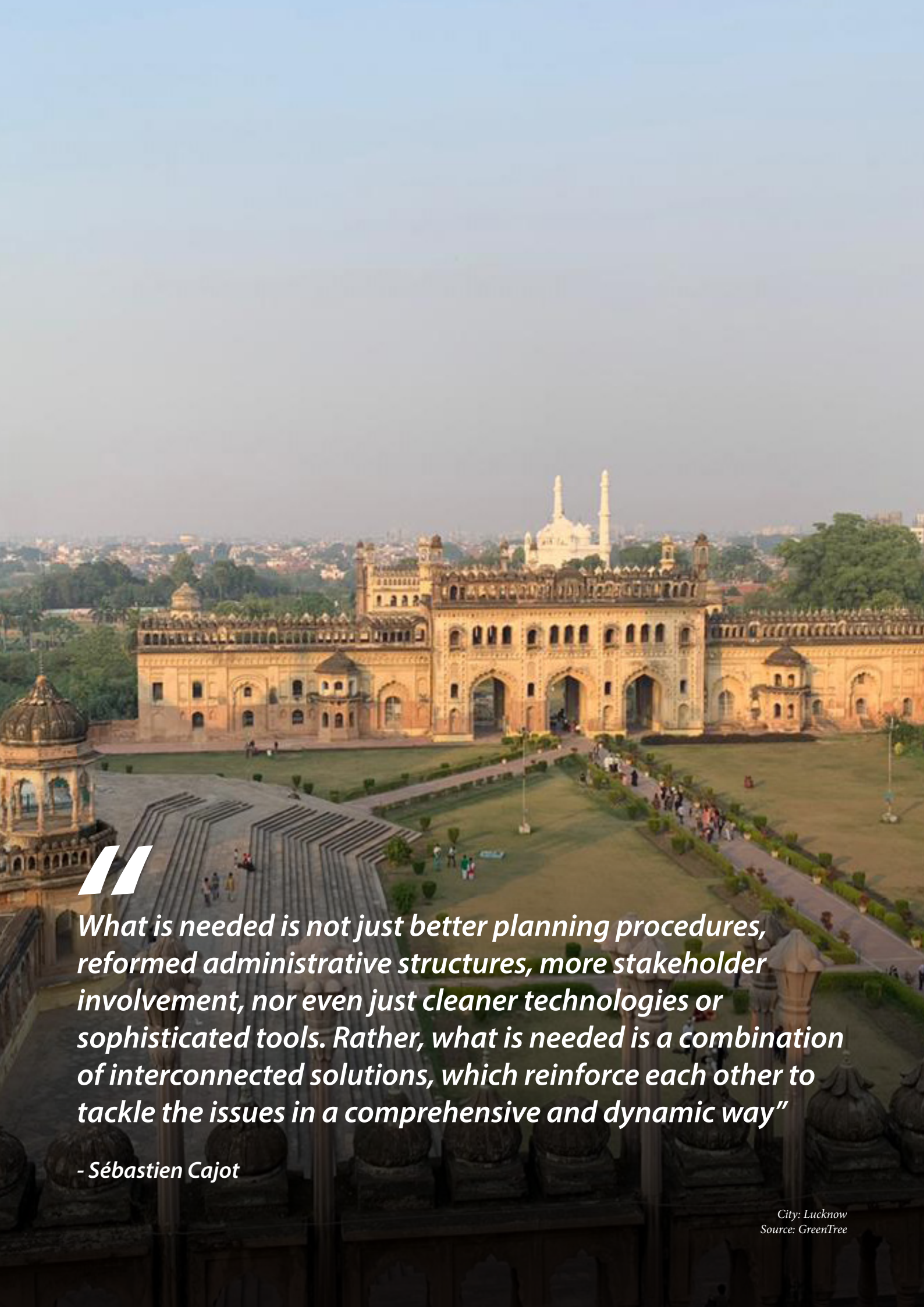
from that perspective and offers a potential alternative for greenfield cities.

Sixth, economic cost-benefit analysis is rarely deployed. Most projects are analyzed purely from a financial perspective and the procurement models follow the least cost approach that does not internalize life-cycle costs.

Last but not the least, lack of financing, inadequate manpower and lack of technical expertise in the staff are universal challenges for most cities. While some progress is being made under the central government schemes, a lot more is required.



City: Lucknow
Source: GreenTree



What is needed is not just better planning procedures, reformed administrative structures, more stakeholder involvement, nor even just cleaner technologies or sophisticated tools. Rather, what is needed is a combination of interconnected solutions, which reinforce each other to tackle the issues in a comprehensive and dynamic way”

- Sébastien Cajot

7 THE CASE FOR INTEGRATED CITY PLANNING AND MANAGEMENT

It is evident that the existing approach to urban planning in India is splintered across organizations. Major utility functions like the supply of electricity, drinking water, sewerage facilities and major roads are generally supplied by State Government agencies. In other cases, such as metro rails, Central Government agencies are providing services jointly with state entities. Acquisition of land for urban development, planning and land zoning is done by state-level agencies in many cases. Further, in most states, municipalities remain administratively and functionally subordinate to the town and country planning departments or the urban development departments.

This situation represents an incomplete implementation of the 74th CAA. While most State Governments have enacted legislation to devolve the constitutionally mandated seventeen functions to ULBs, the actual delegation of various administrative and financial powers to enable them to function as autonomous bodies has been limited. Most ULBs thus continue to operate as departments of the State Government.

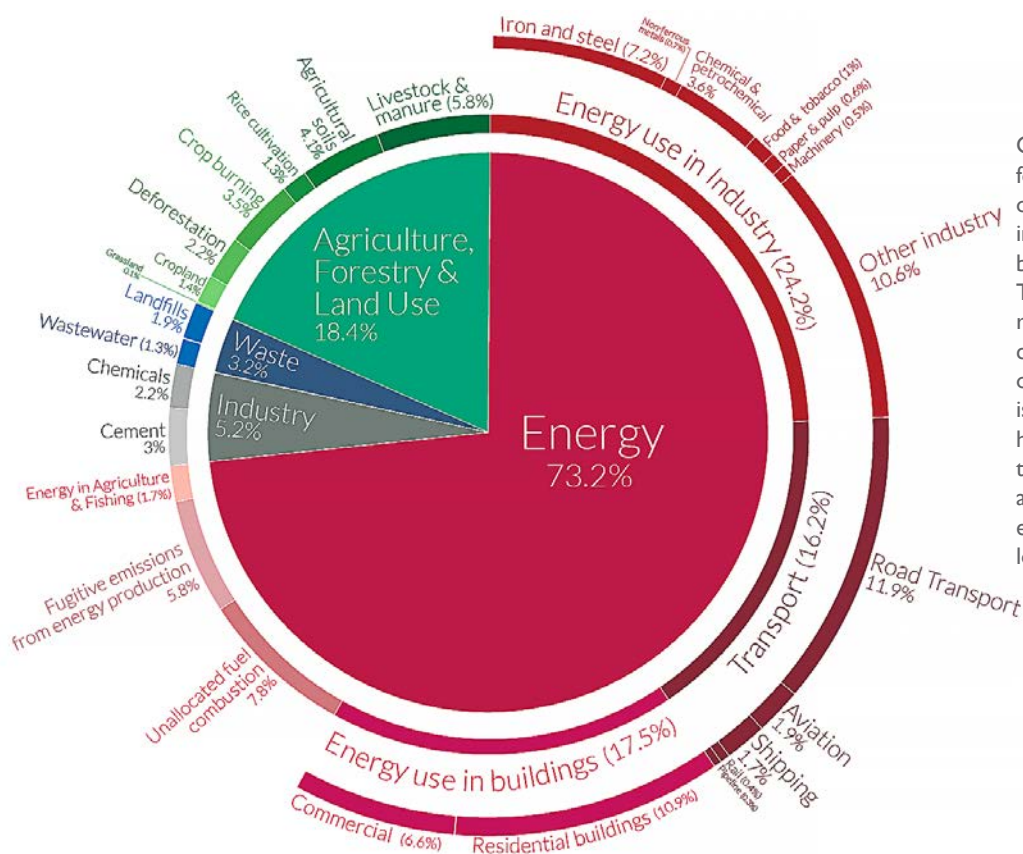
As highlighted earlier, rapid urbanization can accentuate sustainability challenges, particularly with respect to climate change. To enhance the quality of life and sustainability, cities need to re-think urban development. Convergence of master plans with energy and transport planning is particularly relevant for meeting the climate change targets.

7.1 Key Drivers for Integrated Planning and Utility Services

7.1.1 Decarbonization

Energy use accounts for three-fourths of the global carbon emissions (refer to Figure 7.1). Further, as already mentioned, cities consume 60-80 percent of energy and therefore contribute to 70-75 percent of GHG emissions. Decarbonization of energy, particularly in cities, is critical for overall energy transition and carbon mitigation. City regulations can make a difference by enabling a transition to cleaner options.

Figure 7.1: Global GHG Emissions by Sector



Overall cities account for around two thirds of direct energy use in industry, homes, building, and transport. This disproportionate share relative to even the corrected population share of around 52 percent is accounted for by the higher share (80 percent) that cities have in the GDP as compared to rural areas even at India's relatively low levels of urbanization.

Source: Climate Watch, The World Resources Institute (2020)

The path to decarbonization involves a combination of electrification, infrastructure upgrades, change in energy profile, innovative technologies, modification in mobility, and digital and analytical solutions.

There are several examples of how technological innovations are reducing carbon footprint and GHG emissions. For example, a study done for Los Angeles by the National Renewable Energy Laboratory-LA100 (NREL), illustrates the benefits of the convergence of the three key objectives – decarbonization (100 percent renewables), digitalization, and green public mobility by 2045. Thousands of buildings were simulated, aerial scans and customer adoption models were used to assess rooftop solar potential, and utility planning tools were used to ensure power system stability. Advanced scenarios also demonstrated energy efficiency opportunities to complement clean energy deployment. The study calculated that these measures would avoid between USD 0.47-1.55 billion in distribution network investments.

7.1.2 Digitalization

The world is witnessing an accelerated pace in digitization with the mass adoption of smart and connected ICT by consumers, businesses, and governments. Globally, digital technologies are creating new growth opportunities to leapfrog institutions, governance and planning processes and markets. They are also transforming societies into a more integrated, interdependent and connected world.

For example, Singapore’s one-of-a-kind digital twin, Virtual Singapore, is a virtual 3D copy of the city-state. It is a model that integrates GIS data with buildings information, modeling data to replicate the city’s infrastructure, transport systems and buildings. In addition to providing static information like any other map, Virtual Singapore is updated with dynamic real-time data, on traffic and climate for example. The digital twin supports city stakeholders in their decision-making on diverse operations.

Digital solutions can accelerate the clean energy transition in cities, promote climate protection, and enable cleaner air, thereby contributing to SDG11. About 83 billion connected devices and sensors are expected to be creating large, diverse datasets on air quality, energy consumption, geospatial data, and traffic patterns by 2024. Digitalization can also support integrated urban planning practices and transform urban energy use across sectors - such as buildings, transport, and lighting, making the value of smart, sustainable urban energy systems more than the sum of their parts. Digitalized construction can reduce the embodied carbon in buildings. Smart streetlights can save energy. Smart communication can make urban mobility more efficient.

In energy systems, digitization has integrated renewables, improved the reliability of power grids, and reduced the cost of access to electricity, therefore contributing to an equitable energy transition. Data on energy consumption and production patterns can be used to better plan sector transformation, both on a macro and micro level. As renewable energy generation and decentralized generation have increased over the years, they have placed increased strain on aging energy grids, originally built for centralized power generation and large-scale power plants.

Digitization can also improve data collection and life-cycle analyzes, support more efficient design, avoid over-engineering, extend the useful life of buildings and facilitate sustainable dismantling, repurposing, and recycling, and reduce construction time (GlobalABC/IEA/UNEP (Global Alliance for Buildings and Construction, International Energy Agency, and the United Nations Environment Programme), 2020). A case in point is Hotmaps GIS tools used in European countries (refer to Figure 7.2). Real-time information on where energy is being generated from, when to store excess energy in storage devices, and when to request the customers to reduce their consumption can optimize grid management. Better energy management can help in better urban planning and address the growing demand in a sustainable and efficient way. One example is the Urban Future Project in Sao Paulo (refer to Figure 7.2).

Figure 7.2: Hotmaps GIS Toolbox and Sao Paulo Urban Futures Project

Hotmaps GIS Toolbox

Hotmaps GIS toolbox is an open-source platform of heating and cooling demand in European countries. Pilot tests in Geneva, Switzerland, and Bistrita, Romania, demonstrated the ability to achieve heat demand savings of 30-40% by retrofitting 70% of the cities’ buildings. In the United Kingdom, the London Building Stock Model provides a snapshot of all London’s buildings, including demand and energy performance data, helping identify poorly performing buildings.

San Paulo Urban Futures projects

In Brazil, Enel launched the “Urban Futures” project in the Villa Olympia district of Sao Paulo, a living lab to demonstrate the benefits of full digitalization of an urban area in a megacity, starting with the power grid, and involving and engaging all local stakeholders. Over the coming decade, regulatory frameworks will evolve to unlock a variety of barriers, to allow not just industrial sites but also smaller loads such as vehicle fleets homes, and neighbourhoods to participate in the provision of energy and ancillary services that have been traditionally managed centrally.

Source: *The Hotmaps Toolbox (Energy Cities, European Commission, 2019)*

7.1.3 Convergence of Technologies

The convergence of technologies is creating new opportunities. Energy management systems, energy storage, microgrid technologies, and intelligent communications and information platforms are witnessing the convergence of applications and operations. This technological convergence is enabling a greener, locally managed, reliable energy supply mechanism while ensuring financial benefits for participants throughout the smart grid network (Largue, 2021).

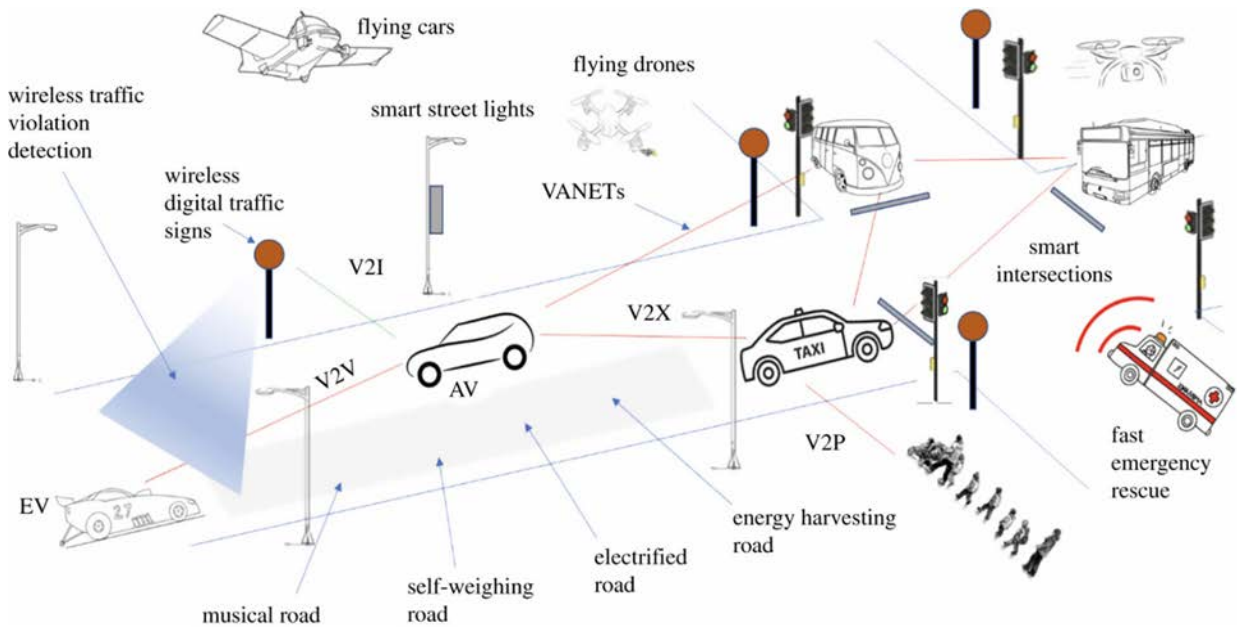
Convergence and technology integration in transportation and traffic management is a growing need and there is evidence that cities are already realizing this opportunity (refer to Figure 7.3). Cities are leading in transport system electrification, with over 40 percent of global passenger EV sales occurring in 25 metropolitan areas. Shenzhen for example was the first in the world to convert its bus fleet to fully electric, with 16,000 EVs saving over one mt CO2 per year. Similarly, Colombia is planning its mass transport systems to be 100 percent electric or zero-emissions by 2035.

potentially triggering network failures (IEA, 2021). Data-based time-of-use strategies can optimize this demand, shifting around 60 percent of the power generation capacity needed for charging EVs away from peak loading. Energy system modeling for California showed that “smart charging” - allowing the rate or time of the charge to be varied algorithmically can reduce peak power and enhance flexibility in grid management.

Open Data can also promote efficient transport solutions. Shared mobility companies could handle 10 percent of public transport journeys in 2025 if supported by open access to data and flexible industrial and labour regulations. “Know and reduce” your carbon emissions - The Finnish city of Lathi has a mobile application that makes travelers aware of transport options along with the emissions cost of each option, for their planned travel. In addition, the city provides virtual credits to those that remain below their chosen personal emissions budget. Residents can use these credits to buy a range of consumer and city services and products.

Further examples include Jakarta has integrated public transport management and payment systems to reduce

Figure 7.3: Convergence of technologies



Source: Chai K. Toh^{1,2}, Julio A. Sanguesa³, Juan C. Cano⁴ and Francisco J. Martinez, Royal Society Publishing

One important consideration in EV is charging infrastructure. The number of publicly accessible EV chargers increased to 1.3 million in 2020 (from 0.8 million in 2019), and analysis shows that the share of EVs charging during peak demand hours could rise by up to 10 percent by 2030 compared to 2020 levels,

congestion and GHG emissions, thereby transforming the city from car-centric to transit-oriented development. Under PT JakLingko Indonesia, this comprehensive integration increased the number of Transjakarta users by over 250% from over 0.4 million per day between December 2017 and February 2020.

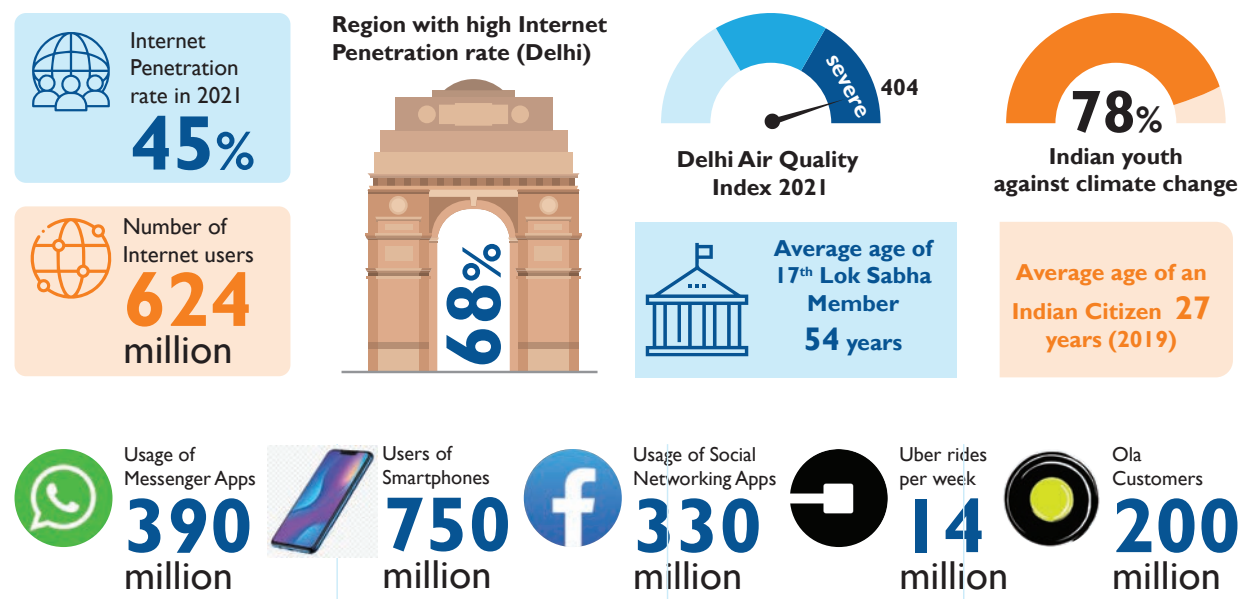
7.1.4 Consumer Aspirations

Consumer expectations are evolving fast, in step with rapid technological innovation, especially in India, home to a fifth of the world’s youth population. Over the past 20 years, a series of rapid technological advances have transformed customer expectations while simultaneously providing enterprises with digital tools to offer cutting-edge services. As the propensity to spend increases, the youth have better access to fulfill their aspirations of private vehicles, power backups, electronics and electrical appliances. For example, young people in India have more access to smartphones and the internet is mainly used to avail services for online entertainment, shopping, payments, social networking etc. (refer to Figure 7.4). Two-thirds of Facebook users in India are from the age group 15-29 years which constitutes 27 percent of India’s population (Kolluri and Abdulla, 2019). The dynamics are changing, young India has emerged and is taking charge.

Expectations of sustainability, ethical production and wellbeing are increasing in Indian cities especially in metropolitan cities in terms of access to facilities and services. This is particularly true for younger generations, as reflected by the ‘Global Youth Letter Report’ that surveyed more than 8,000 people aged 18-35 from 23 countries. One unanimous agenda for youth was climate change (British Council, 2021). Similar were the findings for India. About 78 percent of Indian youth considered it important to act against issues arising from climate change like the loss of forest cover, decreased agriculture productivity, dry seasons, rises in temperature, uneven rainfall patterns and loss of biodiversity.

Overall, increasing societal expectations is a reality, they present a challenge to the policymakers and utilities to take proactive and transformative action. They also represent an opportunity to channel consumer aspirations into positive action.

Figure 7.4: Facts and Figures about Indian Consumer



Source: Internet Penetration Rate in 2021 (Basuroy, 2022); Delhi Air Quality Index 2021 (Agarwal, 2021); Indian youth against climate change (British Council, 2021); Get ready for a younger, more gender-balanced Lok Sabha, The Print (Tewari, 2019); Messaging App Revenue and Usage Statistics, BusinessofApps (Curry, 2022); Numbers tell the story of Ola vs Uber rivalry in India, Entrackr (Singh, 2020)

The increasing influence of millennials, and the generations that follow them, is having the most significant effect on customer expectations. Raised as digital natives, not only do millennials have starkly different expectations than customers of previous generations, but they can also imagine for themselves how technology can be used to improve their lives, making them much harder to surprise.

7.1.5 Cost of Inaction

Besides the present social and technological environment, the rising cost of inaction is a key driver for integrated planning. Inaction can result in loss or negative consequences for individuals, communities and the economy as a whole. These negative impacts can be financial, social, or environmental, but more generally would affect the quality of life. This section

focuses on identifying and measuring the cost of inaction in two areas – the quality of power and quality of air.

7.1.5.1 Quality of Power supply

The most witnessed power quality defects are interruptions, which may last for a few seconds or several hours, and voltage dips, where the voltage drops for a short duration and then comes back to the normal rate again (Pereira, 1998). Long power interruptions are inconvenient for all users of power, but many commercial and industrial operations are particularly sensitive to even very short interruptions.

Several studies have estimated and documented the high economic cost of power shortages, interruptions, and poor power quality. Due to the unavailability of good quality and uninterrupted power, demand, and usage of backup power such as diesel gen-sets have increased. It is estimated that two-thirds of rural and two-fifths of urban households face outages at least once a day (India Residential Energy Survey (CEEW, 2020)).

Total economic costs of unreliable and poor quality power in India were \$9.60 billion in 2009 (refer to Figure 7.5). Research also points to the fact that frequent momentary interruptions result in higher economic costs relative to less frequent but sustained interruptions.

briefly presented here. The survey findings suggest that households that use electricity are willing to pay 13.6 percent more. Households who seem to have legal connections have an 18.5 percent higher WTP. Each additional child of school-going age in a household increases the WTP by 4.3 percent whereas households who own home business are willing to pay 12.3 percent more than other households. For each additional benefit a household can identify, the WTP increases by almost INR 6.0.

Another study of 260 small-scale firms in the region around Hyderabad reveals similar results. These small-scale firms, which are crucial to India’s economic growth, are willing to pay approximately 20 percent more for an uninterrupted power supply (Ghosh, et al., 2017). Anecdotal evidence based on a dipstick survey conducted by RTI across five Indian cities shows similar findings. The majority of the citizens surveyed from Chandigarh, Lucknow and Noida have shown a willingness to pay more for improved quality of power.

7.1.5.2 Quality of Air

Air pollution is the world’s biggest environmental health threat, accounting for seven million deaths around the world every year. The estimated daily economic cost of air pollution has been figured at US\$ 8 billion, or 3 to 4 percent of the gross world product (Greenpeace, 2020).

Figure 7.5: Total Economic Costs of low Power Quality

Country	Cost	Price Year
Europe ¹	\$178 billion	2006
USA ²	\$188 billion	2001
India ³	\$9.60 billion	2009
Brazil ⁴	\$841 million	2010

Source: 1. PAN European LPQI power quality survey (Targosz & Manson, 2007), 2. The cost of power disturbances to industrial & digital economy companies, (Lineweber & McNulty, 2001) 3. Report on Power Quality of Electricity Supply to the Consumers (Forum of Regulators, Central Electricity Regulatory Commission, 2018). 4. Economic impacts of power electronics on electricity distribution systems (Duarte & Schaeffer, 2010).

A number of studies have demonstrated that the consumer (residential or commercial) is willing to pay for an improved and uninterrupted power supply. Studies also indicate that reliance on backup power, though expensive, is a quick and dirty alternative to limit the socio-economic impact. A survey by the Asian Development Bank on “Willingness to Pay for Good Quality, Uninterrupted Power Supply in the state of Madhya Pradesh” (2012) in India is illustrative and

According to the World Air Quality Report 2020, India is the 3rd most polluted country of the 106 countries ranked on air quality levels. The country had experienced the worst air quality in the region with 48 percent of its cities with PM2.5 concentrations greater than ten times the 2021 WHO air quality guideline.

India is home to 11 of the 15 most polluted cities in Central and South Asia in 2021. Delhi saw a

Figure 7.6: Negative Impacts of Air Pollution

Parameter	Impact	Cost
Absenteeism	~1.3 billion working days are lost p.a. due to absenteeism, amounting to an annual loss of USD ~6 bn	USD 6 bn
Presenteeism	Employees overwork to compensate for lost productivity, leading to burnout and attrition	USD 24 bn
Consumer footfall	Air pollution drives a 1.3 percent decrease in India’s consumer spending	USD 22 bn
Premature deaths	India had 1.7 million premature deaths from air pollution in 2019	USD 44 bn

Source: Air pollution and its impact on Business, Dalberg, 2021

14.6 percent increase in PM2.5 concentrations in 2021 with levels rising to 96.4 µg/m³ from 84 µg/m³ in 2020. It is also estimated that about 93 percent of India’s population lives in areas with high PM2.5 pollution levels, worse than even the lowest bracket of the WHO’s tightened air quality standards (PM2.5 exposure level of 5 micrograms/m³ from the previous level of 10 mg/m³). No cities in India met the WHO air quality guideline of 5 µg/m³.

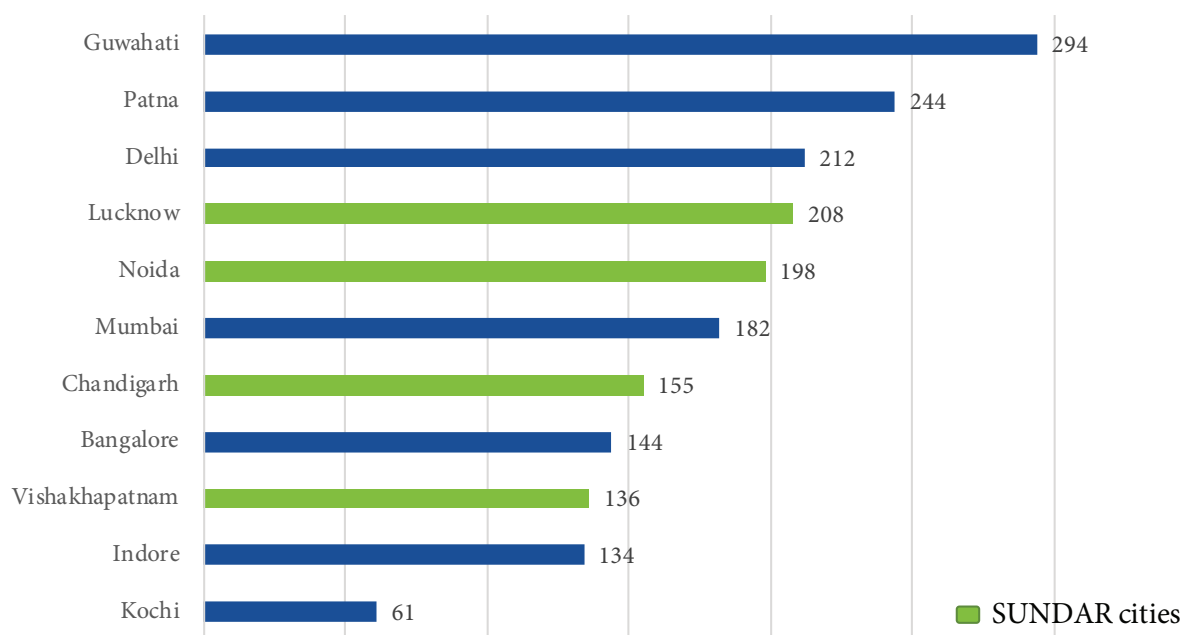
The economic cost of air pollution in India is estimated to exceed \$150 billion dollars annually (Roy, 2020). The social costs are even higher. Air pollution has reduced life expectancy in India by 1.5 years, higher than the reduction in life expectancy from all cancers (1.39 years) (Health Effects Institute, 2022). A recent report by Dalberg Advisers has measured economic costs in terms of absenteeism from work,

reduction in consumer footfall and premature deaths (refer to Figure 7.6).

AQI levels (recorded in March 2022) in most Indian cities are high, Guwahati at 294, Patna at 244, and Delhi at 212. Within SUNDAR cities, Vishakhapatnam and Chandigarh are under the Moderate (100-200 AQI) category, while Lucknow and Noida are at greater risk with AQI reaching 200 and above in the Poor (200-300 AQI) category (refer to Figure 7.7).

It is known that prolonged exposure to high levels of air pollution impact health severely, making air pollution a prime reason for premature deaths globally. SDG 3.9 seeks to “substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination” by 2030. According to a study by The Lancet, 1.67 million deaths were attributable to air pollution in India in

Figure 7.7: Comparison of AQI Levels across Indian Cities



Source: Real-time CPCB data, retrieved on March 17, 2022.

2019, accounting for 17.8 percent of the total deaths in the country. The increase in death and disease burden can have long-term societal implications with destructive consequences such as anxiety, dementia, missed work, criminal behaviour, and much more.

7.2 The National Context and Imperative

7.2.1 India has adopted Net Zero Target

India is the 4th largest emitter of CO₂ after China, the US, and the EU. The total emissions of CO₂ emissions were 2.6 Giga tonnes, with a per capita emission of 1.9 tonnes (Emissions Database for Global Atmospheric Research, (EC)) (refer to Figure 7.8).

draws its power from renewable sources, using efficient digital tools. In the span of two years, it has achieved savings of EUR 1.3 million in electricity costs and 1,00,000 tonnes of CO₂ emissions at the city level.

Cities, as owners, operators and consumers of infrastructure and utilities, have a significant influence on energy production and use. In some cases, municipalities are owners and operators of local utilities. As such, they can influence the energy mix and can automatically enroll residents in low-carbon schemes with an option to opt-out. In some countries, municipal energy companies are among the most important investors in renewable energy projects.

Figure 7.8: Total and per capita emissions of CO₂ in India (annual, 2019)



Note: EU includes the UK

Source: Emissions Database for Global Atmospheric Research, (EC)

India adopted a 2070 Net Zero target for the country. Further, India is committed to reducing the emissions intensity by 45 percent by 2030 along with a minimum share of 50 percent of energy from non-fossil fuels. The renewable energy targets are supported by an improving policy framework which enabled renewables share to increase to 21 percent between 1990 and 2018. Given this background, the transition to a lower carbon intensity economic growth must be initiated immediately, albeit at a differential paces for different sectors.

Cities need to take lead in this transformation. Such an approach will be consistent with the global experience. Worldwide, over 10,000 cities and local governments representing more than 900 million people have committed to combat climate change. As of May 2021, 708 cities joined UNFCCC’s “Race to Zero” campaign ahead of COP26. Cities joining the campaign have pledged to reach net-zero emissions by 2050.

Some cities that did not traditionally own local distribution utilities are beginning to create their own so they can accelerate the energy transition. Barcelona Energia was set up in 2018 and exclusively

7.2.2 Cities need to be Efficient Enablers of Economic Growth

Indian cities occupy only 3 percent of the country’s land but support 35 percent of the population and generate about two-thirds of the economic output. Cities will see an increasing influx which will need to be absorbed. Development and rebuilding of cities, creation of the infrastructure, and low-carbon transition can be leveraged to generate job opportunities.

To create jobs, a city needs to build an ecosystem that can attract new enterprises as well as enable the existing ones to grow in a sustainable fashion. Such an ecosystem should ensure the availability of high-quality infrastructure, including roads and railways, electricity supply, broadband network, water and sewer lines; accessible banking and trading facilities; favourable economic policies and legal processes etc., all of which are assessed by firms before setting up in a location. City-centric policies and programs like National Urban Policy Framework, Value Capture Finance, Smart Cities Initiative, AMRUT, JNNURM etc. have been institutionalized by Government of India initiatives but a lot more is required, particularly at the state and city level.

Going forward, management of urban land and transport- the two most critical drivers of city growth- will be crucial to make cities function as enablers of economic growth. It is critical to harness the synergy between land, transport and urban economics and spatial planning to avail of the opportunities unleashed by the Urban Revolution (Mohanty, 2019). Incorporating the economics of cities into the urban planning model is the need of the hour to promote sustainable and inclusive urban development.

7.3 Smaller and Citizen Friendly Cities

Cities and state governments need to reconsider and restructure their governance model to take advantage of the opportunities presented by demography and networks. PM Modi's mantra - reform, perform and transform- needs to be implemented in letter and spirit.

There are several studies and recommendations post the CAA that have proposed restructuring of urban governance and infrastructure delivery. For example, the National Commission on Urbanization in 1988 (The commission was appointed by the Government of India in 1986) suggested that Bombay, Calcutta, and Madras may be declared "national cities" given that they were the nerve centers of the country. In 1993, the Planning Commission (Annual Report 1992-93) recommended a special program for infrastructure development in mega cities. Some experts have suggested carving out large cities and transforming them into city-states or union territories. In most cases, the rationale for such recommendations has been the reluctance of the state governments to delegate and limited mandate provided to ULBs and related agencies to be able to effectively deliver on the expectations.

The technical and financial rationale, including convergence, digitization and capitalizing on economic opportunities has already been presented. These opportunities encompass a range of urban sectors beyond energy as well. Two additional arguments - one economic and the second related to citizen behaviour and expectations further merit consideration. These subjects are generally not well internalized in traditional urban planning and even states have limited expertise. It is, therefore, not surprising that they have been overlooked.

On the economic side, evidence suggests that all forms of organizations i.e., nations, cities, companies and even institutions, are subject to diseconomies of scale beyond a particular size. In a book by Geoffrey West (Scale: The Universal Laws of Growth, Innovation, Sustainability, and the Pace of Life in Organisms, Cities, Economies, and Companies, 2017), an academic at the Santa Fe

Institute articulates the case for smaller cities by noting that while there are certain benefits with size, negative externalities such as traffic congestion, pollution and poor responsiveness outweigh the benefits. The Mercer ranking (Cost of Living City Ranking, 2021) highlights that most of the top cities were relatively small and were located in smaller countries. Thus, the academic, as well as anecdotal evidence, points to the advantages of smaller cities with the delegation of power. This relates well to the Indian experience as well with cities such as Chandigarh, Indore, and Mysore ranking better than large metros on various parameters. In West's view "the bleak reality of corporate growth is that the efficiencies of scale are almost always outweighed by the burden of bureaucracy". Therefore, it makes sense to develop smaller greenfield cities with GIFT being an excellent example. Better performance of Chandigarh also illustrates the benefits. Even for larger cities, it makes sense to consider smaller but integrated ULBs with New Delhi Municipal Corporation (NDMC) being an example. Jamshedpur Utility Services Company Limited (JUSCO) is another example though it is privately owned.

E.F. Schumacher eloquently summarized the argument in his 1973 classic "Small is beautiful" by stating "Any intelligent fool can make things bigger, more complex and more violent. It takes a touch of genius- and a lot of courage- to move in the opposite direction".

The case for enhanced citizen engagement is well illustrated by Copenhagen. It demonstrates the potential and feasibility of transformational change within a generation by engaging the citizens. Copenhagen was a heavily polluted and congested city in the 1960s. It was designed and engineered to prioritize moving cars over people. Over the next three decades, the city transformed to consistently rank in the top 10 global cities. The 2017 Smart Cities Index which evaluates how well cities are prepared to face the future through integrated planning, ranked Copenhagen first among 500 cities (Easypark, 2017).

Copenhagen redesigned the city for its people and not cars. More than 60 percent of its population of about 0.6 million pedals every day to work and the city has state of art infrastructures such as dedicated lanes, bridges, exclusively for cyclists and special garages for parking the cycles. This transformation

was a conscious choice based on a realization of human behaviour. The redesign of the city was based on humanistic urban planning that put human interaction, building trust, reciprocity and enhancing spontaneity into everyday interactions. It was based on studies that showed more interactions take place when moving at 3-10 kmph (walking or cycling) than in a motorized vehicle. More interactions mean more trust that enhances the agglomeration effect. To enable all of this, the city provided structured incentives (dedicated lanes, bridges, parking etc. for bicycles) and penalties (high car prices, prohibition to park cars in the streets) through calibrated policies. An analysis by Fleming (Fleming, 2012) estimated that for each kilometer that a resident bicycled, society gained 4.8 Kroner (0.75 cents) from energy, health, insurance, and transportation costs. On the other hand, driving a car for one-kilometer costs over 10 cents. This was a transformative change with what is traditionally a cost, became a source of gain for the society.

The transformation of Copenhagen is a story (Breiding, 2019) of the right policies, responsive governance and most importantly putting people at the heart of urban planning, mobility, and environmental sustainability. It is also a story of collective effort and cohesion i.e., coming together for a shared future, where the community was the hero, rather than any one individual or institution.

7.4 The Scope for Integrating Utility Services in Indian Cities

The empowerment of ULBs and their autonomous functioning can enable greater convergence of services at the city level. The subsidiary status of municipal governments in India has inhibited cities from substantively seeking international collaborations or investments in improving municipal governance systems unless the relevant state government supports such initiatives. GIFT city in Gujarat is one such project which has benefited from the global worldview of its government.

The following three “stylized facts” provide a theoretical envelope for defining options for furthering convergence of utility planning and development and integrating utility management in Indian municipalities.

Stylized fact 1: Integrated functioning of municipal utilities will be key in achieving high efficiency and lower cost in the provision of utility services.

The efficiency of integration can be evidenced at multiple levels. First, integration reduces the cost of common functions like metering, billing, and collecting revenue across utilities. Second, utility integration breaks down silos and promotes joint rather than parallel decision making. Third, utility integration promotes joint planning thereby avoiding the cost of gaps, overlaps and disjointed capacity development.

Stylized fact 2: The available period for implementation of municipal reform is shortening.

As economies advance towards Net Zero, the pressure will mount on expanding renewable electricity use and storage, e-mobility, the replacement of private with public transport, enhancement of blue-green sinks for carbon capture and storage and “Green” planning and building standards and codes. This means that municipalities must graduate to being able to oversee utilities providing electricity, digital connectivity, and transport services alongside managing their traditional functions like drinking water supply and waste management.

Stylized fact 3: Barring a few metropolitan areas in India, inadequate financing constraints municipalities from playing a direct role in integrated utility management and provisioning of services.

Municipal budgets are considerably lower than the resources required to enhance access and improve the quality of services provided to acceptable standards. This means municipalities will either need additional grant support or they would have to borrow. There are two options:

First, ULBs could enlarge the volume of their “own revenues” by enlarging tax receipts (property tax) and non-tax collections from user charges and the monetization of land.

Second, ULBs could reduce their responsibilities and thereby their required normative budgets by divesting themselves of the functions which overlap with state governments and instead sharpening their focus on their core utilities and services, which relate closely to the territorial area and context of ULBs.

This is further elaborated in the next section in form of specific recommendations.



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"First life, then spaces, then buildings — the other way around never works."

– Jan Gehl

Source: unsplash.com

8 IMPLEMENTING INTEGRATED UTILITY SERVICES

Evidence from international and domestic experience suggests a strong case for the integration of utility services (electricity, digital, gas supply, water supply and public transport) at the municipal level. Such integration will enable higher efficiency, alignment between city planning and capital allocation and improved customer satisfaction.

At present, integration is constrained by fractured constitutional mandates which prioritize the central and state governments over ULBs. Further, institutional rigidities embedded in delivering municipal functions through state government parastatals or agencies limit flexibility, and responsiveness and lead to higher costs and poor outcomes.

In addition to the various drivers for integration presented in the previous section, investment optimization should also be a key consideration. India is a capital-scarce country and infrastructure investments require a significant upfront costs, typically fixed in nature. According to the National Infrastructure Pipeline, power and urban sectors are amongst the top three investment priorities. Power is on the top with an expected investment of INR 23.4 trillion (21% of the pipeline) while urban sectors require INR 19.2 trillion (17% of the pipeline), collectively comprising almost 40% of the pipeline. Integration of these sectors at the city level through integrated urban planning, therefore, offers opportunities to optimize, leapfrog and future these proof investments.

This section presents recommendations to enhance urban planning, infrastructure delivery and financing required for improving the quality of life in cities and towns. It is divided into two parts. The first half presents specific suggestions and recommendations to improve the functioning and delivery of municipal and utility services within the current framework. The second half explores three options for implementing enhanced urban planning and integration of utilities through the restructuring of existing mandates in various ways.

8.1 Specific Suggestions and Recommendations for Improving Urban Governance and Functioning of Urban Local Bodies

8.1.1 Reconstitute Urban Boundaries

The current definition of “urban areas” is not reflective of the actual level of urbanization in the country. Of

the 7,933 ‘urban’ settlements in India, about half are classified as census towns. Their share in the total urban population increased from 7.3 percent in 2001 to 14.4 percent in 2011. Despite being functionally urban, these towns are governed as ‘rural’ entities. Similarly, other urban areas such as outgrowths and other informal settlements, though seem like a continuation of the city, often lies outside the purview of city planning. The number of urban agglomerations has increased from 384 in 2001 to 475 in 2011, signifying a rapid rise in large expanses of contiguous urban areas. Using a rural development and governance framework often limits their access to policies, finances, and schemes available to urban areas.

Most of these settlements are expanding without any master plan to guide their growth and infrastructural investments. Consequences of such a haphazard growth are evident from urban sprawl, congestion and unhealthy living conditions in the outer limits of many urban and regional centers. There is a need to formally recognize and plan by internalizing the peri-urban areas and informal clusters into an integrated urban plan.

This can be achieved in multiple ways.

One option is to redefine “urban” by considering alternative definitions. However, such a process may encounter socio-political challenges and will be time-consuming. An alternative is to consider settlements around cities as a spectrum, instead of a binary categorization of rural and urban. Municipal boundaries can be reconsidered without the need for formal re-categorization as and when certain thresholds are encountered. A transparent and objective process could be implemented through consensus between the central and state governments.

Such reconsideration of the municipal boundaries will naturally consider the urban characteristics into account for identifying clusters. Satellite imagery, nightlight data, economic activity records along with base data on population and density can be used to identify the urban sprawl. Urban-like areas should be thus, identified and included within municipal jurisdiction, by expanding the jurisdiction of existing ULBs and by establishing new ULBs, wherever appropriate. Given the evidence of smaller being better, the latter approach may be better suited in most cases. Accordingly, it would be required to increase the capacity and financial resources of the ULB.

Making the urban planning process more dynamic in accommodating newer areas as and when required,



will enable a dynamic, flexible, and forward-looking planning process. A periodic review of the process and policies would be necessary to warrant this flexibility.

A common data platform to integrate data from various sources will be useful in providing easy access to data on shared infrastructure and utilities, ensuring interoperability of base maps of the cities and regions, etc. among various agencies.

8.1.2 Implement Land Reforms

The land is the most important asset class in all countries. Better economic efficiency in the use of land can yield significant gains in GDP. Currently, in most cities in India, the land is used inefficiently because of several reasons.

According to the 7th Schedule of the Constitution, the land is a state subject. Land acquisition, ownership and contracting are the biggest issues in city development. Disputes relating to land ownership account for nearly two-thirds of pending legal cases in India. The current state of maintaining land records (records of rights, sale or transfer deeds and spatial records) and land rights suffers from issues of data quality, the backlog of contested claims, and lack of integration/consistency across multiple departments. A few states have however taken noteworthy initiatives such as the Bhoomi-Kaveri Integration (Registration Department's Software) in Karnataka.

The Central Government in 2008 introduced the land record modernization program (DI-LRMP) to augment resources by computerizing land records, integrating

registration with the land records maintenance system, and integrating textual and spatial data. This was followed by the launch of the National Generic Document Registration System (NGDRS), in 2016 to link land records databases to financial institutions, revenue offices, income tax, the unique identification authority of India, etc. with an aim to bring a new level of transparency to land holdings. It has features to accommodate state-specific requirements, including a database of properties that are restricted for transfer. It has already been rolled out in 12 states and needs to expand to other states.

A key consideration is optimum utilization of land as an asset by making our cities expand vertically rather than horizontally. Cities must increase FSI and simultaneously invest in upgrading the carrying capacity of roads and infrastructure. This will require differentiating FSI for commercial and residential buildings, link FSI to land markets, and reflecting differences in FSI based on accessibility around transit nodes. The global best practice is that cities should have 30-40 percent of their land in streets and public spaces, and most of the remaining space in building footprints, i.e., the land beneath buildings. For instance, San Francisco has 61 percent of its land in building footprints and 36 percent in streets and public spaces (IDFC Institute, 2019).

Such a process of increasing FSI will mean more vertical development and therefore presents an opportunity as well as a need to redevelop and enhance infrastructure. Given the convergence, digitization and decarbonization mandate, it is possible to develop

underground utility networks and tunnels to reduce cost, improve safety, lower pollution, and mitigate some of the land availability constraint traditional faced by utilities. Such an approach will also be beneficial to overcoming the “NIMBY” syndrome and consequent citizen pressure, increasingly evident in cities and towns across the country. It is possible to constitute specialized agencies for such integrated development or alternatively bundle such redevelopment with an already planned large greenfield project, such as the construction of metro projects.

In addition, a publicly available database about an inventory of India’s total public lands (along with details of their use) could be the foundation for ascertaining the potential usage of land for providing amenities for the city. Since land is a state subject, this exercise could be undertaken by a public land commission set up by the state government which comprises independent members (retired judges, academics, planners) along with public officials.

Another possible intervention could be adopting form-based codes in all Indian cities, i.e., using physical drawings that specify the building form instead of written guidelines. This will give planners a better sense of how much land will be used in building footprints and public streets and open spaces. Further, form-based codes, with their predictable built form, will improve the ease of granting approvals for construction permits, thereby also improving the ease of doing business. Recently, Indian railways developed form-based codes for station redevelopment and regulating commercial development of railway land.

Last but not the least, the public land must be appropriately priced at market cost to objectively evaluate the full value and magnitude of its potential. Many public land transactions in the past have been conducted on a privately negotiated basis rather than at their market value (Gangopadhyay, 2016). Leasing land may prove to be a more attractive option since it ensures a revenue stream as opposed to a windfall gain to authorities from a sale. Optimizing the use of public lands that are currently unutilized or vacant could mean the construction of low-income housing or providing public open spaces and parks.

8.1.3 Citizens at the Centre of Planning

The need for citizen participation in urban planning has long been recognized. NITI Aayog advocated a “citizen outreach campaign” to make urban plans more accessible. “Dialogue between decision-makers and local inhabitants is a pre-requisite for sustainable urban development” (Enyedi, 2004). Over the years, the planning process has become technocratic making it difficult for citizens to comprehend and participate. It is important to demystify it to enable citizen participation.

Citizen participation is also important to achieving the Net Zero goal (IEA, 2021). It has been highlighted those direct behavioral changes could account for 4 percent of cumulative emission reductions, with 55 percent of emission reductions resulting from the adoption of technologies linked to consumer choices such as purchasing an EV, and retrofitting a house with energy-efficient technologies or installing a heat pump.



City: Lucknow
Source: GreenTree

There is a need to ensure enough publicity about the contents and expected outcomes of various projects among all the relevant stakeholders. Open data access is one such medium. This would not only ensure more active participation but also more informed decision-making. All technology-based platforms can be made accessible to citizens, without hampering their privacy.

Lastly, citizen participation can be taken to next level of citizen financing or crown funding of urban projects (elaborated later).

8.1.4 Digitize and Integrate

City investments that include a large ICT (information and communications technology) component can enable the designing of smarter cities that offer a better quality of life while being more sustainable and cost-efficient. It is not only the residents that stand to benefit; governments can meet their objectives faster and ICT players find new markets.

The linkages between urban form and ICT depend on multiple factors – local characteristics, priorities and needs of the citizens, national priorities and economic factors etc. Many applications of smart city technologies rely heavily on ICT. For instance, the access to information made available by Google Earth has already changed the approach to spatial design. Combined with tools like Google Street view, it allows planners and urban designers to easily move across scales. This information can help calibrate urban spaces and their attributes by understanding the footfalls, preference patterns, user reviews, calculating permeability of large territories, hydrological patterns, population shifts, density and even stimulating financial analysis.

ICT advantages within urban planning and management processes are especially relatable as maps, data and assessment models are increasingly a common heritage. Integration of sensors, web and wiki-based technologies with GIS applications is a fruitful way to improve the chances of constructive interaction between citizens and policymakers.

Further, IoT provides additional advantages by making passive objects dynamic, reactive and automatic in terms of sensing and response. IoT devices connect people, things and applications, which enable remote control and interactive integrated services. IoT's effect on Urban Planning and design is expected to revolutionize and change the way businesses, governments, and citizens interact with the physical world. The development of integrated networks enables such an approach in a cost-optimal manner while enhancing the utilization of assets and improving their operation and maintenance.

8.1.5 Build Capacity

Urban planning is the foundation of the integrated development of cities, citizens, and the environment. It has, however, not received adequate attention. One big challenge has been the lack of capacity – managerial, technical and financial. Significant capacity development for problem-solving, innovation and ideation is required to address the present and future challenges in the planning and management of cities, towns, villages and their infrastructure.

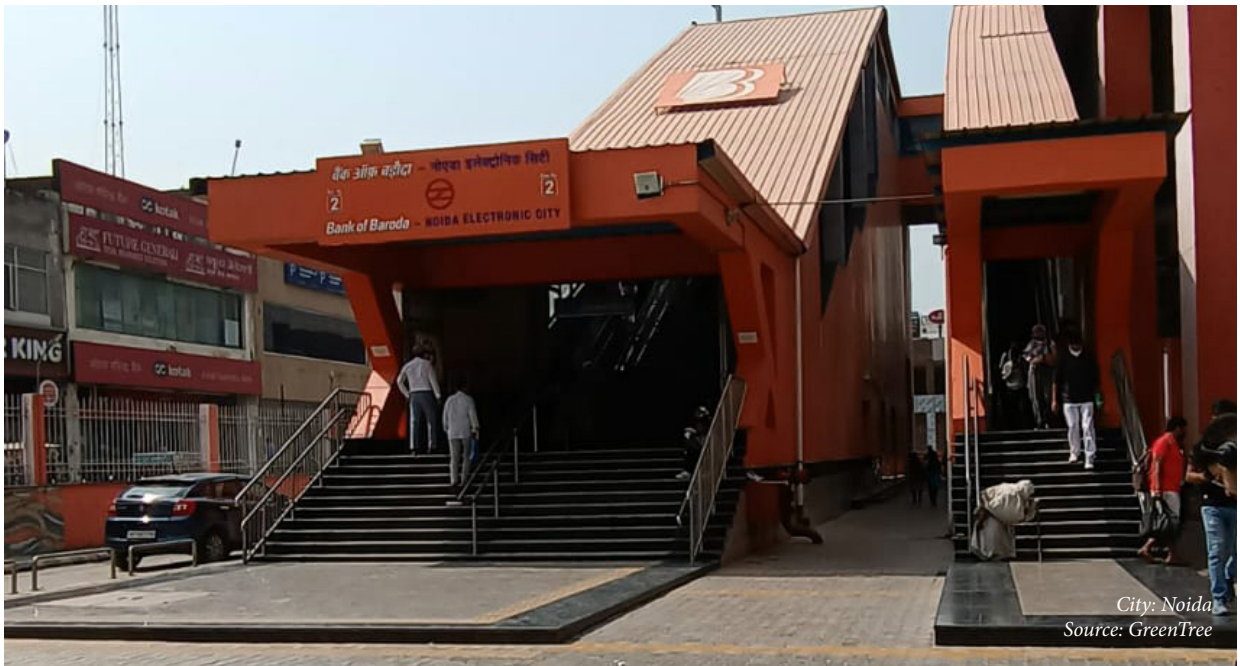
There is an inadequate number of urban planners in the state planning and the planning departments lack multi-disciplinary teams. In several states, a qualification in town planning is not even an essential criterion for such jobs. A study conducted by TCPO and NIUA indicates that over 12,000 posts for town planners are required in the State town and country planning departments. This is in stark contrast to the present situation. There are fewer than 4000 sanctioned positions for 'town planners' in these departments, half of which are lying vacant (NITI Aayog, 2021). Another data point from Janaagraha's Annual Survey of India's City-Systems report (2017) suggests the average staff vacancy in municipalities is as high as 35 percent. Mumbai has approximately 1,300 staff for every 1,00,000 citizens compared to New York with about 5,000 employees for every 1,00,000 citizens.

The quantity and quality of human resources are crucial to raising the urban planning capacity in the country. The States/UTs need to a) expedite the filling up of vacant positions, and b) additionally sanction 8268 town planners' posts as lateral entry positions as an interim mechanism (NITI Aayog, 2021).

Secondly, recruitment rules need to be revised at the state level to ensure the appointment of qualified officials. Introducing lateral entry can bring in talent and experience along with dynamic work culture in the municipalities.

Thirdly, the quality of existing employees can be improved by providing specific training in financial and risk management, organizational and administrative matters, design and implementation of projects etc.

Fourthly, concerted efforts are required by the States/UTs to ensure regular capacity building of the town planning staff. earmarking an appropriate budget is required, participation in capacity-building activities can be made mandatory, the performance of every participant needs to be objectively evaluated so that the results can be used as a criterion for their career progression and finally financial empowerment of ULBs can assist in resolving the problem of understaffing.



8.2 Specific Suggestions and Recommendations for Improving Functioning of Utilities and Delivery of Services

8.2.1 Adopt Net Zero

India's target date for achieving Net Zero is 2070. Additionally, it has set short-term goals of reaching a non-fossil fuel energy capacity of 500 GW, fulfilling 50 percent energy requirements via renewable energy, reducing CO₂ emissions by one million tons, and reducing carbon intensity below 45 percent by 2030. The challenges of a low-middle income developing country are different than developed economies. So would be the roadmap and approach towards Net-Zero.

Despite a low per capita emission and rapid increase in renewable capacity, the global Climate Action Tracker (CAT) rates India's 40 percent non-fossil fuel electricity capacity target as "critically insufficient" and its emissions intensity target as "highly insufficient." Therefore, the country will require to put in place a clear policy direction on energy choices that ensure energy availability to all, affordability for growth and green options for sustainability, and investment incentives for the energy transition.

A multi-dimensional and comprehensive roadmap at the decadal level to plan for the 2070 Net Zero target will be required. An empowered and multi-disciplinary agency at the national level with state and city level representation to implement the roadmap is suggested. Given their economic and carbon footprint, cities need

to be an integral part of the institutional framework. Further, urban planning and infrastructure delivery need to be the core of the energy transition given their critical role in enabling the transition.

Cities, as owners, operators and consumers of infrastructure and utilities, have a significant influence on energy production and use. Thus, cities will be expected to consider, adopt, and lead the transition to net-zero. Therefore, planning, supply and use of energy will emerge as a key consideration and determinant of urban planning. Innovative technologies (IoT) and behavior-driven instruments such as automatically enrolling residents in low-carbon schemes with an option to opt-out will need to be part of the package. This will be possible by closer integration of energy in urban planning and design.

8.2.2 Restructure Power Discoms

Power distribution continues to struggle with significant operational and financial inefficiencies. With few exceptions, the quality of power supply is below par in most cities and states and the scope of improvement is large. Further, the State-owned DISCOMs continue to lose money on every unit supplied and are usually not concerned about customer satisfaction. Key reasons include political interference, a large, centralized decision-making process and a heterogenous consumer base with varied expectations and willingness to pay. There is a strong case for a decentralized approach toward building service-oriented companies that are more manageable, politically distanced and have a robust business model.

While attempts at privatization have led to mixed results, a more nuanced approach based on the local context may be better. Such an approach can potentially include multiple smaller steps and involve diverse stakeholders. Local ownership by customers and local businesses will be consistent with India's drive towards enabling and encouraging micro and small businesses. This is very different from the traditional "privatization" where the winner takes types of big-bang divestment. Such an approach enables minimum disruption and, more importantly, enables local, ground-up solutions, with the active participation of stakeholders.

Delicensing in 1991, followed by reforms in the Electricity Act 2003 led to half the generation capacity being privately owned within three decades, without any big bang privatization. A similar transformation is required in the distribution. International experience suggests that Discoms in India are too big. For example, there are over 3000 distribution utilities in the United States. Smaller ones (municipal) serve 2,000 customers (median) and the larger ones (investor-owned) serves about 400,000 customers each. The network is a scale business and India's population is four times that of the US. Nevertheless, less than 100 distribution companies are too few and far. Their large size, customer base, and heterogeneity of terrain lead to inefficiencies, slow decision-making, and poor customer service. It is hardly surprising that employees disengage, and customers have a low willingness to pay.

Research and anecdotal evidence suggest that the optimum size for a distribution company may be much smaller. i.e., about 1.0-3.0 million customers. This corresponds to the population of an average district or a large metro in India, suggesting a strong case to resize distribution that can take management and decision-making closer to the customers, facilitate competition, and provide more granular data for regulators to benchmark performance. Smaller distribution entities will serve a more heterogeneous customer base, enhance ownership and engagement, and bring localization and continuity to their management. Furthermore, they will be easily approachable and accountable to their customers.

Therefore, the opportunity of transforming distribution businesses into demand-driven organizations, owned and operated by local stakeholders is necessary where local producers or wholesalers of electrical equipment or consumer durables could be the electricity services providers of tomorrow, creating "good jobs" and boosting local opportunities for medium and small-scale businesses.

Some transition support will be required to enable

such a transformation. Both, the Centre, and the States have previous experience through various power sector reform initiatives over the last three decades. Some of the potential support mechanisms that can be considered include a move to market-based power procurement, transition finance and commercial tariffs. Many of these initiatives are already under consideration because of wider sectoral gains.

8.2.3 Underground Infrastructure System for Integrating Energy and Urban Planning

Underground infrastructure systems are gaining popularity globally. Many countries, cities and even rural areas are shifting to the underground cable systems for more efficient, reliable, and safe distribution of electricity from substations to consumer premises. In addition to being aesthetically pleasing, underground systems are not affected by weather conditions or other environmental hazards. They also reduce the public hazard of electrocution. Such systems are more relevant in densely populated areas such as cities and towns.

Power distribution or metro rail or CGD networks can be focal points for developing integrated urban underground utility systems. India loses 4 percent of its GDP due to inefficiency in power distribution, ranking it 80th among 137 economies in terms of reliability of power supply (Economic Times, 2018). The T&D losses in India are one of the highest in the world at ~20 percent (Indulkar & Ramalingam, 2018). This makes a strong case for India to move toward an underground system for power distribution. The move can be graduated i.e., it can focus on cities and high loss areas and subsequently include other towns and peri-urban areas.

Although underground construction can be expensive, it has several advantages. A cost-benefit analysis considering financial and non-financial costs and benefits should be made to determine the case. On the cost side, underground distribution cable installation and final operation can be 4 to 10 times more expensive (Electrical Equipment). However, there are several benefits such as lower life cycle costs, lower maintenance costs, higher safety, lower pollution, less land availability constraint, etc. favor underground utility networks and tunnels (refer to Figure 8.1).

In the United States, for example, most new residential developments have an underground distribution network. In Québec, wire-free environments are becoming a feature of the urban landscape. More and more towns and cities are choosing to bury distribution lines in new neighbourhoods. Various studies document

Figure 8.1: Comparison of Underground and Overhead Cables

Parameters	Overhead	Underground
System cost	Low	High
Safety	Less Safe	More safe
Possibility of expansion	Easy	Difficult
Size of the conductor for the same capacity	Small	Large
Fault detection	Easy	Difficult
Suitability for long distances	Yes	No
Prominent line parameter	Inductance	Capacitance
Appearance	Non aesthetic	Aesthetic

Source: *Electrical India magazine, Electrical Distribution System: Overhead Vs Underground Cables (Nayak, 2020)*

that customers of utilities with a relatively larger share of underground line miles typically experienced less frequent and total minutes of power interruptions (Larsen, et al., 2016).

In India, too, some states and distribution utilities have begun to invest in underground networks. Maharashtra, for example, is carrying out INR 23 billion projects on underground cabling and strengthening power infra to benefit 120 million electricity consumers in urban areas (Times of India, 2021). West Bengal is planning to the ley underground cable system for power supply in 77 urban townships by 2025 (Millenium Post, 2018). Kolkata already has part of its network underground including a tunnel under the Hoogly. Likewise, Mumbai has had a part of its distribution network underground for a long time. Likewise, several colonies and areas in Delhi have underground network as it ensures reliable supply, reduces maintenance cost and losses. The GIFT City is a classic example of how utility corridors can help reduce post-construction costs of accessibility, inspection, maintenance, protection, and social costs. Although the high construction cost is an obstacle to promoting utility tunnels, post-construction cost savings make them an economic alternative solution considering the total lifecycle costs (Alaghbandrad & Hammad, 2018).

The overall beneficial case for the underground network has been formally acknowledged by the Ministry of Power and recorded as a recommendation of the Parliament's (Seventeenth Lok Sabha) Standing Committee on Energy. During the deliberations of the Committee, a formal statement by Secretary Power indicated that underground networks are ideal, though expensive. The Committee noted in its recommendation that underground networks are not only beneficial from an aesthetic standpoint but also a great help in checking pilferage of electricity. Further, according to the Ministry, higher costs were recovered within three years in the areas prone to pilferage. The Committee, therefore,

recommended that the Ministry should endeavor to lay underground cabling on a priority basis in the areas which are highly prone to losses.

8.3 Integrated Urban Planning And Utility Services

This section discusses and explores three institutional forms and redesign options that can be considered for implementing integrated urban planning and utility services.

Model-1 – Expand the mandate of Municipal Government and enhance institutional capacity: This model adheres to the classic principle of strengthening Municipal Government by enlarging the flow of resources to fully implement the existing constitutional provisions i.e., the 74th CAA. This is certainly the best option from a conceptual standpoint, but significant political economy constraints exist, particularly in shifting effective political power via devolution of administrative powers from the state to the ULBs.

Model-2 – Utility services integration by the state government-led metropolitan/region development authorities: This model builds on the existing trend of recognizing the existence and vitality of urban agglomerations and enhancing the role and powers of the state regional development authorities. The Bangalore Metropolitan Region Development Authority and the National Capital Region Planning Board were both constituted in 1985. The former integrates one of the largest Metropolitan Regions covering the entire Bangalore Urban, Bangalore Rural and Ramanagaram Districts measuring 8,005 sq. km with a population of 8.42 million (Census 2011). The National Capital Region (NCR) is a unique example of inter-state regional planning and development, covering the entire National Capital Territory of Delhi, fourteen districts of the State of Haryana, eight districts

of the State of Uttar Pradesh and two districts of the State of Rajasthan, with the Nation Capital as its core.

Another example is the Visakhapatnam Metropolitan Region Development Authority (VMRDA) which was created in 2018 by including the Greater Vishakhapatnam Municipal Corporation, the districts of Vishakhapatnam, Vizianagaram and two other municipalities and one Nagar panchayat. The trade-off is that MDCs are agencies of state governments that are not directly elected, thereby sidestepping the weakness of municipal management, and instead focusing on integrating development across state government executed functions like electricity, water supply and sewage, transport and land development.

Model-3 – Greenfield township development by the private sector with co-opted state government and citizen representation: Hybrid models could include non-state private partners for the provisioning of municipal services and development of residential and institutional housing and land development. Comprehensive models, where the entire management of utility services, is handed over to the private sector include the GIFT City in Gujarat and Jamshedpur in Jharkhand state. A comparable state government-led model is where Industrial Development Authorities are constituted to develop green field integrated townships that involve land acquisition and developing infrastructure facilities within the jurisdiction such as NOIDA.

A comparative analysis below in Figure 8.2 reveals significant variations. This qualitative assessment compares the three options on the six criteria and averages the scores on each to reflect an overall score of what is best implementable, given the political economy constraints.

The criterion of institutional change assigns ratings based on the complexity of specific legislative needs of each option. Metropolitan/Region management by state-led entities has been successfully implemented and therefore is well established. The private sector-led development model is less well established and depends entirely on consistent State Government support. It is also not a model which has been widely adopted. Consequently, the level of disruption is likely the highest from attempting to strengthen the municipal government and the least from continuing with the state agency-led metropolitan/regional model.

System-wide efficiency gains (defined as optimization of three impacts – (a) cost in terms of political capital spent to bring about change, (b) acceptability of the option by citizens and (c) the potential efficiency gain from improved public services) are the highest from the state agency led metropolitan development model, the lowest from a strengthening of the municipal government itself and are potentially moderate to high from the boutique opportunities available for private sector-led municipal management.

However, the context differs significantly across India and opportunities for all three models could emerge simultaneously depending on the interplay of political economy, local traditions, the level of satisfaction with the existing supply of municipal services, and the capacity of consumers to pay. Another key differentiator is in situ redevelopment versus greenfield development (best for private sector-led model where the capacity to pay is not a binding constraint).

The next section reviews the implementation steps and issues in each of the three models mentioned above.

Figure 8.2: Comparative Analysis of Implementation Impact of Options for Municipal Reform

Criteria	Strengthening elected Municipal Government	Integration through metropolitan/region development authorities	Greenfield development by the private sector with co-opted State and citizen representation
Institutional change required (Constitutional Amendment, Legislation)	Significant	Minimal	Moderate
Level of disruption	High	Low	Moderate
Level of local representation/ buy-in	High	Moderate	Low to
Quality of services	Moderate	Moderate	High
Self-financing capacity	Low	High	Moderate
Scaling up potential	Low	High	Moderate
Ease of implementation	Low	High	Low to Moderate
System wide efficiency gains	Low to Moderate	High	Moderate to High

Source: RTI India analysis

8.3.1 Model-I – Expand the mandate of Municipal Government and enhance institutional capacity

Under this approach, the focus is to overcome challenges faced by the Municipal Governments. Limitations about the capacity of municipalities to govern prudently, efficiently and effectively have been embedded into their institutional architecture. The power to tax, a basic attribute of autonomy, was never delegated in full measure to municipalities. Therefore, a significant effort to reform their institutional and organizational form will be required along with capacity development to raise their profile, functional ability and financial strength.

The Government of India Act, 1935 divided power (specifically tax-related) and concurrent powers to the Centre and the state governments. The Central legislation, however, prevails unless specifically approved by the President of India (who is expected to work on the advice of the Centre Government). There has been no change in the “fiscal limitations” of ULBs,

best illustrated by the fact that even the Constitution does not extend an inherent power to tax to ULBs, despite the 74th Amendment to the Constitution, 1992.

Figure 8.3 lists the key reforms needed for the empowerment of municipalities for becoming functionally autonomous, administratively effective, technically efficient and financially stable. It also assesses the possible willingness of state governments, in general, to agree to the changes envisaged in each case and the assessed probability of success in making the change. Further reforms include allowing the municipalities to make regulations on the subjects in the Twelfth Schedule without requiring state governments’ approval. This will require empowerment of mayors and councils, stability in tenure of mayors and shifting real decision-making authority to the elected municipal leadership. In a similar vein, empowering the ward committees, provided by the 74th CAA as a mechanism of participative municipal management, requires delegation by the state governments. Reports indicate that empowerment levels are low even where the ward

Figure 8.3: Matrix of Change Parameters

Objective	Proposed change	State Government support	Probability of Success
Fiscal autonomy	Separate Municipal Taxes list	Uncertain	Low to moderate
Additional fiscal flow from Union Government	Fiscal stability	Yes, as additionality if the state government’s share in the UFC formula is preserved	High
Financial autonomy	Power to appoint officials and use budgeted expenditure without prior approvals.	Possible if performance criteria are met and own revenue is satisfactory.	Medium to high
Political autonomy	Mayor’s term coterminous with Council term	Possible in select cases	Medium
Administrative autonomy	Power to issue regulations without state government approval	Possible in select cases	Medium
Administrative autonomy	Mayor to select and appoint CEO.	In some states	Medium
Participative democracy	Ward committees to be constituted with consultative and expenditure review powers	Yes	High
Objective	Proposed change	State Government support	Probability of Success
Creditworthiness	Own Revenue meets admin, salaries and wages, operational costs and interest.	Yes	Medium to High
Integration of utility services	Municipality co-owner of parastatals/PPP/SOEs managing utility services	Only if state governments are compensated in cash or for the transfer of assets.	Low to Medium

Source: RTI Analysis

committees have been constituted.

The institutional and legal framework will require the following modifications in order to enhance municipal autonomy. This will address the two big issues of insufficient municipal empowerment and lack of financial independence.

8.3.1.1 Seventy Fourth (74th) CAA and SFCs

What is needed: Institutional modification implies amending Part XI of the Constitution which defines the distribution of legislative powers (further amplified in the three lists in the Seventh Schedule of the Constitution of India, under Article 246). There has been a precedence to it when Article 246A was inserted to provide legislative competence to the Centre and the States to make laws with respect to GST. This was the most important operative provision for the implementation of GST.

Where is the gap: In contrast, the 74th CAA did not alter the provisions of Article 246, which is the only way to change the mandates and is linked to the taxation powers of the Centre and the State Governments. Instead, it inserted an amendment to the Part IX of the Constitution which provided for the establishment of municipalities and a Twelfth Schedule which lists the subjects state governments could devolve through legislation to the municipalities at their own discretion.

This arrangement took the decentralization reform agenda, one formal step further, without diluting the control of state governments over the municipalities. There is also no demonstrated appetite in the central or the state governments to support municipal autonomy by amending the constitution to provide for a separate list for municipal finances as was advocated by the

74th CAA. Consequently, municipalities lack a legal basis for demanding a defined share in the divisible pool of taxes at the central or the state level.

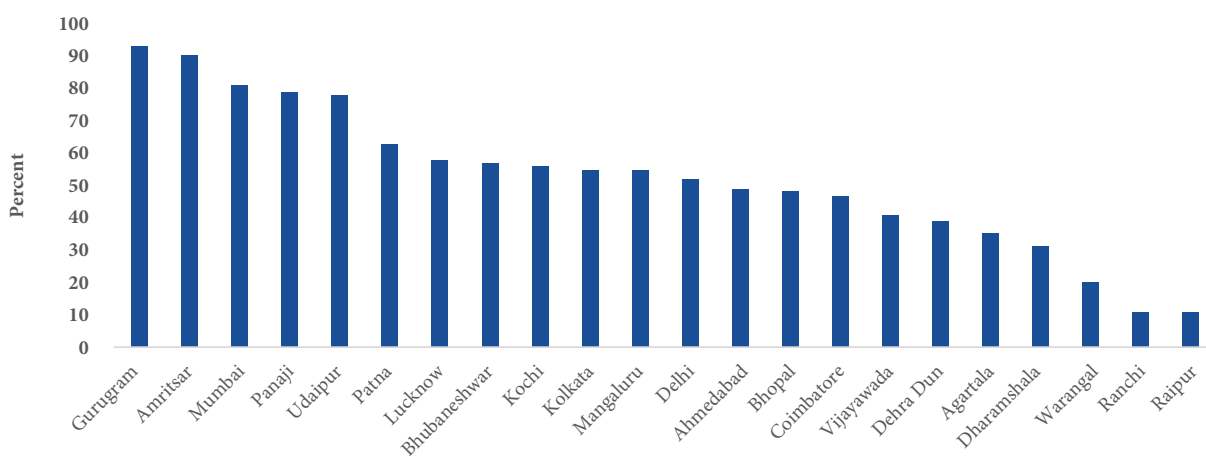
The next step: An institutional mechanism will be required to enable the municipalities to reach out to state governments to be empowered by making them financially and operationally autonomous. Being the last leg of the Government and closer to the community, their autonomy is important for improving and integrating service delivery.

8.3.1.2 Revenue enhancement in municipalities

What is needed: A strong fiscal position of municipalities can transform their operations and functioning, resulting in the delivery of better public services. The Reserve Bank of India (RBI) has also emphasized the need by arguing that “...*Going forward, increasing the financial autonomy of civic bodies, strengthening their governance structures and financially empowering them via higher resource availability, including through own resource generation is critical for their effective intervention at the grassroot level....*”.

Where is the gap: Poor financial autonomy has been a challenge due to a number of reasons. First, the institutional change of establishing SFCs every five years failed in making the desired impact. Most states have established SFCs, but their functioning varies. For example, only four states (Assam, Bihar, Punjab and Rajasthan) have appointed SFCs on time (XV Union FC 2021to 2025). The amounts recommended for devolution vary between 4 and 10 percent of state resources. However, the disbursements lag by as much as 15 to 20 percent, often because the municipalities fail to achieve the associated conditionalities.

Figure 8.4: Own Revenue to the Total Revenue of Indian Cities



Source: PRAYAS, Mumbai, 2021

Second, most of the ULBs have a low base of “own revenues”. As against the municipal revenue of Rs 4,624 per capita, own revenue was about Rs 1,975 (less than 50%) in 2018 (Ahluwalia, et al., 2019). The ratio of own revenue as a percentage of revenue expenditure remained stagnant at around 62 percent. In contrast, the increase in capital expenditure has been largely met by external grants (Shah, NIUA).

Property tax and the monetization of land are the two main options for enhancing own revenues. Figure 8.4 illustrates the potential is unevenly developed (PRAYAS, 2019). A survey of 29 municipalities revealed that only five had a share of more than 75 percent own revenue. Another seven had a share of more than 50 percent.

Third, the overall state of municipal finances restricts their capability to improve service delivery. Cross-country data on municipal revenue as a share of GDP reveals a large gap. Overall, municipal revenues as a proportion of GDP have been stagnant at around 1 percent of GDP since 2007-08, compared to Poland at

4.5 percent, South Africa (a federal country like India) at 6 percent, Brazil (a federal country) at 7.4 percent, the United Kingdom at 13.9 percent and Norway at 14.2 percent (OECD 2012). Despite the increase in the Center and State Government transfers, municipalities experienced a negative trend in their own revenue generation as shown in Figure 8.5.

Fourth, the aggregate data on municipal finances is not readily available in the public domain (after FY18). The central government presents an annual budget, a provisional annual estimate within six months and an audited statement within a year. Several states also follow a similar cycle. However, it appears that since the municipal expenditures are rolled into state expenditure, public disclosure is not made till three years later.

The next step: Enhancing municipal revenues to levels that are fiscally stable and enable municipalities to discharge their obligations per norms is the way forward. Buoyancy and elasticity of own revenue are essential to enable them to upgrade services for productivity, environment, and quality of life.

Figure 8.5: Municipal Finance Flows for 2010-11 and 2017-18

		2010-11	2017-18	
		Percentage of GDP	INR Billion	Percentage of GDP
A	Own revenue	0.48	733.3	0.43
A1	Tax	0.30	429.4	0.25
A1.1	Property Tax		255.5	0.15
A1.2	Other Tax		173.8	0.10
A2	Non-tax revenue	0.18	303.7	0.18
B	Central and state transfers	0.35	761.4	0.45
B1	Central transfers	0.07	205.7	0.12
B1.1	CFC		123.2	0.07
B1.2	Other transfers	0.04	82.2	0.05
B2	State transfers	0.28	555.7	0.33
C	Market borrowings	0.04	37.9	0.02
D	Other sources of finance	0.07	184.3	0.11
E=A+B+C+D Total Revenue		0.94	1716.9	1.00
F Total Expenditure		0.82	1325.5	0.78
F1	Revenue expenditure		781.9	0.46
F2	Capital expenditure		543.5	0.32
G	GSDP		170950.0	

Source: ICRIER, 'The state of municipal finances' (Ahluwalia, et al., 2018)

The evidence suggests that the largest upside for municipalities (especially Category 1 urban agglomerations) is to enhance their own revenues through property tax reform and monetization of land assets. For example, changes in the property tax base, full documentation of properties and better collection can potentially double the tax base from 0.25 percent of GSDP (2017-18) to 0.5 percent of GSDP. One way to do this is by broadening the base, and improving assessment and land records through the use of technology. Bruhat Bengaluru Mahanagar Palike (BBMP), for instance, has undertaken a series of reforms that included using GIS to map all properties, setting up a self-assessment system for valuing properties, spreading awareness of the system, and instituting random checks and strong enforcement mechanisms (Ahluwalia, 2014).

Another way to increase own revenues is through the VCF tools (such as ToD, impact fee, land tax, betterment levy, etc.). It is based on the principle that private land and buildings benefit from public investments in infrastructure and policy decisions of Governments such as change of land use or FSI. Appropriate VCF tools can be deployed to capture a part of the increment in the value of land and buildings, that can be used to fund projects being set up for the public by the Central/State Governments and ULBs.

In addition, setting up municipal financial management systems, which work on the same time scale as state and union finances will enable them to publish their data independently as do the state and union governments. This is an urgent reform that could have far-reaching implications for bringing about greater efficiency in municipal accounting systems. It will also enable municipalities to raise financing from capital markets, particularly through instruments such as bonds.

Lastly, crowdfunding opportunities can also enhance civic participation in cities. For instance, in the Netherlands, Rotterdam was able to build a 400-meter-long pedestrian bridge that reconnected three districts in the heart of Rotterdam, primarily with the residents' contributions. A crowd-funding campaign 'I Make Rotterdam' was started; for €25 anyone could buy a board inscribed with their name, and over 8000 such boards were sold. Another example is the SunExchange in South Africa, which is a "peer-to-peer solar leasing platform". It crowdfunds the capital cost of solar rooftop investments in schools and other buildings, allowing an investor to purchase a solar cell for as little as USD 5.

8.3.1.3 Rejig roles and responsibilities between State and ULBs

The "principle of subsidiarity" states that decisions should be made by the entity best suited to implement them. In other words, decision-making should be delegated, and decisions are taken as near as possible to the grassroots. Hence, it is proposed to reorganize the roles and responsibilities of the State Government and the municipalities. The proposed changes include:

- a. For all municipalities, the addition of functions relating to the registration of marriages, and those relating to electricity distribution (including enabling and supporting decentralized renewable energy projects and energy efficiency) and public transport (only for larger municipalities) demonstrate fiscal capacity and meet prescribed performance benchmarks on governance and public financial management.
- b. To lighten the fiscal and administrative burden transfer back certain functions (mandates 3, 8, to 10 and a portion of mandate 4), to the state governments.

The rationale for suggested transfers from municipality list to state list

The rationale for proposed changes is described below, starting with a justification of functions to be deleted and followed by those proposed to be added.

- a. Planning for social and economic development i.e., Mandate 3, encompasses a range of programs that are beyond the scope of municipalities, as is the case with Mandate 11 for urban poverty alleviation. The slow development of public service facilities in rural areas - a key state government function - is the root cause of much of urban poverty. This problem cannot be solved only by municipalities (refer to Figure 8.6).
- b. Safeguarding the interests of the weaker sections of society and others (Mandate 9) with special needs through welfare schemes cannot be divisible across municipal borders and needs to be embedded in a state-wide or even a nationwide policy and programs.
- c. In a similar vein, a portion of Mandate 4, that is for the construction of expressways and arterial roads, involves high-cost interventions, which are best managed by the state government, except in the case of well-managed and big metropolitan areas. Such metros could potentially elect to manage these services themselves based on demonstrated capability. However, these will be an exception and not the norm. One example of large-scale land development driven by aggressive road development is the Outer Ring Road in Hyderabad.

Figure 8.6: Suggested Transfer of Responsibilities

Municipality list → State list	State list → Municipality list
Mandate 3: Planning for economic and social development	Registration of marriage
Mandate 4: Roads and bridges (Transfer expressways, arterial and sub-arterial roads)	
Mandate 8: Urban forestry, protection of environment and promotion of ecological aspects	Public transport (Selected municipalities)
Mandate 9: Safeguarding the interests of the weaker sections of society	Electricity supply (Selected municipalities)
Mandate 11: Urban poverty alleviation	

Hyderabad constituted a Special Purpose Vehicle (SPV) for the development of the Outer Ring Road, called the “Hyderabad Growth Corridor Limited” (HGCL), under the Companies Act 1956 on 26th December 2005, with 40 percent equity participation from INCAP (Infrastructure Corporation of Andhra Pradesh) which performs multiple roles of a developer, advisory, financier and manager to render a full range of services in every phase of project development, and 60 percent equity from the Union Government-owned Housing and Urban Development Authority in 2005. The project was ambitious and sought to relieve congestion on the existing ring road and to pull in additional land for development by constructing a 158 km long eight-lane expressway or outer ring road around 3000 sq km of Outer Hyderabad linked by radial roads to Hyderabad. Clearly, Hyderabad being a capital city, the implicit guarantee of state government entities was used to pull in the debt financing. This is an effective model. But it does nothing to transfer ownership of local transport from the state to the municipality.

This is the reason for proposing that the responsibility for developing and maintaining expressways and arterial roads must vest with the state government because of scale effects. The municipality must however provide the feeder service roads and the public mobility services (city buses) to retain its connection with the population and to establish its credentials for levying tax on benefits accruing to residents via property tax.

- d. Urban forestry and interventions to preserve the ecology or the environment i.e., Mandate 8, has regional implications (case of rice stubble burning in Haryana and Punjab causing pollution in Delhi) as does pollution of waterways and rivers and consequently fit best within the domain of state or regional management.

How to implement: A proposal to reorganize responsibilities between State and ULBs will require a legislative change. This can be executed by each state by amending the relevant state-level Acts through which these mandates were transferred to the ULBs, in compliance with the 74th CAA.

The rationale for suggested transfers from the state list to municipality list

- a. Registration of marriages: Municipalities record births and deaths, while registration of marriages is done by the state government even in municipalities. This works against the rationale of integrating demographic data. Birth data, in most cases, is linked to marriage data. Both functions relate to the maintenance of local demographic data and identity certification. This function could be usefully integrated with municipalities simply by authorising the municipality as an agent to perform this function for state governments. Municipalities could appoint special magistrates (who could even be retired judicial officers) under the relevant Marriage Acts.
- b. Electricity supply in large municipalities: Municipalities are large consumers of electricity as they provide street lighting to keep the city functional 24X7. More importantly, stability in the supply of electricity is a significant input into well-being and economic value addition. So, it is more like backward integration by a large consumer in much the same way as industries set up captive generating capacity earlier when power was scarce to protect their access and the quality of supply.

In the early decades, Municipalities used to provide electricity supply. In the US and other developed countries, many municipalities continue to do so. In India, the subject was transferred in 1935 to the provincial governments, because electrification was required to be extended to the rural areas and there was a perceived lack of financing, expertise, and technical sophistication for this massive expansion. In recent times, the concept of scale effects has

changed with distributed renewable electricity and battery storage. In developed countries, it is usually the exception, and not the rule, that government utilities supply electricity. In India too, privatization of the distribution segment of electricity supply in Delhi, Mumbai, Kolkata, Ahmedabad, Surat, Greater Noida, GIFT City, and Indore has provided significant economic gains. Efficiency and supply quality indicators are better in urban areas, particularly those supplied by smaller private utilities if compared on a like-to-like basis.

Further, the issue of capital-intensive nature is more relevant for expanding the generation and that too for large thermal power stations. India now has a rapidly developing power market and surplus generation capacity. All of this means that ULBs themselves do not need to generate their own power. They can buy power either from the power market or individual generators. ULBs do not even have to distribute on their own. They can either privatize the function completely or choose to own a minor share in the distribution utility. In the future, as “open access”, is implemented more rigorously, retail supply companies will likely proliferate, each with their own special offerings and expertise in catering to the wholistic (cost of supply, quality of supply, time of supply, the composition of supply – RE or part fossil fuel-based) needs of a special class of customers. This will enable customers to buy electricity from apps, similar to buying daily needs.

How to implement:

Electricity, being the lifeblood of cities, the responsibility of power distribution can be delivered through small, local companies, partially owned and operated by the municipalities. Transfer of such mandate will require state-level schemes to be implemented to restructure the distribution companies owned by the state. It is pertinent that a few municipalities, such as the New Delhi Municipal Corporation (NDMC) already own and operate power distribution. Likewise, BEST in Mumbai is another example of an existing municipal body delivering power distribution in a concentrated geographical area.

Public transport in large municipalities:

The provision of efficient public transport has been a constraint in most cities. Only 20 out of 85 cities with a population exceeding 0.5 million have a city bus service (MoUD, 2008). Public transport in India accounts for 22 percent of the total versus 48 percent in lower-middle-income countries and 40 percent in upper-middle-income countries. Looking at the rising levels of road congestion and air pollution, it is time that public transport is integrated and becomes the primary facilitator of mobility in urban areas.

The falling share of public transport can also be attributed to the road tax policy (a state government tax) which favours personal vehicles versus buses. An analysis by the Centre for Science and Environment (2009) estimated that the road tax on a bus was much higher than the tax on a car (priced at Rs 0.4 million). It was 11.8x for Lucknow, 25.7x for Delhi, 4.5x for Bangalore and 4.4x in Ahmedabad. Since personal cars add disproportionately to road congestion and carbon emissions, the policy needs a 180 change from subsidizing personal transport to a congestion tax on personal cars. Such a move will be incentivizing public transport by making it competitive and also provide revenues for its expansion.

Currently, the big gaps in public transport are its ease of access and last-mile connectivity. It is closely linked with the planning and design of the city. High-rise developments in close proximity to well-designed transport corridor is an attractive proposition for urban dwellers owing to the immediate access to public transport in varied directions. Such efforts can increase the uptake of public transport and solve the issues of its economic sustainability. Municipalities, with the core function of urban planning, are in a better position to integrate public transport into city design and realize efficiency gains.

How to implement:

First, the financial viability of operations is important. Municipalities can enable and develop a partnership with private players to make the provision of public transport economically viable. Cities like Surat and Indore are successful examples of the same. It may however require institutional restructuring. In most cities, multiple organizations engage in different segments of transport management or regulation. While the Development Authorities, the State Road Transport Authorities and the Police regulate various aspects of mobility, Public Works Departments regulate the building standards, execute road projects (mostly through private contractors) etc., and State Road Transport Corporations manage the fleet of buses and provide public transport services. Such a silo-based-functioning system often lacks seamless coordination and results in inefficiencies. Bangalore, for example, restructured overlapping jurisdiction and mandate gaps by establishing the Urban Metropolitan Land Transport Authority which is headed by the Chief Secretary of Karnataka. It was set up through an executive order in 2007 to act as a platform for coordination between the state government authorities dealing with land transport in Bangalore. Further institutional changes to integrate transport services and planning into the architecture of the Municipal Corporation of Bangalore are yet to be done.

Financing the change

There are multiple ways to innovatively finance the challenge of developing power infrastructure and

public transport in cities. In addition to the traditional sources, climate financing is emerging as one of the most relevant ones given the possibility to develop smaller decentralized sources of energy within cities. These include rooftop solar, small wind, demand response, electric vehicles and other storage as a resource to supplement traditional power plants.

Climate-positive investments in the 2020s was roughly equivalent to 2 percent of the global GDP (USD 1.83 trillion annually). The C40 Cities Finance Facility (CFF), funded by the German, UK and US governments, facilitates access to finance for climate change mitigation and resilience projects in urban areas. It provides technical assistance to transform cities' sustainability priorities into bankable investment proposals. The CFF aims to deliver project preparation and capacity development, share knowledge widely and establish partnerships between city authorities and financiers.

Green bonds are becoming an attractive instrument for financing low-carbon projects. The appetite for green bonds is growing as numbers of public and private funds, including pension funds, are encouraged to invest in climate-friendly projects. In 2013 the city of Gothenburg, Sweden, was the first city in the world to issue green bonds. It raised a total of USD 500 million (SEK 4.36 billion) in four years and funded projects including district heating systems, EVs and a biogas project. Mexico City has issued three bonds, one in each 2016, 2017 and 2018, each for USD 100 million (MXN 2 billion), which were used for sustainable and climate actions in clean transport, green buildings, energy efficiency and renewable energy.

Thus, multiple options exist which can be explored by different cities based on their needs and particular circumstances. A key intermediate step is to improve revenues and credit rating of the municipalities to ensure the availability of a full suite of options at their disposal.

8.3.2 Utility Services Integration by State Government Led Metropolitan/Region Development Authorities

State Government-led direct investment in infrastructure and municipal services has been a feature of the division of work between the Municipalities and the State Government since the late 1970s. This was being done by setting up Infrastructure Development Authorities or Boards. These authorities and boards have been somewhat successful in integrating utilities with urban planning. Some of the noteworthy examples (NCRPB and BMRDA) are briefly presented below.

Further, the State Governments have been active in directly financing industrial development and in providing infrastructure for industrial development

through plug-and-play industrial parks since the 1950s. For example, twenty-eight State Industrial Development Corporations are in existence under the Companies Act, 1956, as wholly owned state government undertakings for the promotion and development of medium and large industries. In addition to the provision of financial assistance, they develop industrial estates, and industrial parks on their own or in collaboration with the private sector. Likewise, ten State Industrial Infrastructure and Investment Corporations have been set up under the Companies Act in the States of Andhra Pradesh, Gujarat, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh, Delhi, and Goa.

Infrastructure projects undertaken by these corporations include developing industrial growth centers, export promotion zones, software parks, industrial townships, industrial parks, as also industrial estates.

Another strategy adopted is the policy of devolving sovereign powers related to urban planning and development for a specified contiguous area to a state government entity created for the special purpose of building industrial townships. The rationale is to accelerate infrastructure development. The case of the Noida is illustrative and is also briefly presented below.

8.3.2.1 National Capital Regional Planning Board (NCRPB)

In 1985, the NCRPB was constituted through an Act of the Parliament, based on resolutions of the participating states i.e., Haryana, Uttar Pradesh, Rajasthan, and the then Union Territory of Delhi as a single, high-level planning agency. It had a population of over 46 million (2015-16) with an urbanization level of 62.6 percent. Its jurisdiction spans 24 districts in the three neighboring states around the National Capital Territory of Delhi.

The Board formulates (a) policies in relation to land use and the allocation of land for different uses; (b) proposals for major urban settlement patterns; (c) proposals for providing a suitable economic base for future growth; (d) proposals regarding transport and communications including railways and arterial roads serving the National Capital Region; (e) proposals for the supply of drinking water and for drainage; (f) identifies the areas which require immediate development as "priority areas". It exercises autonomous control over all land and urban development planning decisions, exercises supervision to ensure that sub-regional plans are aligned with the regional priorities and develops and finances regional projects. It is managed by a Board, chaired by the union minister for urban development with ministerial representation from each of the participating states.

8.3.2.2 Bangalore Metropolitan Region Development Authority (BMRDA)

In 1985, BMRDA was created through state level legislation. BMRDA is chaired by the Chief Minister with representations of state level urban development and utility services-related departments and representation of the Indian Railways and Bangalore Telephones (both Union government entities).

The BMRDA is entrusted with planning for the entire Bangalore Urban, Bangalore Rural and Ramanagaram districts measuring 8,005 sq. km, with a population of 8.42 million (Census 2011). It can also execute works and schemes to implement the plan, coordinate the execution of the town planning schemes, raise finance for any project or scheme and extend assistance to the local authorities in the region for the execution of such projects. Further, it can entrust any Local Authority with the execution of any development plan, project or town planning scheme and coordinate the activities of various departments connected with developmental activities in the Bangalore Metropolitan Region.

8.3.2.3 New Okhla Industrial Development Authority (Noida)

Noida covers an area of around 1440 sq. km and hosts a population of around 0.7 million (2011). It is Uttar Pradesh's most valuable urban real estate and enjoys a relatively better quality of public services, including a metro service and easy access to Delhi. The legal and constitutional authority was transferred to the state government-controlled administration under Section 12A of the UP Industrial Area Development Act, 1976. The Authority was empowered in multiple ways.

- a. Section 6A empowers "The Authority" to authorize a person to provide infrastructure or amenities and collect taxes or fees.
- b. Section 11 (1) provides the Authority may, with the previous approval of the State Government, levy such taxes on transfer or occupation of any building or site, as it considers necessary, provided that the total incidence of such tax shall not exceed one percent of the market value of such site, including the site of the building.
- c. Section 7 empowers it to sell, lease or otherwise transfer whether by auction, allotment or otherwise any land or building belonging to the Authority in the industrial development area, on such terms and conditions as it may, subject to any rules that may be made under the Act.

- d. Section 8 empowers the Authority to issue directions in respect of the erection of the building.
- e. Section 9 bans the erection of buildings in contravention of regulations.

With these wide-ranging powers, such an authority can be fiscally independent, and administratively autonomous of elected representatives. Both the Vice-Chair and CEO are usually state government officials from the cadre of the administrative service.

Noida has an adjoining sister authority in Greater Noida which was constituted in January 1991 with a notified area of 380 sq. km comprising 124 villages of which just 13 percent has been urbanized. The targeted final population is 1.2 million. The quality of services is better than in other cities in the state though the density of population remains low. Noida has proposed several new and innovative projects to upgrade its infrastructure with the view of improving the quality of services in the city.

One such example is the Yamuna Expressway from Greater Noida to Agra, which will connect it to the Noida International Greenfield Airport - an international airport being constructed near the town of Jewar, Uttar Pradesh. The airport aims to grow into the country's largest airport. An eight-lane, 25 km-long expressway connects Greater Noida directly to Delhi. A dedicated metro line connects it to the Delhi metro system. Power distribution is privatized in some parts. In a nutshell, this model of urban development and governance has several pros and cons, as presented in Figure 8.7.

This model can be said to have been tried and tested. It can be expanded to cover larger metros and peri-urban areas. Additionally, the powers and functions of the authorities must be commensurate and aligned to forward looking challenges such as job creation and climate change.

8.3.3 Hybrid Model – Greenfield Township Development by Private Sector with State Government and Citizen Representation

Greenfield township development in India has generally been led by the State Government. GIFT City is a noteworthy example. In colonial times, the cities of Madras (now Chennai), Calcutta (Kolkata) and Bombay (now Mumbai) were all established through specific legislation. One exception to this rule is the city of Jamshedpur in the State of Bihar (now Jharkhand).

8.3.3.1 Jamshedpur

Jamshedpur is an exceptional example of a privately managed city in terms of service delivery and quality

Figure 8.7: Pros and Cons of Metropolitan/ Regional Authorities Providing Municipal Utility Services

S. No	Advantages	Disadvantages
1	State-led municipal development has the advantage of ensuring a sufficient volume of resources, including grant funds and monetization of land, to fund infrastructure development at scale.	Direct citizen participation in the management of the Authorities is limited in the absence of elections to choose the Ward Committee members and Council members.
2	The absence of political economy constraints facilitates the levy of fees, penalties, and corrective action where necessary for ensuring compliance with building regulations and the maintenance of utility services.	In the absence of a direct local relationship between citizens and the Administrators, local feedback loops are missing. Citizens use back channels (Member of the Legislative Assembly or Member of Parliament acting as intermediaries of citizens) to bring political pressure to bear on authorities for grievance redressal.
3	The relative absence of political economy constraints also allows for efficient contracting out of development and maintenance services.	New models for direct citizen engagement and participation must be envisaged and implemented,
4	Scaling up of services is easier given that the funding is less of a constraint.	The levers of effective control pass inevitably to the State Government which is deleterious for local initiative, innovation and inclusiveness.
5	Utility integration in planning and implementation becomes simpler as inter-departmental coordination mechanisms are including informal mediation from the government.	State appointed administrators are routinely transferred, breaking continuity. Also, external Administrators may not reflect the ethos and culture of the City and have a less than empathetic understanding of the local issues.

of life. Jamshedpur Notified Area Committee (JNAC) was formed through a State Government notification in June 1924. Since its inception, the President and the Vice President of the committee were from TISCO (formerly the Tata Iron and Steel Company) or other private companies, vested with effective executive power. Jamshedpur Utilities and Services Co., or JUSCO, a subsidiary of Tata Steel Ltd was responsible for providing the township with utility services and amenities - road, power, water, sewage, and solid waste management, spread over almost 14,500 acres. By all accounts, it has done a satisfactory job of providing these amenities. The company however incurs a significant annual loss of INR 2.5 billion to keep the user charges low as part of its corporate social responsibility (Government of Jharkhand).

Of the 0.7 million residents in the city, TISCO claims more than 0.2 million are employed with the company or have permanently settled. With enhanced democratization, there was pressure on the state government to transition the city to an elected municipality. At least three attempts have been made to create a civic body in Jamshedpur, the first dating back to 1967. Faced with resistance from TISCO, the state gave up the idea in 1973. Following public interest litigation (in 1988) notification was issued by the Bihar government in 1990 for the creation of a civic body for Jamshedpur. But further action was

stalled because of the strong resistance from TISCO and the sense of satisfaction amongst residents with the level of municipal services. The third attempt was made in December 2005, when the state government of Jharkhand issued another notification expressing its intention to turn Jamshedpur into a municipality.

The legal battle to revert the City to citizen-led management continues. One option could be to convert it into an industrial development authority with dual representation from Tata Steel and citizens. But there is little support from the resident employees for changing the status quo. They are cautious that the town may turn into another Adityapur – an adjacent civic body recently put under elected representatives and Jugsalai or Mango, adjacent civic bodies still managed by the government officials. While Jamshedpur has almost zero outages, industries and factories in Adityapur have to often operate on backup power. Vendors of Tata Motors Ltd based in Adityapur had run their factories on diesel to meet delivery commitments. Since JUSCO's entry into Adityapur as the second power utility, people are switching from the state-owned distributor to a private Discom (Mint, 2018).

It is uncertain how long Jamshedpur can withstand the introduction of democratization in the management of the city. But the fact that Jamshedpur has flourished over the past century and still provides a competitive quality of life is an inspiration for sustainable private

management of civic bodies – albeit it remains the sole example of a thriving, privately managed, mid-size city. It is the most successful private investment-led township development, creating both the demand and the supply of a township that sustains the economic engine of the Tata Steel plant and its ancillary industries.

8.3.3.2 Gujarat International Finance Tec-City (GIFT City)

The GIFT City project was originally a joint venture between the Gujarat Urban Development Company Ltd and Infrastructure Leasing and Financial Services Ltd (IL&FS). Of the 886 acres of land on which the GIFT City is being developed, 261 acres are for an SEZ and the remaining 625 acres are for the domestic tariff area. The SEZ has the International Financial Services Centre (IFSC), international exchanges and banking units while the domestic tariff area comprises hotels, the Jamnabai Narsee School and towers housing various offices.

Now that GIFT has become a wholly owned corporation of the Gujarat Government, it probably fits into the classification of a state financial and investment development corporation- albeit targeted at attracting foreign investments, financial services and banks to India. GIFT city in Gujarat seeks to emulate a similar model of both creating an economic engine – the International Financial Centre – and the associated supply of township services around it. The strong commitment of the Government of Gujarat and the Government of India to stick to the course will likely help in eventually making the project a success.

8.3.3.3 Gurugram

Another example with somewhat mixed mandate and outcomes is Gurugram in the National Capital Region. This is a variation of the GIFT model as an alternative and hybrid approach where large-scale private investment in residential colonies and commercial complexes was combined with lagging state investments in infrastructure development and municipal management. The revenue model was better

because it responded to an unmet need for additional development, in response to the rapid economic and population growth around Delhi. Further, the scarcity of land in Delhi due to regulatory constraints in the land market led to artificially high land prices for the new development. However, the results have been mixed. While many excellent societies and private infrastructure were developed, the arterial and main roads, power network and water and sanitation lagged. The citizens had to rely on private solutions for a long time and these gaps were addressed over a period.

This approach i.e., hybrid model, is particularly appealing for greenfield development or large-scale redevelopment projects. The advantages are obvious. It enables efficiencies through integration, improves customer interface by creating manageable size and ensures financial viability by creating a responsive organizational and corporate structure.

8.4 Conclusion

To sum-up, it is sufficient to recognize that different options exist. Most have been tried though at a limited scale and in special settings. The evidence from this research points to significant upside potential in learning from these experiences and scaling up the effort to integrate infrastructure (electricity, transport, water, IT, telecom etc.) more systematically in urban planning and delivery of services. Such an approach will enable higher efficiencies, improved quality of life and transition to clean energy.

Since states and cities have varying needs, different options can be exercised, depending on the scale of the initial capacity deficit and the contextual, best-fit from the political economy point of view. At the central level, if required, an enabling policy presenting options and a broad roadmap can be prepared. More importantly, commitment to fiscal devolution of resources and achievement-based incentivization of milestones (devolution of power, clean energy roadmap, integrated planning) will create the desired demand for reform in urban planning and integrated delivery of urban services.

8 IMPLEMENTING INTEGRATED UTILITY SERVICES



City: Lucknow
Source: GreenTree



City: Noida
Source: GreenTree



City: Lucknow
Source: GreenTree



City: Lucknow
Source: GreenTree



City: Lucknow
Source: GreenTree



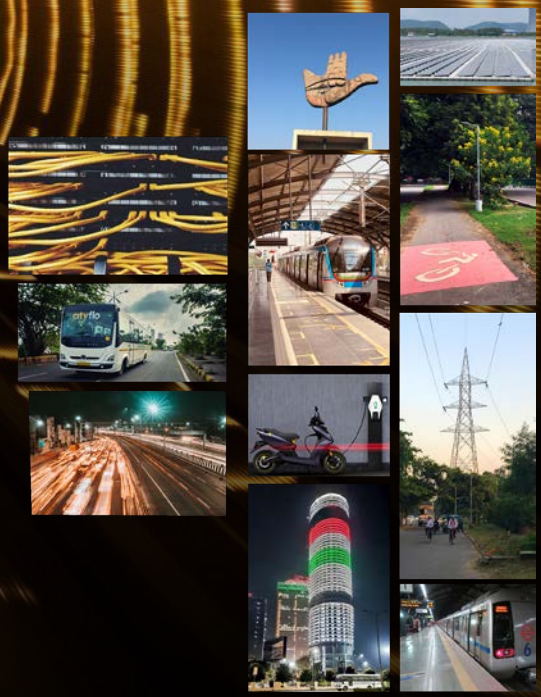
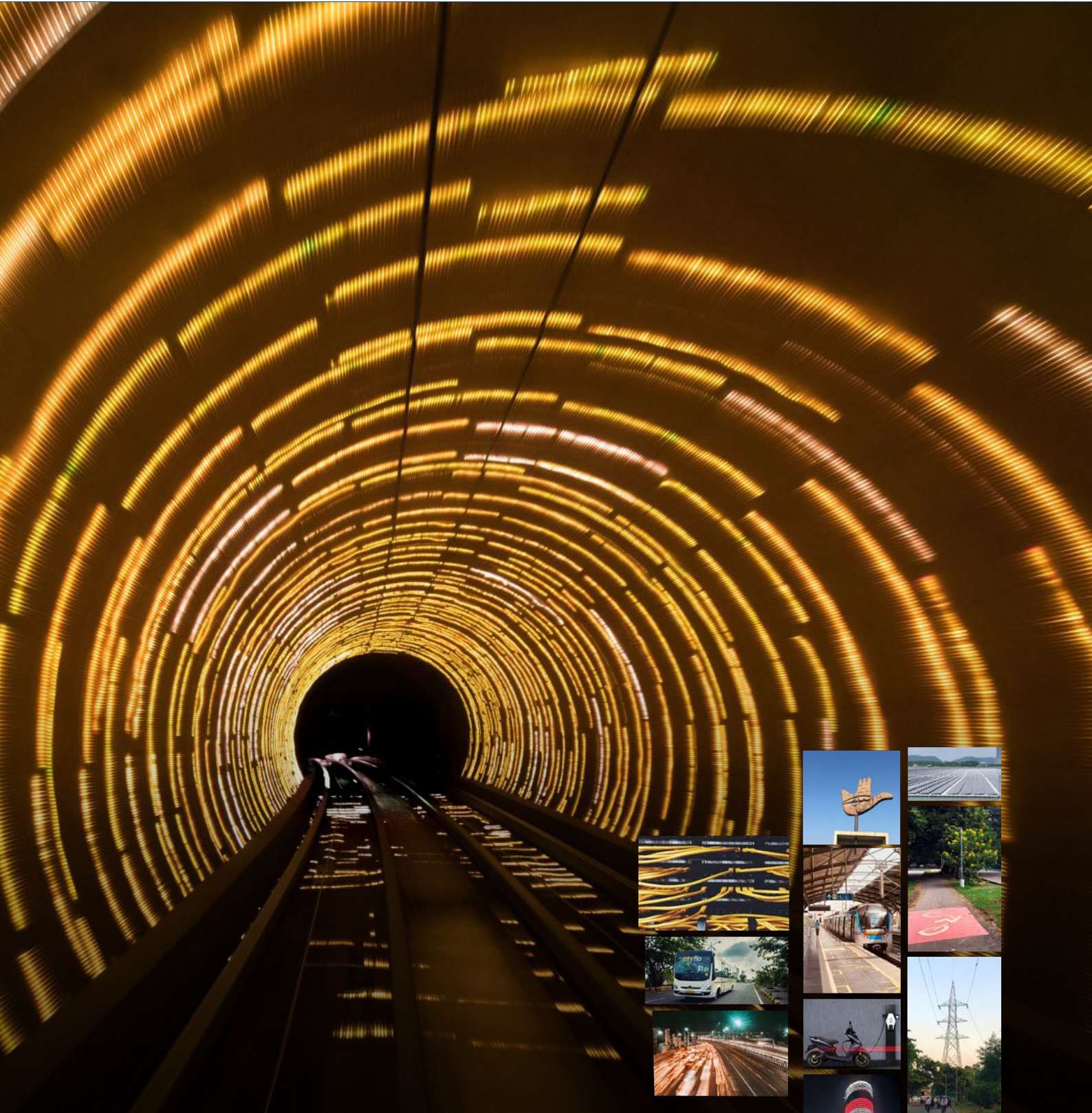
REFERENCES

1. Agarwal, P., 2021. AQI touches 'severe mark', Delhi in a haze as relief disappears into thick air. *Times of India*.
2. Ahluwalia, I., 2014. *Transforming our cities: postcards of change*, HarperCollins India.
3. Ahluwalia, I., 2015. *Planning for Urban Development in India*, ICRIER.
4. Ahluwalia, I. et al., 2018. *Analysing the State of Municipal Finances in India by Developing a set of Indicators*.
5. Ahluwalia, I. et al., 2019. *Analysing Sources of Own Revenue of 53 Municipal Corporations in India*, ICRIER.
6. Alaghbandrad, A. & Hammad, A., 2020. Framework for multi-purpose utility tunnel lifecycle cost assessment and cost-sharing. *ScienceDirect*, October, Volume 104.
7. Asarpota, K. & Nadin, V., 2020. Energy Strategies, the Urban Dimension, and Spatial Planning. *Energies*, July, Volume 13(14), pp. 1-25.
8. Basuroy, T., 2022. *Internet penetration rate in India 2007-2021*, Statista.
9. Batty, M., 2018. *Inventing Future Cities*. The MIT Press.
10. Bloom, D., Canning, D. & Gunther, F., 2008. Urbanization and the Wealth of Nations. *Science*, February, 319(5864), pp. 772-775.
11. Breiding, R. J., 2019. *Too Small to Fail: Why Small Nations Outperform Larger Ones and How They Are Reshaping the World*, HarperBusiness.
12. British Council, 2021. *Global Youth Letter on Climate Action*.
13. Byrne, J., 2008. *Sustainable Energy Utility design: Options for the City of Seoul*, Newark: Center for Energy and Environmental Policy.
14. CEEW, 2020. *India Residential Energy Survey*.
15. Curry, D., 2022. *Messaging App Revenue and Usage Statistics*. [Online].
16. Duarte, C. & Schaeffer, R., 2010. Economic impacts of power electronics on electricity distribution systems. *Energy*.
17. Easypark, 2017. *Smart Cities Index*.
18. Economic Times, 2018. Reliability of power supply is crucial, merely adding households to electricity grid not enough: World Bank. December.
19. Electrical Equipment. *Introduction to underground distribution system (MV/LV)*. [Online] Available at: <https://engineering.electrical-equipment.org/electrical-distribution/introduction-to-underground-distribution-system-mv-lv.html>
20. Energy Cities, European Commission, 2019. *The Hotmaps Toolbox*.
21. Enyedi, G., 2004. *Public participation in socially sustainable urban development*.
22. Fleming, S., 2012. *Cycle Space - Architecture and Urban Design in the Age of the Bicycle*, nai010 publishers.
23. Forum of Regulators, Central Electricity Regulatory Commission, 2018. *Report on Power Quality of Electricity Supply to the Consumers*.
24. Gangopadhyay, S., 2016. *India needs to manage its publicly held land holdings with more diligence and data*.
25. Ghosh, R., Goyal, Y., Rommel, J. & Sagebiel, J., 2017. Are small firms willing to pay for improved power supply? Evidence from a contingent valuation study in India. *Energy Policy*.
26. GlobalABC/IEA/UNEP (Global Alliance for Buildings and Construction, International Energy Agency, and the United Nations Environment Programme), 2020. *GlobalABC Roadmap for Buildings and Construction 2020-2050: Towards a zero-emission, efficient and resilient buildings and construction sector*, Paris: IEA.
27. Government of Jharkhand. *Jamshedpur NAC*. [Online] Available at: <https://udhd.jharkhand.gov.in/ULB/Jamshedpur/Jamshedpur.aspx> [Accessed 2022].
28. Greenpeace, 2020. *Tracking the Cost of Air Pollution*. [Online] Available at: <https://www.greenpeace.org/india/en/explore/tracking-the-cost-of-air-pollution/>
29. Health Effects Institute, 2022. *How Does Air Pollution Affect Life Expectancy Around the World? A State of Global Air Special Report*, Boston.

30. Hindustan Times, 2019. LESA draws up plan to improve power infrastructure in Uttar Pradesh's Lucknow.
31. Hindustan Times, 2022. Lucknow: LESA starts survey of markets to remove overhead wire mesh.
32. IDFC Institute, 2019. *Reforming Urban India*.
33. IEA, 2021. *Global EV Outlook*.
34. Indulkar, C. & Ramalingam, K., 2018. Transmission Losses in India. *Electrical India*, 17 September.
35. Jacobs, J., 1961. *The Kind of Problem a City is*.
36. Kolluri, S. & Abdulla, S., 2019. *Social media for youth & civic engagement in India*.
37. Lague, P., 2021. Smart technological convergence driving prosumerism. *Smart Energy International*.
38. Larsen, P., LaCommare, K., Eto, K. & Sweeney, J., 2016. Recent Trends in Power System Reliability and Implications for Evaluating Future Investments in Resiliency.
39. Lineweber, D. & McNulty, S., 2001. *The cost of power disturbances to industrial & digital economy companies*, EPRI IntelliGrid Initiative (A Primer report from EPRI & CEIDS), Ref no. 1006274.
40. Mayor of London. *London Infrastructure Plan 2050 A Consultation*.
41. Mercer, 2019. *Quality of Living City Ranking*.
42. Millenium Post, 2018. Power dept to introduce underground cables in 77 urban townships across Bengal.
43. Mint, 2018. Battle for the soul of Jamshedpur.
44. Mint, 2022. At GIFT city, the glass looks half full. 13 May.
45. Mohanty, P., 2019. *Planning and Economics of Cities*.
46. MoHUA, 2018. *Credit Ratings & Issuance of Municipal*.
47. MoHUA, 2020. *National Urban Policy Framework Strategic Intent*.
48. MoUD, 2008. *Traffic and Transportation Policies and Strategies in Urban Areas in India*.
49. Nayak, S., 2020. Electrical Distribution System: Overhead Vs Underground Cables. *Electrical India magazine*.
50. NITI Aayog, 2021. *Reforms in Urban Planning Capacity in India*.
51. NITI Aayog, 2021. *Reforms in Urban Planning Capacity in India*.
52. NREL. *LA100: The Los Angeles 100% Renewable Energy Study*.
53. Parvinder, M., 2015. *Amsterdam 2040 master plan*.
54. Pereira, F. C., 1998. *An analysis of costs related to the loss of power quality*.
55. Phillip Capital, 2014. Diesel Gensets in a Sweet Spot. *Vol 1. Issue 5*, July.
56. Ramamurthy, A. & Devadas, M., 2013. *Smart Sustainable Cities: An Integrated Planning Approach towards Sustainable Urban Energy Systems*.
57. Reddy, D., Babu, K. & Murthy, D., 2016. Transportation Planning Aspects of a Smart City- Case Study of GIFT City, Gujarat. *Transportation Research Procedia*, Volume 17, p. 134–144.
58. Roy, A., 2020. *Finding solutions to air pollution in India: The role of policy, finance, and communities*, Observer Research Foundation.
59. Schmid, W., 2018. *Integrative energy planning: How to support decarbonisation by integrating energy planning and urban planning*, Urban Learning.
60. Shah, NIUA. *Overview of Municipal Finance Existing Financial Situation of Municipalities in India*. [Online] Available at: https://mohua.gov.in/upload/uploadfiles/files/9%20Presentation_Jagan%20Shah.pdf
61. Singh, J., 2020. Numbers tell the story of Ola vs Uber rivalry in India. *Entrackr*.
62. Targosz, R. & Manson, J., 2007. *PAN European LPQI power quality survey*, Vienna: Proceedings of 19th International Conference on Electricity Distribution (CIRED).
63. Tewari, R., 2019. Get ready for a younger, more gender-balanced Lok Sabha. *The Print*.
64. The Fourteenth Finance Commission & ASCI, 2014. *Municipal Finances and Service Delivery in India*.
65. Times of India, 2021. 4,364 km underground cabling done: MSEDCL.
66. Tripathi, S. & Mahey, K., 2016. *Urbanization and Economic Growth in Punjab (India): An empirical analysis*.

67. Tumbe, C., 2016. *Urbanization, demographic transition, and the growth of cities in India, 1870-2020, IGC Working Paper, 2016.*
68. UN Habitat and the Chinese Academy of Social Sciences (CASS), 2020. *Global Urban Competitiveness Report 2019-20.*
69. UNEP & ICLEI, 2009. *Local Governments for Sustainability.*
70. UNFPA, 2022. *Reaping India's demographic dividend.* [Online] Available at: <https://india.unfpa.org/en/news/reaping-indias-demographic-dividend>
71. Vaidya, C., 2009. *Urban Issues, Reforms, and the Way Forward*, Department of Economic Affairs Ministry of Finance.
72. World Economic Forum, 2016. *Inspiring Future Cities & Urban Services Shaping the Future of Urban Development & Services Initiative.*
73. World Economic Forum, 2018. *The Global Competitiveness Report.*
74. World Economic Forum, 2021. *These 5 global cities are leading the charge to a renewable future.*





India is one of the most beautiful countries in the world. The cover design depicts images from the cities visited for this research, combined with others, and a map in the backdrop. The integration of urban planning and infrastructure offers potential to beautify our cities, complementing the natural beauty of SUNDAR India. Underground infrastructure tunnel as seen on the back cover represents a strategic and practical solution for enabling integrated urban planning in our cities.