



# Urban Pathways

INDIA

## POLICY ENVIRONMENT AND ADVICE PAPER



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# Urban Pathways

***The Urban Pathways project helps delivering*** on the Paris Agreement and the NDCs in the context of the New Urban Agenda and the Sustainable Development Goals. It has established a facility in close cooperation with other organisations and networks active in this area to support national and local governments to develop action plans and concrete implementation measures to boost low-carbon urban development. This builds on UN-Habitat's role as "a focal point on sustainable urbanisation and human settlements including in the implementation and follow-up and review of the New Urban Agenda". The project develops national action plans and local implementation concepts in key emerging economies with a high mitigation potential. The local implementation concepts are being developed into bankable projects, focusing on the access to urban basic services to create a direct link between climate change mitigation and sustainable development goals.

***The project follows a structured approach to boost*** Low Carbon Plans for urban mobility, energy and waste management services that deliver on the Paris Agreement and the New Urban Agenda. The project works on concrete steps towards a maximum impact with regards to the contribution of urban basic services (mobility, energy and waste management) in cities to global climate change mitigation efforts and sustainable and inclusive urban development. This project makes an active contribution to achieve global climate change targets to a 1.5°C stabilisation pathway by unlocking the global emission reduction potential of urban energy, transport and resource sectors. The project will contribute to a direct emission reduction in the pilot and outreach countries, which will trigger a longer term emission reduction with the aim to replicate this regionally and globally to make a substantial contribution to the overall emission reduction potential.

***This project implements integrated urban services*** solutions as proposed in the New Urban Agenda providing access to jobs and public services in urban areas, contributing to equality and social coherence and deliver on the Paris Agreement and the Sustainable Development Goals. This is the first dedicated implementation action oriented project, led by UN-Habitat to deliver on inclusive, low-carbon urban services. Securing sustainability and multiplier effect, the project aims to leverage domestic and international funding for the implementation projects that will follow from this initiative

## Project concept

## Project aims





# Urban Pathways



## Urban Pathways Project and Replication Cities

# ABSTRACT

In the context of the low-carbon Urban Pathways initiative in India, this paper analyses the administrative, legislative and political environment which influences policymaking at three tiers of the government: National, State (Kerala) and the pilot city (Kochi). Based on the NDC's objective of maximising co-benefits to achieve India's climate-related targets, the paper assesses how multi-level governance could build synergies between sustainable development programmes and policies within three sectors – energy, transport and resources. The paper also identifies relevant policy recommendations and veto-players with decision-making capacities within respective public organisations.





# Urban Pathways





# COUNTRY OVERVIEW

India's urban system with 7933 cities and towns of vastly diverse sizes is the second largest globally (India Habitat III National Report, 2016). India is also the world's second most populous country with 1,393.41 billion inhabitants and an urban population of approximately 430 million. Further, India is projected to rapidly urbanise from presently 33% to 40% by 2030 and add another 416 million urban dwellers by 2050 (UN, 2017). United Nations, too, highlights that India's urban population size will nearly double between 2018 and 2050, from 461 to 877 million. This process of urbanisation also remains a crucial driver for the India's economic development, contributing to over 60% of the country's GDP. As a result, between 2004 and 2012, the share of urban poor declined significantly from 25.7% to 13.7% (Government of India, 2016).

India is the world's third largest GHG emitter after the US and China and contributes 4.4% to the global GHG share. From 1990 to 2014, India's GHG total emissions were 2279 MtCO<sub>2</sub> with per capita emission of 1.76 tCO<sub>2</sub>. For the same duration, sector-wise contributions relevant for the Urban Pathways initiative were: Energy (Electricity) – 1082 MtCO<sub>2</sub> (47.4%), Transport – 232 MtCO<sub>2</sub> (10.2%), and Waste – 61 MtCO<sub>2</sub>e (2.7%) (CAIT-WRI, n.d.).

Although a comprehensive GHG inventory for the city of Kochi does not exist, a cumulative study of India's seven largest cities offers the following sector-wise split of total GHG emissions – commercial energy (15-24%), transport (30%), domestic energy (30-39%), industries (10-20%) and waste management & treatment (3-9%) (Ramachandra et al., 2015)



# SUMMARY OF INDIA'S NATIONALLY DETERMINED CONTRIBUTION (NDC)

India was severely impacted by COVID 19 during the second wave in the first half of 2021, which has further reduced the resilience of climate change vulnerable populations already at risk of displacement by storms, floods, extreme heat, droughts and other climate related disasters.

India launched the National Action Plan on Climate Change (NAPCC) in 2008. At the sub-national level, SAPCC (State Action Plan on Climate Change) was developed to align the national framework with the regional development goals and to manage local climate risks effectively.

India's Nationally Determined Contributions (NDC) define several key aspects regarding the country's diplomatic as well as domestic positions on climate mitigation and adaptation. Instead of establishing a limit on emissions or specifying a timeline for peak-emission, India chose to adopt a 'middle of the road' climate policy approach (Dubash & Joseph, 2016). Following this path, the NDC document presents a three-pronged policy of—(a) Creating a favorable environment for a rapid increase in renewable energy, (b) Moving towards a low-carbon sustainable development pathway, and (c) Adapting to the impacts of climate change. The conclusion of India's official pledge states that its development plans will continue to simultaneously lay a balanced emphasis on both economic development and environment (Government of India, 2015, p.34). Towards this, the NDC define several key aspects

regarding the country's diplomatic as well as domestic positions on climate mitigation and adaptation.

The NDC document considers four major objectives for 2030. These are as follows –

- Reducing the emissions intensity of India's GDP by 33% to 35% compared to 2005 levels.
- Increasing the share of 'non-fossil fuels' within the cumulative installed power capacity to 40% through technology transfer and low cost international finance.
- Creating a carbon sink of 2.5 to 3 billion tonnes of CO<sub>2</sub> equivalent through forest and tree cover.
- Set up a National Adaptation Fund with an initial allocation of 3,500 Rupees (55.6 million USD)
- Increasing renewable power capacity from 36 GW in 2015 to 175 GW in 2020 (60 GW wind and 100 GW solar).

In August 2022, India officially submitted its updated Paris Agreement targets, having first announced new targets at COP26 in November 2021. It strengthened both the value of its 2030 emissions intensity target and the share of electricity that will come from non-fossil fuel-based sources, compared to its first NDC. In essence, India has replaced its first NDC targets with targets close to its current level of climate action.

While India indicated in its updated NDC that achieving its 50% non-fossil capacity

target would require international support, it is already on track to achieve 60-67% non-fossil capacity by 2030 under current policies. Indian Prime Minister Modi announced a 2070 net zero target at the World Leaders Summit at COP26 in Glasgow. Reference to the target was also made in India's updated NDC submission; however, few details about the target are available.

The last target is particularly significant since it established India's ambitious aim of aggressively promoting the renewable energy sector and attract international investments (Anand, 2017). However, despite the NDC targets, the future trajectory of India's energy consumption continues to be both projected and planned to be reliant on fossil-fuels. Over 80% of India's energy needs are met by three fuels: coal, oil and solid biomass. Coal has underpinned the expansion of electricity generation and industry, and remains the largest single fuel in the energy mix. Oil consumption and imports have grown rapidly on account of rising vehicle ownership and road transport use. Biomass, primarily fuelwood, makes up a declining share of the energy mix, but is still widely used as a cooking fuel. Despite recent success in expanding coverage of LPG in rural areas, 660 million Indians have not fully switched to modern, clean cooking fuels or technologies. By September 2022, India had reached a cumulative installed capacity of renewables (excluding large hydro) of more than 118 GW (29% of total capacity), which has doubled since 2016 (CEA, 2022). This includes 58 GW

of solar and 41GW of wind energy, with net capacity additions of 22.5 GW of solar and 3 GW of onshore wind between 2020 and 2022, implying that the pandemic has not affected India's commitment for renewable energy expansion (CEA, 2019, 2022).

Under the Glasgow Climate Pact from COP26 India signed a commitment to phase down coal. An expert committee has been appointed by the Ministry of Power to develop a plan to stop building any new coal capacity in India after 2030 (Shah, 2022a). But in the recently-released draft National Electricity Plan (NEP2022) the government projects an increase in coal capacity by 18% between 2031-32 and 2021-22. This would result in a 40% increase in coal consumption between 2021-22 and 2031-32.

India has over 200 GW of coal-fired capacity in operation (a share of 11% of global capacity), 32 GW under construction and 25 GW of announced and permitted projects, similar coal capacity addition is also projected in NEP2022 (Global Energy Monitor, 2022a; Ministry of Power, 2022c).

In September 2022, Central Electricity Authority (CEA) released a draft version of its National Electricity Plan 2022 (NEP 2022). This plan highlights that India is planning to add considerable solar and wind capacity by 2031-32, of 333GW and 134GW, respectively. But coal will continue to play a significant role in the country's energy mix.

# POLICIES AND STAKEHOLDER MAPPING

## Governance and Institutions

Considered as the world's largest democracy, India follows a tripartite governance model of 'cooperative federalism', whereby administrative responsibilities and environmental policies are divided between the Centre (national), State and City governments. However, the main responsibility of climate policy and multilateral negotiations rests with the Central Government. Although, it is under the purview of the individual states to implement climate policy, India is still a relatively centralised federal country and the states still rely tremendously on the Central Government, both politically and financially (Jorgensen & Wagner, 2016). Moreover, in the absence of publicly-elected mayors in cities, policymaking and funding for local governments is largely controlled by the states, often by establishing independent Special Purpose Vehicles (SPVs) (Dhanuraj & Mathew, 2017). Due to such fiscal and administrative interdependence within multiple governmental levels, it becomes pertinent to identify – (a) Key 'veto-players' or constitutionally-empowered decisionmakers within administrative structures, and (b) Measures through which relevant policies are transmitted down the hierarchy. The following sections outline these aspects for the three primary governmental stakeholders.

## National government

With respect to the three Urban Pathways themes (energy, transport and waste), the following national ministries are engaged in drafting and legislating relevant policies –

1. Ministry of Housing and Urban Affairs: It is the nodal ministry responsible for all urban development initiatives, including formulation of planning guidelines, municipal capacity building and coordinating national urban renewal programmes such as Smart Cities Mission and Atal Mission for Rejuvenation and Urban Transformation (AMRUT) Mission. Additionally, this ministry is also in-charge of monitoring and supervising the flagship Swachh Bharat (Clean India) Mission focused on urban waste management.
2. Ministry of Power: It is responsible for establishing electricity tariffs, regulating State power distribution companies as well as promoting electric mobility through its National Mission on Electric Mobility. It also regulates development of charging infrastructure for electric vehicles.
3. Ministry of New & Renewable Energy: It is responsible for the promotion of renewable energy (solar, wind, hydropower, biomass) through subsidies and creating an enabling environment for entrepreneurial ventures via a National Solar Mission. Its flagship Solar Cities Development programme and promotes renewables in 60 cities/towns to reduce conventional power usage.
4. Ministry of Environment, Forests and Climate Change: It is responsible for formulating environmental policies, approval of permits for large-scale infrastructure projects, preparation of the National Action Plan for Climate Change (2008) and the NDC (2015).



5. Ministry of Roads Transport & Highways: It is responsible for construction and upgradation of national road infrastructure to facilitate urban and rural transport, Draft Road Safety Policy (2016) and the National Urban Transport Policy (2014).

6. NITI (National Institute for Transforming India) Aayog: This is a federal think-tank which develops economic/development policy and coordinates UN's Sustainable Development Goals (SDGs)-related initiatives. It is chaired by the Prime Minister while the Governing Council consists of Chief Ministers from all 29 States Governments.

horizontal sections between which policy formulation and its monitoring is divided. Within this structure, the Additional Secretary is the most important nodal bureaucrat who coordinates both these functions.

Political landscape:

The Bharatiya Janata Party (BJP) has been in power at the National Government since 2014. As of December 2022, the party also controlled a ruling majority in 17 out of 28 State Governments. It has emerged as India's largest political party in terms of parliamentary and State Assembly representation. The nationalistic BJP headed by Prime Minister Narendra Modi projects its agenda being strongly driven by both public participation and economic development. Accordingly, while promoting industrialisation and

Governance/Administrative structure: The typical hierarchy of an Indian national ministry is illustrated in Figure 2. It is split into two

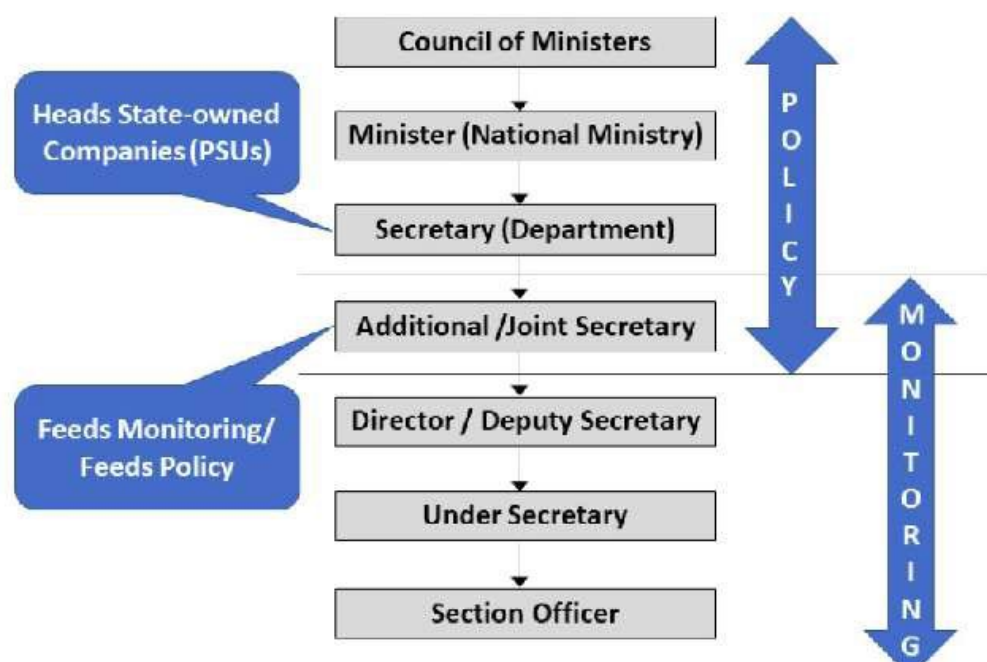


Figure 2: Administrative structure indicating veto players at the national level  
(Source: Agarwal O.P.,2017)

infrastructural growth, the party's Manifesto also includes climate change mitigation, creating '100 new cities' and a transition to cleaner fuels (BJP, 2014). Moreover, the current Central Government has been a vocal proponent of low-carbon urban development

as evidenced by its support to the UN's New Urban Agenda, the SDGs, ratification of the Paris Agreement and a range of new programmes launched since 2014.

## STATE GOVERNMENT

### **Governance/Administrative structure:**

With a Chief Minister as the head, each of the Indian State Government ministries is led by a Cabinet Minister. The ministry's administrative staff comprises of a Principle Secretary, Additional Secretary, Joint secretary and a Commissioner. These ministries also further consist of line departments, regulatory committees and executive divisions. The key departments responsible for driving a planning and implementing sustainable development projects are described below

1. Transport Department: This department regulates the Kerala State Road Transport Company (KSRTC) which operates bus-services in the city of Kochi. It is also responsible for land-acquisition for Kochi's Metrorail project and registering the city's private vehicles.
2. Public Works Department: It is responsible for tendering, construction and maintenance

of the state's road transport corridors. Urban highways and major intersections in metropolitan Kochi also come under its authority.

3. Power Department: It is responsible for ensuring the electricity provision, regulation of tariff, power generation, conducting energy audits as well as setting up new energy infrastructure.
4. Three environmental agencies: This portfolio is divided between – (a) Department of Environment, (b) Directorate of Environment headed by the Chief Minister, and (c) Department for Environment and Climate change. The third department is also the nodal agency for coordinating all climate change-related initiatives at the State level. It also prepared the State Action Plan for Climate Change (Kerala SAPCC, 2014).



# KERALA

## State overview:

Kerala, a south western coastal state of India, is flanked by the Arabian Sea on the west and the Western Ghats mountains on the east. Kerala consists of 14 Districts, 21 Revenue divisions, 75 Taluks, 152 Block Panchayats, 941 Gram Panchayats, 87 Municipalities, 6 Corporations, and 1664 Villages, and holds 3.44% of India's population. With a population of 33,406,061 at 860 persons per km<sup>2</sup>, it is nearly three times densely populated compared to the rest of India. Kerala is also experiencing a rapid rise in the percentage of the aged population (above 60 years). (Kerala Department of Economics and Statistics, 2018)

Accordingly to the latest census, the state has been urbanizing more rapidly than the national average with an annual urban population growth of 6.5%. About 52% of the total urban population live in mid-sized Urban Local Body (ULB) having population ranging between 20,000 and 100,000 and the remaining 48% live in larger ULBs that have population greater than 100,000. The state, however, has not registered corresponding growth rates in the provision of urban infrastructure, particularly, the solid waste management related infrastructure and the service levels are substantially below the national level benchmarks.

Kerala's human development indices (HDIs) — primary education, health care and elimination of poverty—are among the best in India. The state has one of the highest literacy rates (94.0%) and life expectancy (74.9 years) among Indian states. Kerala has also made an extensive stride in reducing both rural and urban poverty. (Office of the Registrar General

& Census Commissioner India, 2014)

## Political landscape:

Kerala's state-level politics is dominated by two coalition fronts – the Left Democratic Front (LDF) led by the Marxist Communist Party of India (CPIM) and the United Democratic Front (UDF) led by the Indian National Congress (INC). Neither coalitions have gained consecutive terms (each one being 5 years) in power. The present LDF State Government was elected in 2016 with P. Vijayan as the Chief Minister. Since Indian states depend on the Central Government for facilitating large-scale infrastructure funding, the political relationship between the National and State ruling parties significantly impacts projects at regional and local scales. With the nationalist BJP party governing at the Centre, their relationship with Kerala's communist State Government has been adversarial in nature. This is evidenced by conflicting claims for the ownership of successful local initiatives (for e.g., Kochi Metro) or the frequently-reported violent clashes amongst opposing party-workers (Pai, 2017). The CPIM's Election Manifesto articulates the current State Government's stance with respect to low-carbon development. It includes 600 actionable agenda items, 17 of which focus on pertinent topics such as – urban development, urban transport, renewable energy and urban waste management (Left Democratic Front, 2016). Moreover, CPIM's press releases regularly comment on international climate negotiations which have not only indicated CPIM's support to the Paris Agreement but also its inclination to hold the Central Government accountable for their climate policy (CPIM, 2016).



# LOCAL GOVERNMENT

## **Governance/Administrative structure:**

Like all other Indian states, Kerala follows a 'Commissionerate' system of municipal governance which determines the division of authority between the elected representatives and the bureaucracy. Accordingly, the administrative head of the Kochi Municipal Corporation (KMC) is the Municipal Commissioner (alternately termed as the 'Secretary') appointed by the State Government. This officer is responsible for implementing all metropolitan initiatives while also heading the municipality's Executive staff. In parallel, elected representatives from each of the 'wards', the small unit of urban governance, form a Municipal Council chaired by the Mayor. The Councillors also form a Standing Committee which approves annual municipal budgets and financing for development projects.

To address a low-carbon agenda for the three Urban Pathways sectors, the following Kerala Municipal Corporation (KMC) departments and parastatal agencies are relevant –

1. **Engineering Department:** While KMC does not have a specialised Transportation Department, this department is responsible for the construction and maintenance of roads along with other civic infrastructure such as sewage systems, storm-water drains, traffic signals, signage, treatment plants etc. It is headed by the Superintendent Engineer (SE).
2. **Health Department:** It is responsible for construction and maintenance of sanitation facilities and Solid Waste Management along with other public health-related duties. It is headed by the Corporation Health Officer (CHO).
3. **Town Planning Department:** It is responsible for enforcing the Urban planning regulations, awarding building permissions and facilitating land-acquisition for urban expansion. It is headed by the Town Planning Officer (TPO). This department also plays a major role in integrating transit infrastructure with its surrounding urban development.
4. **Greater Cochin Development Authority (GCDA):** It is responsible for regional planning and implementing special infrastructure projects which require State Government assistance. Jurisdictional area comprises of Kochi city, 6 surrounding municipalities and 25 'panchayats' (rural wards). It is headed by the State Minister for Local Self Governance and a Chairperson.
5. **Kochi Metro Rail Limited (KMRL):** This is a public company set up as a Special Project Vehicle (SPV) and jointly owned by the State and Central Governments. It is in-charge of constructing and operating Kochi's Metrorail system. It is governed by a Board of Directors comprising of senior bureaucrats and State Government Ministers.
6. **Urban Metropolitan Transport Authority (UMTA):** Legislated in January 2018, this agency is responsible for coordinating and disbursing Central Government's infrastructure funding across all Urban Transport line-agencies in the metropolitan region. It is also expected to formulate Comprehensive Mobility Plans (CMP) for respective cities.

State-wide civic elections are held every five years in Indian cities whereby Councillors from individual urban constituencies (wards) are publicly elected. These elections culminate in the selection of the Mayor and a Deputy Mayor from among elected Councillors of the majority party. In Kerala, the two primary political coalitions at the state level – the LDF and the UDF, also contest civic elections and have alternated being in power in Kochi. In November 2015, the Congress-led UDF coalition registered victory after winning 38

seats out of 72 Wards and Mrs. Soumini Jain was subsequently selected as Kochi's present Mayor. The socialist Congress party's publicly-declared 'achievements' lay emphasis on developing transport infrastructure, industrial corridors and coastal management (KPCC, n.d.). Notable projects initiated by the UDF include both the Kochi Smart City project (2015) and the Kochi Metro (2012), which have been important milestones for the city's urban planning strategy.



# ENERGY

India's energy-sector related CO<sub>2</sub> emissions have more than quadrupled since 1990, with the major sources of emissions growth being power generation, industry and transport. Emissions growth from power generation over this period has been nearly twice total emissions from all sectors in 1990. Coal meets 45% of India's primary energy demand, but is responsible for 70% of India's energy sector CO<sub>2</sub> emissions. The objectives of prominent national initiatives in the (urban) energy sector could be classified into three categories – (a) Monitor and increase the energy-efficiency of residential buildings, while promoting greater uptake of efficient lighting systems such as Compact Fluorescent Lamps (CFL)

(b) Reduce fossil fuel share of the urban energy mix by increasing the uptake of renewable energy through feed-in tariffs and solar photovoltaic (PV) subsidies, and (c) Increase the modal share of electric mobility by subsidising electric-vehicles (EV), expanding government-owned EV fleets and development of charging infrastructure in cities (India Habitat III National Report, 2014). Figure 3 illustrates India's current and projected renewable capacity. After the enactment of the Energy Conservation Act of 2001, two major initiatives aimed at increasing the building sector's energy efficiency were implemented. These include – (a) A residential Green Rating for Integrated Habitat Assessment (GRIHA) system based on the Bureau of Energy Efficiency's (BEE) Star Rating Scheme, and (b) Energy Conservation Building Code (ECBC) to set energy standards for new commercial

buildings. Additionally, the Ministry of New and Renewable Energy (MNRE) is also currently implementing its flagship 'Solar Cities' programme (2008) in 60 cities and towns in India. This initiative aims at a 10% reduction in fossil-fuel-based power consumption in 5 years. It consolidates a range of technological and financial incentives for subnational governments to promote renewable energy (IRENA, 2017).

The Indian government has responded to the economic crisis by unveiling one of the largest stimulus packages in the world, equating to a share of around 11% of the country's GDP in 2019. India's overall COVID recovery stimulus package mainly supports activities related to industries likely to have a large negative impact on the environment by, for example, increasing the use of fossil fuels, and unsustainable land use.

However, India's most recent stimulus (2021) is more climate-friendly, with two-thirds of the resources targeted towards a green recovery, including roughly USD 3bn in battery development and solar PV. While the additional stimulus is a positive step, India continues to support coal, with fresh loans to a number of thermal power projects, undermining a green recovery.

Currently, India's space cooling energy consumption per capita is one of the lowest in the world and only about a quarter of the world's average consumption. However, mainly due to the growing Indian economy, the associated increase in prosperity, urbanization and cli-



mate change, the cooling energy demand will increase significantly in coming decades.

Based on current coal expansion plans, India's coal capacity would increase from current levels of over 200 GW to almost 266 GW by 2029-2030, with 35 GW expected to come online in the next five years: an increase of 17.5% in coal capacity. India's coal-fired power plant pipeline is the second largest in the world and is one of the few to have increased since 2015. A recent move to

increase domestic coal production has opened coal mining to private investors, risking a fossil fuel lock-in as well as harm to areas of ecological significance.

India provides subsidies for both fossil fuels and renewable energy, including direct subsidies, fiscal incentives, price regulation and other government support. While coal subsidies in absolute terms have remained largely unchanged since 2017, they are still approximately 35% higher than subsidies for renewables.

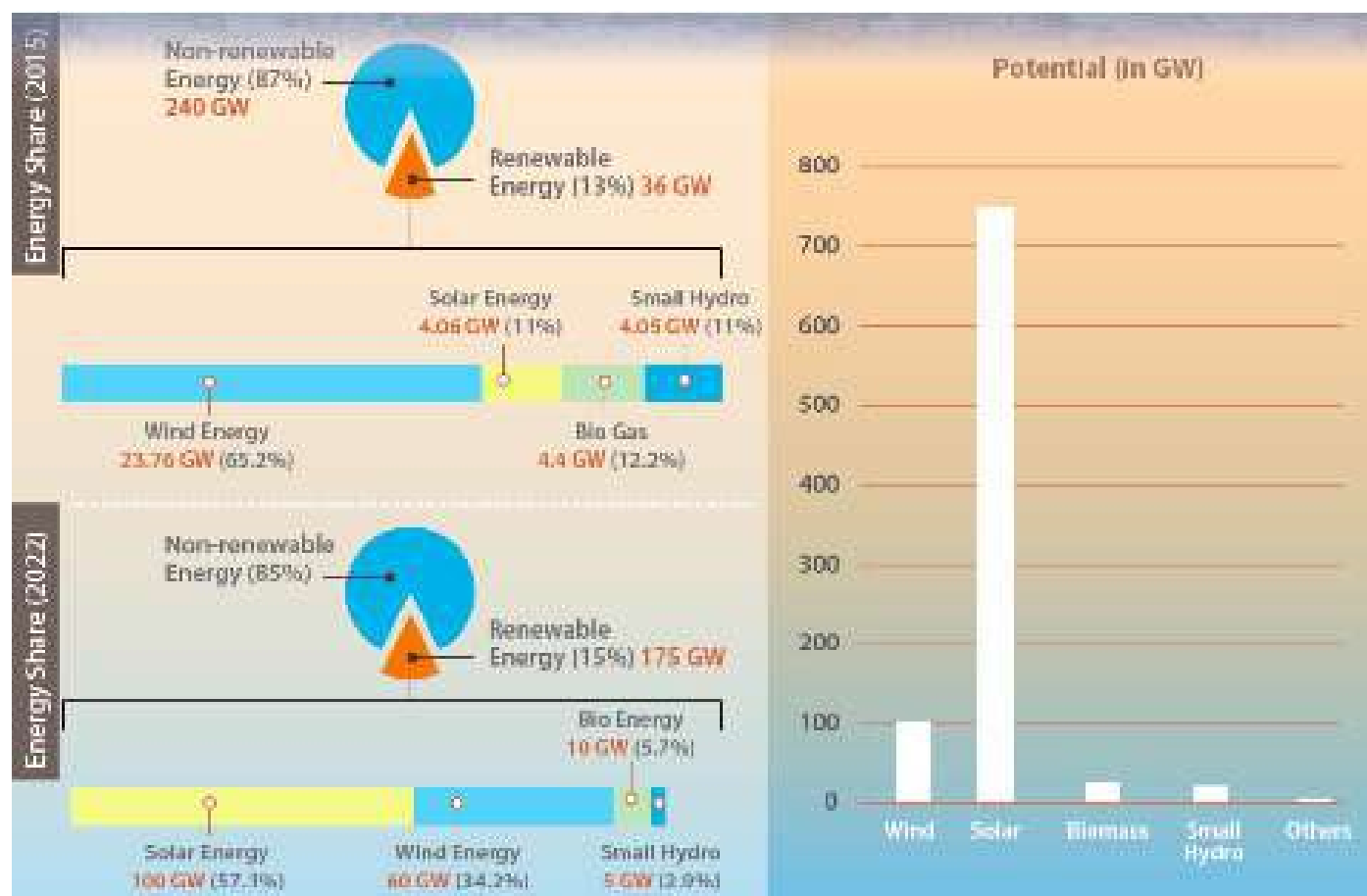


Figure 3: Current and estimated installed capacity of renewable energy in India  
(Source: India Habitat III National Report)

# TRANSPORT

India's rapid urbanisation between 2005 and 2012 converged with the growth of two-wheeler and car sales by 12% annually. As a result, mode-shares of private vehicles are projected to rise from 24% in 2007 to 46% by 2030. Concurrently, it is also estimated that mode-shares of public and non-motorised transport (NMT) would fall from 46% to 26% in a business-as-usual scenario (Dubash et al., 2013). Being the second most energy-intensive sector after power, transport plays a crucial role in realising India's mitigation targets. From 1994 to 2000, the sector was responsible for about 24% of India's GHG emissions (Government of India, 2014). These factors highly necessitate a transition from personal vehicle-based mobility in order to achieve low-carbon urban growth.

The National Urban Transport Policy (2014) marked a paradigm shift through its objective of 'moving people and not cars' and prescribing an 'Avoid (cars), Shift (to sustainable modes), Improve (infrastructure)' framework to guide cities in mobility planning. This has coincided with substantial investments in and launch of public transport projects. These comprise of Bus Rapid Transit (BRT) in 7 cities, Metrorail systems in 8 cities and Public Bike Sharing (PBS) in 5 cities (Bhatt, 2017). To ensure the efficiency of these newly-introduced systems, the Central Government has

formulated two key policies, namely, (a) National Metro Policy (2017), and (b) National Transit-Oriented Development (TOD) Policy (2017). These are aimed at creating dense, walkable and mixed land-use districts around transit stations to induce modal shifts and better walkability.

The Government of Kerala (where the City of Kochi is located) emphasizes the importance of efficient, safe and sustainable movement of people and goods. Through its Rebuild Kerala Initiative (RKI) and the Electric Vehicle policy, Kerala envisages developing bus ports and logistics ports for the state and preparing a state action plan for e-mobility. In line with this, Kochi has set out strategies to explore the inland waterways for goods transport and is exploring alternatives to mainstream electric mobility in the city.

Cities in India have also geared towards electrification in rickshaws and reduction of conventional fuel use in two-and threewheelers, which are commonly used to transport goods. The State of Kerala gave an initial approval for operations of e-rickshaws in 2016 and it plans to issue taxi-permits to e-rickshaws only to reduce the number of conventional three-wheelers. However, except for a few private operators, the e-rickshaws sector in Kochi is still at a nascent stage and yet to reach its potential.



# WASTE MANAGEMENT

India generates 150,000 tonnes of Municipal Solid Waste (MSW) per day (Singh, 2018). This quantity is estimated to increase to 377,000 tonnes per day by 2025 (World Bank, 2012). The amount of sewage generated is equally significant at 38 billion litres per year (Ghosh, 2016). Solid waste and waste water together account for between 3-9% of GHG emissions for Indian cities (Ramchandra et al., 2015). Unlike transport and energy, waste management was one of 18 functions devolved from the National and State Government mandates following the 74th Constitutional Amendment in 1992. Accordingly, the responsibility of Solid Waste Management is solely the prerogative of municipalities and local NGOs. However, as was expected, this decentralisation has not resulted in improved service delivery. Presently, 30-40% of total urban waste remains uncollected, while less than 10% is segregated or scientifically treated (Mani & Singh, 2016).

Until 2000, there existed no national policy to address the resources sector in India. This changed when the Ministry of Environment drafted Solid Waste Management (SWM) Rules in 2000, which were then revised in 2015. Concurrently, the Ministry of Urban Development (MOUD) also formulated a Draft Municipal SWM Manual (2015) to guide municipal agencies in implementing SWM systems. The Central Government's Swachh Bharat (Clean India) Mission (2014) was an important landmark in strategically addressing SWM with a massive investment of 10.6 billion USD over 5 years. Prominent

SWM objectives currently being pursued under this programme in urban areas consist of – 100% collection, segregation and recycling of MSW, end open defecation, construction of toilets, capacity building, public health awareness campaigns and encourage private investments in constructing sanitation facilities (SBM Revised Guidelines, 2017).

## **Waste Management - Kerala**

The total solid waste generation in Kerala is estimated at 3.7 million tons annually. Of the total waste generated, the total share of biodegradable and non-biodegradable waste (NBDW) is at 69% and 31 % respectively (World Bank, 2019). The biodegradable waste (BDW) has a moisture content of about 70%. It is estimated that only ~20% of the BDW is treated at household or community levels, and the remaining ~80% is not properly treated and disposed. Similarly, about 60% of the NBDW is dumped illegally or burned, while the remaining waste is collected informally by rag-pickers. A minor fraction is recycled at the community level. The State has no engineered landfills and/or centralized waste management facilities for municipal waste. Consequently, a major fraction of municipal waste has been openly dumped in public spaces, low-lying lands and water bodies for many years now, resulting in creation of numerous illegal open dumpsites that pose serious environment and public health hazards.

74th Constitutional amendments entrusted the Urban Local Bodies (ULBs) to prepare plans for economic development and social jus-

tice and their implementation under relevant schedules of the Constitution of India. Accordingly, the local government institutions are mandated with many responsibilities including Solid Waste Management. The imposition of state agencies and their nonaccountability to the local self-governments has led to overlapping mandates lacking synchronized vision. In addition, the local self-government institutions are not adequately staffed and lack a dedicated SWM unit, to deal with SWM in an efficient, systematic, and planned manner.

Currently, the waste management system in the state focuses on the citizen responsibility of managing biodegradable waste at source under 'My waste, My responsibility' approach with a focus of instilling a sense of ownership and duty among citizens. The local government's involvement in handling of waste is restricted mostly to collection and recycling of nonbiodegradable waste and collection of biodegradable waste from bulk generators.

The Solid Waste Management Rules, 2015 of the Government of India state that it is the responsibility of the Local Self Governments (LSG) to provide waste management services in their jurisdiction and collect user fees from individual households and institutions for such services. The Rules also mandate the segregation of waste at source. Furthermore, there are the guidelines laid down by the National Green Tribunal (NGT) pertaining to the management of waste as per which the LSGs are supposed to keep a track of the waste generated as well as the quantities of waste handled and segregated to provide informa-

tion to the NGT as and when needed. Thus, keeping in mind the constitutional and legal framework governing waste management in India, as well as the contextual realities of the state, The Government of Kerala has adopted a policy for solid waste management with two strategies:

1. Decentralised waste management
2. Centralised waste management where necessary

The Decentralized Solid Waste Management (DSWM) as conceived in Kerala, is a system involving the segregation and processing of waste at source to the maximum extent possible and then at the community level. There are different methods for the treatment of biodegradable and non-biodegradable waste in such a system. These aspects substantially reduce the amount of waste reaching the landfill sites minimising associated issues. The decentralized system has been credited for not only being sustainable and financially viable but also for helping improve the quality of life and working conditions of the waste collectors. It is known to promote green growth, reduce GHG emissions and also reduce transportation of organic Solid Waste to the waste disposal site.

The adoption of a decentralized solid waste management system also necessitates the need to have an institutional framework with strong Local Self Governments directly responsible for waste management and an empowered and informed citizenry indulging in responsible waste management practices and behavior.



This shift of the administration towards decentralization and circular economy has also marked a significant change in the approach of the administration- that of looking at 'waste' as a 'resource'. In order to turn waste into a valuable resource, the need for systematic ways to manage resources has been recognized and this management has to begin right at the household and institution level- where proper segregation of various kinds of waste i.e. food waste, plastic waste, bio-chemical waste is to take place.

A major component of building a sustainable system for waste management has been the formation of the Haritha Karma Sena (HKS) in 2016. The HKS is a women led, women-owned network of micro-enterprises who undertake collection from houses, institutions and other sources and perform waste storage and segregation activities. These enterprising women, who mostly come from the neighbourhood groups, undertake the task of door-to-door collection of non-biodegradable waste, segregating it at Material Collection Facilities and encouraging source level segregation at the houses and institutions they visit.

The user-fees collected by these women from the houses and institutions acts as a source of remuneration for them and helps generate livelihood.

The Kerala Government prepared an amendment to the Kerala Municipal Act (KMA), 1994, including stringent provisions to ensure enforcement of Solid Waste Management Rules, 2016. At present, solid waste management is handled as a subsection in the clause relating to health in the Act. The plan is to add a detailed clause for solid waste management with subsections comprising rules for enforcement and penalty provisions complying with the 2016 rules.

The proposed amendment main objective is to ensure effective implementation of the KMA rules and to mitigate public resistance relating to waste management. It will also have provisions to add separate clauses for source-level segregation of waste, an effective mechanism for user-fee collection, and ease the procedures of bringing in new bylaws related to waste management for effective enforcement.

# KOCHI

Second to Mumbai, Kochi is the most important port city on the western coast of India. However, the city has become increasingly exposed to the risks and concerns associated with climate change. The city is embedded into a complex network of rivers, tidal creeks and backwaters, due to which Kochi has been regularly subjected to natural disasters like floods, cyclones, droughts and landslides. Over the past decade, sea level rises and increased frequency of extreme rainfall events have led to growing concern. Rising temperatures exacerbate the heat island effect in Kochi too. The area is warm and humid, with two monsoon periods annually, neither as intense as the major summer monsoon on India's east coast and neither associated historically with disastrous flooding or other storm damage. The city is administrated by the Kochi Municipal Corporation (KMC). Kochi has 74 wards within seven administrative zones.

Kochi was significantly impacted by the 2018 Kerala floods, driving efforts to build a more climate resilient city.

## Energy

The main sectors of energy demand in Kerala are electricity and fuel for mobility. On the demand side the residential sector with 50% in 2019-20 and the industrial sector with 27% are the most relevant sectors. Based on the ~34.8 million inhabitants of Kerala, every citizen consumes 658 units of electricity (kWh) per year on average. Therefore, the average electricity consumption per inhabitant in Kerala is only 58% of the average in India, at 1144 units per inhabitant. (Fraunhofer Institute, 2020).

In Kerala, 74.5% of the gross electricity demand is imported and mainly generated by fossil fuels. Hydro power plants are the main source of electricity generation in the state. They are owned and operated by the state company and supply about 35% of peak demand and 25% of the electricity requirement of the state.

Kochi has committed to increasing its energy efficiency in final energy consumption by 5 percent by 2020 compared to 2014 level. There is a high potential for solar power. In India, the energy sector is governed at national and state level. Most of the energy policy related to Kochi is made by the Kerala state government, there is no use of smart grid technologies

## Transport

On-road transport-related emissions in Kochi accounts for 57% of total emissions – 2.900.000 tonnes CO<sub>2</sub>e (Kochi Municipality, 2013).

In Kochi, out of the total urban traffic entering the city, the share of freight vehicles is around 14 percent. Moreover, approximately 46 percent of the freight trips are performed by smaller vehicles, including 3- and 4-wheeler rickshaws, pick-ups, vans, tempos and other light goods vehicles, followed by trucks and two-axle vehicles (3.5 t - 12 t) with 44 percent. Multi-axle vehicles (MAV, 12 t - 20 t) account for 10 percent of the freight traffic. (Greater Cochin Development Authority, 2015)

Existing actions for addressing urban freight issues - A proposal to redevelop the Ernakulam market area, one of the major hotspots for urban freight, has been initiated. The new redevelopment plan touches upon requirements for freight such as loading/unloading bays, non-motorized transport (NMT) delivery system to shops, clustering of shops and routing strategy. Discussions on revitalization of inland waterways for freight transport have started, together with Integrated Urban Regeneration and Transport System (IURWTS). Kochi's comprehensive mobility plan identifies policies to restrict heavy vehicle movements in the city.

Kochi has initiated various successful initiatives for the multimodal integration of the first phase of the metro in development. The city has introduced an integrated smart card, has an agreement with rickshaw associations, and integrated metro stations with walking and cycling infrastructure. The city has two railway stations, namely Ernakulam North and Ernakulam South, with an estimated daily passenger volume of 65,000.

In the recent years, there has been a renewed interest on the need to improve mobility along the corridor. In addition to the construction of a light metro, Kochi is also tackling non-motorised modes, which account for 15% of all trips. The preparation of a Mobility Improvement Plan along the North-South Railway Station corridor also referred to as the Green Mobility corridor, is one of the major outcomes of this endeavour. The intent is also to facilitate multi-modal integration by improving the accessibility of metro stations with the identified

activity centers. The specific objective of the project is to promote mobility focusing on pedestrians and non-motorized modes to create a more walkable, safe, environment friendly and humane city.

The government of Kerala has set ambitious targets for the market launch of EVs. However, providing the charging infrastructure for EVs could become a bottleneck for EV deployment. The EV charging infrastructure needs to be built in parallel with the market penetration of EVs and requires a concept for EV charging in public spaces, at work and at home.

## **Waste**

Kochi City have been facing issues related to the collection, treatment and management of solid waste. Therefore, there is an urgent need for an improved planning and implementation of comprehensive solid waste management system for upgrading the environmental scenario of the city.

The common sources of MSW comprises of Residential, Commercial, Industrial, Agricultural, Construction and Demolition, Industrial and Municipal Wastes. As per SWM Rules (2016), Markets, Restaurants, and all institutions and gated communities having an area greater than 5000m<sup>2</sup> are made mandatory to treat biodegradable waste within their premises. Use of Biogas plants or composting facilities such as organic waste converters, vermicomposting units, bio-bins, aero bins, etc. can be used depending on the quantity of waste generated within their premises.

The current situation in the city of Kochi (Kerala, South India) is that, the existing waste disposal process is limited to just collection and surface dumping of the waste into uncontrolled sites. Developed countries have over the past three decades mastered the art of converting waste to energy (WTE) as an answer to the challenges of processing Municipal Solid Waste (MSW) into a sustainable green energy source.

In 2015, Kochi corporation authorities and the state government designed a WTE plant in Kochi Brahmapuram. The proposed plant will have a gross installed capacity of 12.4 MW. The power generated from the MSW will be purchased by Kerala State Electricity Board (KSEB). The power generated will be Green energy preventing significant amount of methane and CO<sub>2</sub>. However, after seven years, the authorities are unable to implement it.

### **Recommendations**

Under current policies and action, greenhouse gas emissions in India (excluding LULUCF) are projected to reach a level of 3.84-4.02Gt-CO<sub>2</sub>e in 2030.

With the formulation of a national policy on climate change, it has become imperative to achieve coherence between the strategies and actions at national and state levels. Adaptation challenges are experienced most acute-

ly at the state level. Thus the preparation of State Action Plans for Climate Change (SAP-CC) should be consistent with the broad objectives of the National Action Plan for Climate Change (NAPCC) and result in a set of sectorial activities and programmes that will take into account state level variations, geographical specificities and socioeconomic considerations. It is therefore crucial for the urban development of Kochi to have a climate change and policy landscape that provides the framework for a sustainable transition at a local level.

- Due to weak enforcement and lack of priority, there have been no city-level plans or policies on climate change in Kochi itself. The need for structural and binding plans, especially in the areas of water drainage, stormwater management and urban heat islands, was perceived as crucial for the city's future. In terms of available financing and funding sources, access to funds is very limited. Regarding the availability of climate information, existing data sources at state level exists, whereas for the Panchayat (village) or the Municipal level, significant data gaps.
- Reformation of regulations and development of incentive schemes to encourage different sectors like water, energy, mobility and buildings to address sustainability challenges



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