University of Stuttgart
Institute of Human Factors and Technology Management IAT

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CITY LAB KOCHI, INDIA

SMART CITY FINANCE REPORT

FULL VERSION AND RESULTS

Photo: Alain Dubois

mgi MORGENSTADT GLOBAL SMART CITIES INITIATIVE
GLOBAL APPROACH – LOCAL SOLUTIONS

MorgenStadt City of the Future

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IKI INTERNATIONAL CLIMATE INITIATIVE

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF TEXTBOXES

1 Introduction

This report on "Smart City Finance" for the Kochi Municipal Corporation (KMC) has been developed under the Morgenstadt Global Smart Cities Initiative (MGI). MGI, funded by the International Climate Initiative (IKI) of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), supports pilot cities in India, Mexico and Peru in the development and implementation of sustainable transformation processes and contributes to the achievement of the Sustainable Development Goals (in particular SDG 11 "Sustainable Cities and Communities"). The MGI's primary objective is to mitigate the consequences of climate change in the pilot cities, to increase their resilience to climate risks, and to preserve their natural resources better. The project is being implemented by the University of Stuttgart in cooperation with the Fraunhofer Institutes, the Frankfurt School of Finance & Management, C-HED and NIUA.

The City Lab[1] investigated the key challenges and opportunities in Kochi following the Morgenstadt City Lab methodology process and prepared a Kochi City Profile report which also includes Road Map for the city of Kochi. The Road Map comprise the series of potential measures for the future development of Kochi. The on-site discussions with stakeholder organisations (during January 2020) concluded with the Local Stakeholder Workshop held on 22nd January 2020, where the City Lab team presented 15 initial project ideas. Out of these 10 project ideas were described in detail in the Kochi City Profile report.

This report offers readers a detailed analysis of the existing alternatives of financing institutions, potential sources of financing, instruments, strategies and other economic-financial resources for the eventual implementation of adaptation and mitigation project ideas (identified as above) for moving towards a smart, resilient and sustainable city. The report is structured in 7 sections:

- Section 1: Introduction (provides overall framework the report and the genesis);
- Section2: Project ideas (discussion on the project ideas identified during the develop of the roadmap towards the sustainable development of Kochi);
- Section 3: Economic and financial barriers to the implementation of sustainable development projects
- Section 4: General financial instruments
- Section 5: Financial institutions and sources of finance in India
- Section 6: National and Regional financial institutions and sources of finance
- Section 7: Recommendations

Note: *Section 7 (recommendations) has discussed "Smart City financing options" for the prominent areas which include, energy, green building / infrastructure, water / waste water treatment and urban planning.*

[1] *The Fraunhofer society developed the Morgenstadt City Lab approach (in cooperation with the University of Stuttgart and partners from the industry), a holistic analytical framework for designing individual sustainability strategies for cities building on innovation, clean technologies and broad stakeholder dialogue.*

2 Project ideas identified as potential catalysts for sustainable development in the Kochi, India

The MGI initiative initiates a long-term and sustainable transformation process, leading to replicable, viable and sustainable solutions in relation to ecological, economic and social aspects, conceiving a city of tomorrow that uses its resources efficiently, is resilient to the challenges of climate change and with greater habitability and quality of life for its citizens.

The project ideas identified within the Road Map and on which this guide is built, were identified through the Morgenstadt City Lab methodology. This methodology was developed by the University of Stuttgart, partners from industry and the Fraunhofer society as a holistic analytical framework for designing individual sustainability

The results of each City Lab include an individual sustainability profile, a detailed analysis of specific urban sectors, the action-oriented roadmap including concrete measures and projects for sustainable urban development.

The City Lab focused on the "Energy", "Water" and "Green Buildings / Infrastructure" sectors. Below is a brief description of the project ideas identified and prioritized through the City Lab methodology, making a qualitative analysis of the needs and financing challenges for implementation, which they present.

1- Fishermen's Settlement		
Description	Many of the local fishermen in Kochi are living in informal settlements in the Coastal Regulation Zone. Each year, even without special events like the floodings from 2018 in Kochi, these settlements are flooded for around two months during Monsoon and the affected families have to move to shelters. There are different offers from the government to give housing to the people but acceptance is poor because that would mean for the beneficiaries to leave the livelihood and to move away from their workplace.	
Objectives	This project aims to develop and implement a holistic concept for a settlement for the fishermen and their families	
Main activities	1) Identification of suitable building land; 2) Involvement of the beneficiaries, survey of their needs; 3) Concept creation; 4) Implementation of the construction measures; 5) Implementation of the framework concepts (mobility concept, funding concept, ...)	
Principal Stakeholders	Kochi Municipal Corporation; Fisheries department; Kudumbashree - https://www.kudumbashree.org/ (Pradhan Mantri Awas Yojana (PMAY)); Building contractor from the private sector	
Associated costs and expenses	CAPEX	Land, construction cost, resettlement cost, etc.
	OPEX	Maintenance expenses, utilities,
Indicative means of financing	There are two possibilities for financing such a project such as - a) only government funding, b) partly funded by private sector construction company (PPP); percentage contribution from individual funding agency can vary depending upon circumstances.	
Smart financing options	Municipal bonds issued by a municipal corporation for a large-scale project. On the other hand, blended finance could be explored.	

Table 1: Fishermen's Settlement

2- Green building initiative		
Description	In this project, the combination of urban greening and urban farming is intended to create a double added value, with food production as an additional value to the sponge city effect. Current urban farming concepts are hardly economically viable so far and this project does not specifically aim at this. At the moment, it is rather unrealistic to really produce a significant part of the demanded food in a city like Kochi from urban farming. Nevertheless, this project can pave the way to economic urban farming in the long term (Thomaier et al., 2015). Different technologies like vertical farming or indoor farming are technically very sophisticated. Also, they would not have a positive effect on the sponge city effect. In this approach, we aim at using methods as simple as possible which contribute to the sponge city effect, which makes the "horizontal farming" on rooftops (open rooftop farms) and urban areas like vacant parcels and brownfields most interesting.	
Objectives	This project aims to integrate more green spaces into the city to make the city more resilient to heavy weather events and to improve the urban climate. Parts of it will be used for urban farming to create a double value	
Main activities	1) Identification of suitable areas in the city for a) Establishment of areas; b)) Greening of facades; c) Greening of roofs; d) Urban agriculture on the building; e) Urban agriculture on urban areas; 2) Quantification of the various measures in terms of their potential to contribute to the objectives above; 3) Development of a concept for the use and maintenance of the areas; 4) Implementation of first pilot projects.	
Principal Stakeholders	Kochi Municipal Corporation (KMC); Kerala Department of Town and Country Planning; Local construction / greening partner.	
Associated costs and expenses	CAPEX	Cost of construction (new building), cost of implementing green measures, equipment cost, top soil cost (in case of rooftop garden development), cost of paint (roof reflective paint), rating fees (to be paid to a rating agency)
	OPEX	Utilities expenses as applicable, maintenance expenses
Indicative means of financing	Green measures can either be financed by municipal body (out of taxes) or owner of the house / building. In the case of pilot project, individuals who own buildings are expected to finance capital costs. Individuals may approach local private sector banks and institutions for availing loans.	
Smart financing options	Large scale city-wide projects could be financed by a) large private sector commercial banks clubbing all loans to individuals together (as a cluster or group). b) local government owned institution can offer loans to individuals at competitive rates.	

Table 2: Green building initiative

3- Integrating Climate Services into the Kochi GIS-Map	
Description	A Geographic Information System (GIS) map for Kochi is currently being prepared by AMRUT as part of the new master-plan for the city (Harigovind 2020). This map includes basic geographic information like buildings, streets, water bodies, land use and utilities. Underground information is provided where possible. Furthermore, information services are to be added, for example, to provide necessary data for land- or house-buying. A data standard for this AMRUT project was also developed (Town and Country Planning Organisation and Ministry of Urban Development 2016). However, this existing project focusses on mapping the current state of Kochi. To enable foresighted planning and adaption, future developments and drivers must be considered in such an informative tool. Therefore, we propose to add climate services into this new GIS-map for Kochi, for example, scenarios for sea-level-rise. The necessary information for this mapping of climate services can be gathered in multiple ways: • Collecting already existing data of climate change induced effects, preferably from open data sources. These can, for example, be maps on flooding or maps from regional climate models on relevant meteorological parameters like temperature or precipitation. • The collected data from AMRUT can be assessed to gain information on Kochi's current climatic risks. For example, an objective classification of the urban landscape can be used for mapping the heat island magnitude (Stewart and Oke 2012). • By combining the above-mentioned climate data with the collected data of AMRUT new information layers can be created, for example, evacuation plans for floods or mapping of cultural heritage sites and their expected impact of climate change.

	The climate service data can then typically be displayed as maps in the GIS. Furthermore, they can be included into an information system, where the user can retrieve information on climatic risks for single properties or districts. Typical tools for planning or developing climate services can be connected to the GIS tool via software interfaces.
Objectives	This project aims to integrate information on future climate predictions together with assessment and information tools into the Kochi GIS-map that is currently in development by AMRUT.

Main activities	• Accessing the AMRUT GIS data and developing an interface to include climate services
	• Identification of suitable open data climate services, e.g.:
	  ○ Sea Level Rise
	  ○ Flooding
	  ○ Meteorological parameters like temperature or precipitation
	• Development of a methodology to combine the AMURT data with climate services to develop enhanced assessments (e.g. evacuation plans for flooding)
	• Stakeholder workshop

Principal Stakeholders	• AMRUT • WRI India • Kochi Municipal Corporation • District Disaster Management Authority • C-HED • National Remote Sensing Institute • Command and Control Centre
Associated costs and expenses	CAPEX: New computer systems to handle enhanced data handling may be required (in the case existing systems are inadequate) OPEX: Mainly salaries and wages, consultancy fees, software expenses
Indicative means of financing	The project could be financed out of grants (local taxes such as property tax and central or state budgetary allocations) received from Kochi Municipal Corporation (KMC) or any other sources that offer grant funding.
Smart financing options	As such this project can be combined with other large climate change adaptation or mitigation projects to

Table 3: Integrating Climate Services into the Kochi GIS-Map

4 - Urban Heat Island Mitigation Strategies	
Description	Worldwide, cities are typically warmer than their surrounding areas. This phenomenon is called the urban heat island (UHI) (Oke et al. 2017) It is also present in Kochi, despite the city being close to the sea, which can provide beneficial conditions to reduce UHI. Nonetheless, an observation study for Kochi measured an UHI-increase from up to 4.6 °C in 2012 (Thomas et al. 2014). During the on-site-visit, interviewees reported a subjective increase of the UHI effect in the last years. In view of climate change and the associated warming (Hoegh-Guldberg et al.), a further significant increase in heat stress is to be expected also for the city of Kochi. The increasing number of inhabitants will lead to further densification, construction activity and sealing, which will also increase the effect. The expected drastic rise in air conditioning in India in the next decades (Ministry of Environment, Forest and Climate Change and Ozone Cell 2019) will significantly increase anthropogenic heat sources in cities and thus the UHI. Countermeasures to adapt to these developments require intervention in local urban planning and must therefore be planned at an early stage. Effective countermeasures that can be implemented in Kochi are: • Ventilation pathways from the sea or rural areas into the city to transport colder air into the overheated districts. This will be most effective during nights. Furthermore, increased ventilation also helps to reduce air pollution. • Water bodies also have a positive effect on urban climate, as they generally help to transport air from outside, in Kochi's situation mostly colder air from the sea, into the city (Oke et al. 2017).To use this effect, the positioning of the water bodies must be planned with caution, ideally perpendicular to the coast. Also on a local scale, the water surfaces

	are beneficial for thermal comfort (Oke et al. 2017). Furthermore, they can help to provide flood protection. • Vegetation has multiple positive effects that contribute to Annex mitigate UHI: Shading and evapotranspiration reduce the thermal stress and help to improve human comfort conditions during day. At nights, vegetated areas are a source for cold air production. Furthermore, trees can remove air pollutants (Oke et al. 2017). A good example for the benefits of vegetation can be found in Kochi at the promenade at Marine Point View. • Sealed surfaces and buildings are a major contributor to UHI. Vegetated surfaces can also be used to reduce these influences, e.g. by implementing green roof or wall constructions or green road elements. • The proposed measures also are effective for other aspects in the urban system, like for example an improvement in terms of water sensitive city design to mitigate extreme water occurrences like monsoon. They can also be used as design elements to create an appealing city aesthetic. We propose to implement a pilot project that works as a proof of concept for strategies to mitigate climate change and UHI in Kochi. The pilot combines the above-mentioned measures of increased ventilation and vegetation in a localized area: The rejuvenation of a canal, ideally close to the coastline, with accompanying vegetation on its banks and on surrounding buildings. A central part of the project must be an information campaign to raise awareness and sensitivity in Kochi's population for climate change adaption and include them in the planning and implementation process. The pilot can be carried out in coordination with parallel ongoing projects like canal rejuvenation or the water-metro to minimize costs and land use.
Objectives	This project idea aims to implement a pilot that works as a proof of concept for strategies to mitigate climate change and UHI in Kochi. The pilot combines measures of increased ventilation and vegetation in a localized area: The rejuvenation of a canal, ideally close to the coastline, with accompanying vegetation on its sideways and on surrounding buildings. A central part of the project must be an information campaign to raise awareness and sensitivity in Kochi's population for climate change adaption and include them in the planning and implementation process. The pilot can be carried out in coordination with parallel ongoing projects like canal rejuvenation or the water-metro to minimize costs and land use.
Main activities	• Selection of a canal that serves as a pilot for the demonstration. • Setting up a working group of local experts to accompany the development of the concept. • Development of the concept for the canal renewal effective in terms of urban climate in coordination with the local expert group. • Quantifying the effectiveness of the proposed concept • Establishing and starting the citizen participation and information process together with local partners. • Structural implementation of the concept on the selected pilot. • Development and implementation of the education concept
Principal Stakeholders	• WRI India • C-HED • University (Cities 4 Forest Project) • Citizens
Associated costs and expenses	CAPEX: Principal expenditure will be toward canal rejuvenation, planting vegetation and plants, reflective coating on building façade, etc. OPEX: Operational expenses not envisaged unless media campaign or training is associated with the project.
Indicative means of financing	Pilot level project (restricted to a ward or small community) could be financed by KMC (out of local taxes such as property tax and state or central allocations) and other NGOs / donors. Private sector participation may be minimal (unless being taken up under corporate social responsibility (CSR) initiative.
Smart financing options	City wide initiative in this area need to be clubbed with other climate change mitigation and adaptation projects (preferably revenue generating ones) so as achieve scale adequate to raise green bonds or secure finance from other sources.

Table 4: Urban Heat Island Mitigation Strategies

5 - Kochi integrated Water Master Plan	
Description	The integrated Water Master Plan covers the following areas: • Water supply (multiple sources) • Sewage collection and treatment • Groundwater protection • Protection of surface waters (canals, sea) • Flooding through heavy rain It should be developed based on Kochi Master Plan (town planning) and involve citizens where appropriate. The Water Master Plan shall be published as a report and updated regularly, at least every 5 years.
Objectives	Development of a comprehensive Water Master Plan to coordinate the various water-related activities in Greater Kochi Area and allow for a strategic development of water infrastructure, the protection of aquatic ecosystems and the improvement of liveability in Kochi, where most inhabitants live close to a water body. As climate change with increasing heat waves, periods of water scarcity and heavy rain events threatens the water sector particularly, a coordinated planning is needed even more in the future.
Main activities	• Identification of coordinating organization • Application for funding • Start of developing Water Master Plan • Water Master Plan finalized
Principal Stakeholders	• Kochi Municipal Corporation • Kerala Water Authority • Centre For Heritage, Environment and Development • Kochi Metro Rail Limited • Pollution Control Board • Greater Cochin Development Authority • Schools/ universities • Private consultants
Associated costs and expenses	CAPEX: Procurement of advanced computer systems OPEX: Mainly salaries and wages, consultancy fees
Indicative means of financing	The project can be financed by Kerala Water Authority (KWA) and KMC funds (mainly grant funds generated out of local property taxes and / or state / central allocations.
Smart financing options	Large scale project on city level could be primarily funded by KWA (major share) and KMC (minor share) their respective funds. KMC may use its property tax revenues as grant fund to meet the cost of the project.

Table 5: Kochi integrated Water Master Plan

6 - Holistic Spatial Data	
Description	Coordinated collection of spatial data (GIS) as basis for planning and maintenance as well as for coordinated infrastructure development. Includes data on water pipes, sewer lines, drains, canals, electric lines, etc. Integrated with Command Control Centre, thus data is easily available for all legitimate users.
Objectives	To get a quick overview of available data concerning state of the infrastructure in Kochi
Main activities	• Identification of coordinating organization • Assembling existing data • Collecting primary data • Updating and extending data base
Principal Stakeholders	• Kochi Municipal Corporation • Kerala Water Authority • KSEB • CSML (data officer) • Centre For Heritage, Environment and Development • Schools/ universities • Private consultants/ GIS data providers

Associated costs and expenses	CAPEX	New computer systems to handle enhanced data handling
	OPEX	Mainly salaries and wages, consultancy fees, software expenses, etc.
Indicative means of financing	The project can be financed by KMC out of its grant funds accrued through local tax revenues such as property tax. The project is not expected to generate direct revenues.	
Smart financing options	KMC may explore possibility of combining other climate change adaptation projects and finance these out of proceeds from "Green Bonds".	

Table 6: Holistic Spatial Data

7 - Ecological apartment building		
Description	Development and implementation of demonstration apartment building, covering the following aspects: • Housing for lower and medium income groups in proximity to a metro station (densification, less individual traffic) • Water: Rainwater harvesting, own sewage treatment plant, water saving installations in households • Energy: low cooling demand, PV on rooftop • Comfortable indoor climate • Construction: heat resilient and durable • Local materials and construction techniques • Awareness campaign for residents	
Objectives Main activities	Demonstration of a best-practice sustainable apartment building in Kochi • Identification of involved stakeholders • Identification of plot • Development of detailed concept • Securing of financing	
Principal Stakeholders	• Kochi Municipal Corporation (KMC) • Centre For Heritage, Environment and Development • Confederation of Real Estate Developers' Associations of India (CREDAI) • Development company, e.g., Sobha Ltd. • Schools/ universities • Private consultants	
Associated costs and expenses	CAPEX	Construction cost of green building (ecological building), including equipment (e.g. rooftop solar PV system).
	OPEX	Utilities, salaries, maintenance expenses, monitoring expenses.
Indicative means of financing	Private sector construction company may finance construction cost, KMC can provide grant funds out of local taxes collected or central / state allocations. Local private sector housing finance institutions can also provide finance to individuals who acquire apartments in such an apartment.	
Smart financing options	Blended finance approach could be explored. Large complex of buildings can also be financed through bilateral lines of credit (e.g., KfW finance which may be available through State Bank of India or any other partner bank).	

Table 7: Ecological apartment building

8 - Decentralized solar desalination and rainwater harvesting	
Description	Main source for drinking water in Kochi is the Periyar River. Due to high water losses in the distribution network, residents far away from the water source do not have a reliable water supply and need additional supply by water tankers. Seawater desalination is a proven technology, but energy consumption is relatively high and brine disposal an unsolved issue in large-scale plants. As Kochi has a lot of sun, it is proposed to combine a decentralized seawater desalination plant with PV electricity production. Due to limited space, these PVs shall be floating on the water. Due to there being less sun during monsoon, but sufficient rain, a rainwater harvesting facility shall be combined with the desalination plant. Depending on the weather, the two water sources can be combined flexibly, thus guaranteeing water supply for around 10,000 to 100,000 residents along the coastline. Modular units can be developed, thus reducing the transport requirements of the water (via pipeline).

Objectives	To establish an alternative source of drinking water for residents of areas close to the coast (i.e. on the outskirts of the existing water supply network).	
Main activities	• Identification of involved stakeholders • Identification of plot, scale, and financing • Start piloting • Start construction of full-scale plant • Start of operation	
Principal Stakeholders	• Kochi Municipal Corporation • Kerala Water Authority (KWA) • Kerala State Electricity Board (KSEB) • Cochin Port Trust • Schools/ universities	
Associated costs and expenses	CAPEX	Cost of the proposed pilot project comprises mainly equipment cost (floating solar PV plant, reverse osmosis desalination plant and other associated equipment).
	OPEX	Operational cost (cost of operating reverse osmosis desalination plant, maintenance expenses related to all equipment including floating solar PV installation.
Indicative means of financing	Kochi Municipal Corporation (KMC) could be the principal funder of the project (on a pilot level) with contribution above 51%. KMC may use grant funds derived from taxes collected and allocations from central government. Besides, this KWA, and Cochin Port Trust can provide grants from their budgets.	
Smart financing options	Large scale project comprising a) desalination assisted through solar PV electricity generation and b) rainwater harvesting may be expected to generate revenue through sale of water. Such a project could be financed through Public Private Partnership (PPP) approach. Blended finance approach can also be explored.	

Table 8: Decentralized solar desalination and rainwater harvesting

9 - Energy efficiency audits for public and commercial buildings	
Description	As public and commercial buildings are the largest energy consumers and examples for private building owners, an Energy Efficiency Initiative focusing on public and commercial buildings is proposed. As a first step of such an initiative, energy audits of all public buildings should be carried out. All audits should be implemented using a common methodology and all reports should be prepared in the same format to enable the comparison of the results. The audit results should provide up-to-date data on the buildings, their total energy consumption per building and specific energy consumption per unit of floor area, a description of the conditions of the buildings and their HVAC equipment and lighting, an assessment of the weak points of the buildings, recommendations for efficiency measures and an assessment of the costs and expected efficiency improvements, i.e., energy reduction potential, if the measures are implemented. Based on the assessment of the energy audit results, a plan for energy efficiency investments in public buildings can be developed, starting with the low-hanging fruits with the best relation of energy savings to costs. It is proposed to publish the audits and plan online to raise awareness of energy efficiency and demonstrate the willingness of the city council and the state government to increase the energy efficiency.
Objectives	Preparation of energy audits for all public and many commercial buildings with the aim of determining economic energy efficiency measures in the buildings, which are then implemented step by step by the city and by businesses.

Main activities	• Preparation of the audit of **public buildings**:
	  ○ Identification of number of buildings in Kochi under the jurisdiction of the city administration and the number of buildings under the jurisdiction of other public authorities.
	  ○ Identification of size of these buildings (floor area, number of working places, etc.).
	  ○ Evaluation of average costs per audit.
	  ○ Definition of minimum requirements for energy efficiency audits for buildings based on the audit experiences by EMC.
	  ○ Development of an audit plan and assessment of related budget.

	• Preparation of the audit of **commercial buildings**:
	  ○ Identification of number of commercial buildings in Kochi, categorization according type and size.
	  ○ Identification of size of these buildings (floor area, number of working places, etc.).
	  ○ Evaluation of average costs per audit.
	  ○ Definition of minimum requirements for energy efficiency audits for buildings based on the audit experiences by EMC.
	  ○ Evaluation of interest of the commercial sector to join the energy efficiency audit initiative.
	  ○ Development of an audit plan and assessment of related budget based on assumptions, which share of the owners of commercial buildings is ready to join the initiative
	• Application for public support of the energy efficiency audit for public and commercial buildings according 1) and 2).
	• Implementation of energy efficiency audits for **public buildings**:
	  ○ Development of a detailed plan, how the audits should be executed, which are results are expected and how they should be presented
	  ○ Selection of e.g. 3 companies to prepare the audits based on a public call
	  ○ Preparation of the audits (this could be done in several phases since the resources will not allow to prepare all audits in parallel)
	  ○ Development of a website to prepare the audit results in a systematic, transparent and easy understandable way
	  ○ Finalization of audits and publishing the results
	• Implementation of energy efficiency audits for **commercial buildings**:
	  ○ Development of a scheme, how the subsidies are provided to the private sector for the preparation of audits (e.g. 50% co-financing)
	  ○ Development of a detailed plan, how the audits should be executed, which are results are expected and how they should be presented
	  ○ Motivation of private sector to do the audits, e.g., by cooperating with industry associations, etc.
	• Publication and evaluation of the audit results. Development of a concept, which energy efficiency measures identified by the audits shall be implemented by whom, in which framework and with which budget.

Principal Stakeholders	• Administration of the City of Kochi (Kochi Municipal Corporation - KMC) • Energy Management Centre of Kerala (EMC) • Government of Kerala, Department of Power (Kerala State Electricity Board (KSEB) • Energy efficiency services Ltd (EESL) • Industry associations, representing commercial building owners and others
Associated costs and expenses	CAPEX: Energy audit equipment, measuring instruments OPEX: Consultant fees, salaries of staff, data logging expenses and report preparation expenses.
Indicative means of financing	This project could be financed by Kerala State Electricity Board (KSEB), Energy Management Centre (EMC)- Kerala and International NGOs through operating budgets of KSEB and EMC – Kerala.
Smart financing options	Large scale project needs to be on the state level. Such a project could be financed with specific objective of implementing energy efficiency (EE) improvement measures. Cost of energy audits could be recovered from the savings generated by EE measures. Investment grade energy audits can result into financially viable EE improvement projects in these buildings (mainly commercial buildings owned by private sector entities). These audits will be conducted by Energy Service Companies (ESCOs)

Table 9: Energy efficiency audits for public and commercial buildings

10 - Pilot project for controlled charging for electric vehicles		
Description	The replacement of internal combustion engine vehicles (ICEV) by electric vehicles (EV) has several advantages: The efficiency of EVs is significantly higher (factor 3 to 4) than the efficiency of ICEV, EVs avoid air pollution and drastically reduce noise. In addition, switching to renewable energy is much easier and more efficient for EVs than for ICEVs. The government of Kerala has therefore set ambitious targets for the market launch of EVs. However, providing the charging infrastructure for EVs could become a bottleneck for the 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. The EV infrastructure development plan must consider to the expected growth of EVs depending on their types (two, three, and four-wheelers, cars, trucks, and busses). Business models and payment systems for public EV charging points must be developed as well as investment sources identified. In addition, the power supply system must be expanded in such way that the EV expansion does not lead to power shorts. KSEB has already taken the initiative to build EV charging infrastructure in Kerala to enable the state goal of bringing one million EVs onto the roads by 2022, including 3,000 buses, 200,000 two-wheelers, 50,000 three wheelers, 1,000 delivery vehicles and 100 ferries. In June 2020, KSEB short listed eight companies which offer to build 56 EV charging stations in Kerala. In the next phase 300 EV charging stations are to be set up. As part of the Kochi Smart City initiative, it is recommended to complement this initiative with a pilot project for the evaluation of controlled charging of EVs. By implementation of some pilot EV charging stations with related technologies for controlled charging, the additional load on the power grid by EV charging without controlled charging in comparison with controlled charging could be evaluated. In the case of controlled charging, the charging load is not immediately at full power when the EV is connected to the charging station, but distributed over the intended charging period, e.g., overnight. Therefore, additional load on the power grid due to EV charging is shifted from times with high load to times when the power requirement is lower, which is reducing the grid load.	
Objectives	Evaluation of technologies for controlled charging of electric vehicles to limit the additional load on the electricity system of Kochi by electric vehicles	
Main activities	• Developing a general concept for the project (motivation, possible solutions, possible project design, possible actors for implementation, related budget needed, etc.). Discussions with the Government of Kerala and KSEB about their interest and the preferred project design. • Development of the project proposal and a consortium to execute the project in Kochi. Application for funding of the project proposal. • Execution of the project Publication of the results with recommendations how controlled EV charging should be implemented	
Principal Stakeholders	• KSEB as responsible actor for building up the EV charging infrastructure • The Government of Kerala • Research institutes and/or innovative companies, which offer technologies and methods to control EV charging.	
Associated costs and expenses	CAPEX	Charging infrastructure development and associated equipment
	OPEX	Operating expenses (utilities)
Indicative means of financing	The pilot level project can be financed jointly by KSEB and Government of Kerala out of grant funds at their disposal. No revenue generation is expected.	
Smart financing options	Large-scale controlled charging project may be expected to generate revenue from charging fee. Such a project could explore through “Blended Finance” approach.	

Table 10: Pilot project for controlled charging for electric vehicles

3 Economic-financial barriers to the implementation of sustainable development project

These projects identified by the Morgenstadt Initiative are grouped under three main thematic clusters: urban planning and green infrastructure, water and energy. In addition, master plans & GIS, a cross-cutting tool across the three thematic clusters to foster the optimisation of the planning and operation of projects and initiatives, is included as a fourth thematic cluster for the purposes of this document. This is due to the scope and complexity that master plan initiatives require for their incorporation into the planning and public administration infrastructure.

The diagram below groups the Morgenstadt Initiative's project ideas into one of these four clusters.

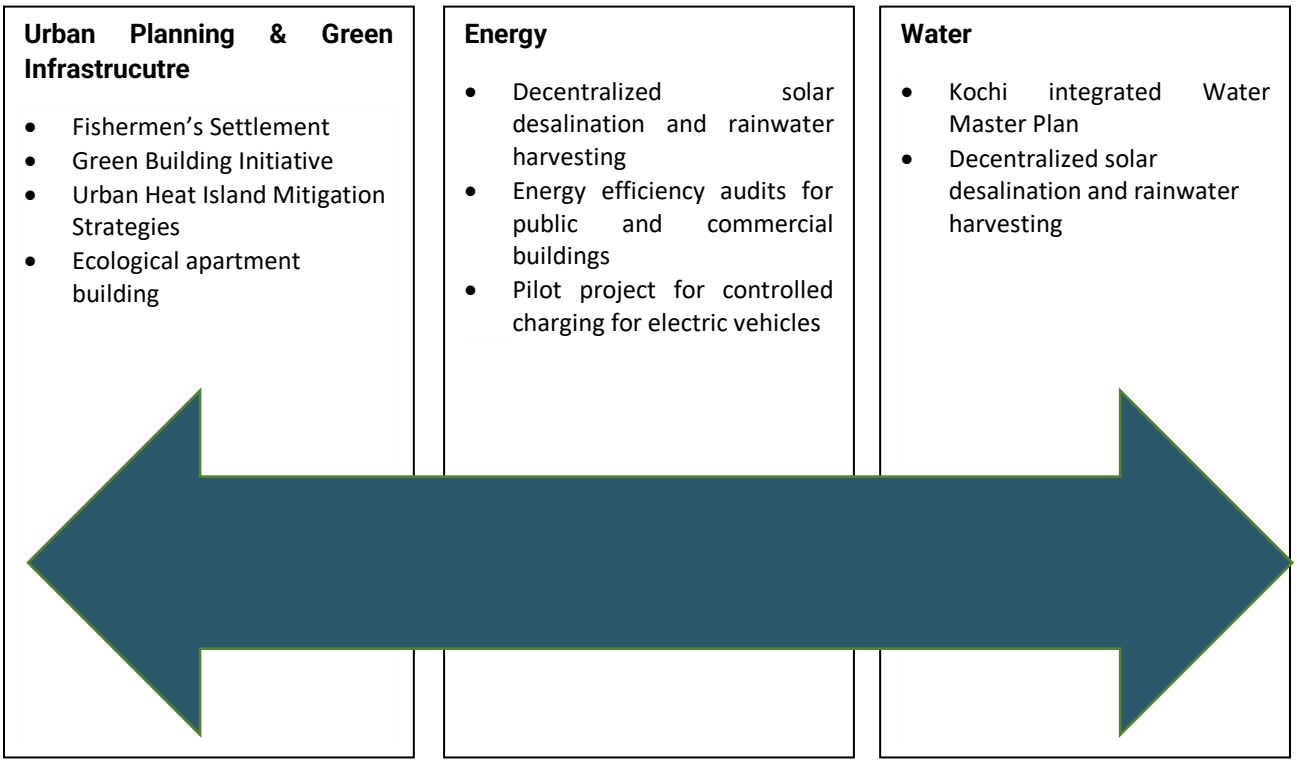


Figure 1: Diagram of 12 project ideas of the Morgenstadt Initiative within the four main clusters

Considering the thematic lines, the economic and financial barriers characteristic of each of the thematic groups are identified:

3.1 Main barriers to energy sector projects

Most of the projects in this sector generate revenue, directly (in electricity generation projects) or indirectly (as in energy efficiency projects). Power sector in India is a concurrent subject, meaning central government as well as state governments have responsibility and powers to manage the sector. Electricity generation, transmission and distribution in the state of Kerala is undertaken mainly by the Kerala State Electricity Board (KSEB). Reforms in the electricity sector has over the years have provided opportunities for Independent Power Producers to generate electricity under the state electricity regulations. Municipal authorities have

traditionally been away from this sector. On the other hand, renewable energy development is also supported through state level nodal agencies (in Kerala - Agency for New and Renewable Energy Research and Technology (ANERT) supports development of renewable energy sources). Energy efficiency efforts are coordinated by Energy Management Centre (EMC) in the state of Kerala. Some of the barriers to implementing energy projects include:

- **Inadequate financial resources** with municipal corporations. There are several pressing expenses on different fronts which require funding support. These areas and sector compete to secure limited capital available. Thus, right from conducting feasibility to implementation of energy projects need resources.
- **Lower awareness** about energy sector needs (especially energy efficiency improvement needs in government buildings)
- As mentioned earlier, municipal corporation is not directly responsible for energy sector. This creates a barrier for municipal authorities to initiate projects in power sector.
- **Inadequate staff** – Most state organisations such as KSEB or EMC have skeletal staff. These staff and officials have to manage regular operations (e.g. electricity distribution in KSEB). There may be staff shortage if a state agency has to initiate new project.

3.2 Main barriers to green building / infrastructure projects

While buildings construction and providing permissions to construct new buildings is the responsibility of municipal corporations (urban local bodies – ULBs). Central government agencies such as Bureau of Energy Efficiency (BEE) under the Ministry of Power develops new Energy Conservation Building Codes (ECBC) and Minimum Energy Performance Standards for residential and commercial buildings. However, many ULBs are slow to adopt these standards and implement them. Municipal corporations generally resist to develop projects in new areas such as green buildings. Some of the barriers to implementation of green building / infrastructure projects include:

- **Inability to secure private sector participation:** Municipal corporations generally find it difficult to secure participation of "reputed" and good private sector construction companies. This mainly due to regulations and procurement rules / procedures. These rules either elongates the process of securing participation or cannot provide adequate compensation in order to attract good and progressive companies to participate.
- **Inadequate financial resources** with municipal corporations. As mentioned earlier, there are several pressing expenses on different fronts which require funding support. These areas and sector compete to secure limited capital available. Thus, right from conducting feasibility to implementation of green building projects need resources.
- **High initial cost** – Green building projects cost about 5% to 15% higher than the conventional buildings. Thus, there is higher upfront investment. Most government organizations in India follow lowest first cost approach to procurement. This practice does not consider savings that could result as a result of green building.
- **Green infrastructure projects do not generate revenue**: Consider urban heat island mitigation projects. Such projects do not generate revenue streams. Most ULBs would find such projects to develop and implement. Considering that Kochi has several areas to address in respect of basic infrastructure development, it may not be able undertake path-breaking infrastructure projects with ease.

3.3 Main barriers to Water supply and waste water treatment

Water supply and wastewater treatment in the state of Kerala is the responsibility of the Kerala

Water Authority [2](KWA). Although amendments to the Constitution of India in 1992 regarding Municipalities introduced water and sanitation as functions to be devolved by State Governments to Urban Local Bodies, this transition is incomplete, and implementation is still at work-in-progress stage. In most states, the State Governments continue to hold responsibility over urban water supply and sanitation through state-level departments and parastatal agencies[3]. Some of the barriers to implementation of water supply and water treatment projects include:

- **Inadequate capacity** to develop and implement water projects within ULBs. Most ULBs do not have trained staff to develop large water projects.
- **Lack of financial resources:** Most ULBs do not have financial resources to implement large water supply projects. Limited resources which they collect are needed for expenses for regular operations.
- **Master plan development:** Most water projects for large cities must be well-thought out in advance. Cities need to develop masterplan to advance on a list of priority water projects. Wate water treatment also need to be structured under the master plan.
- **Lower tariff levels:** Lower water tariff leads to inadequate fund generation. In addition, lower collection of water charges is another issue that ULBs face. Consequently, ULBsfind lower revenue generation level to justify investment in new projects.

3.4 Main barriers to urban planning

Urban planning projects generally include masterplan development, structured data generation which is needed for masterplan development. Such projects do not generate revenue. Besides town planning department of the municipal corporation must initiate these projects. Main barriers to urban planning projects include:

- **Inadequate capacity:** Most ULBs have bare minimum staff (Skeletal staff) to hand town planning function. This leads to inability of ULBs to take up large scale urban planning projects. Most ULBs do not have trained staff to develop urban planning projects.
- **Lack of data:** Most ULBs do not have well-structured advanced data or GIS mapping. On the other hand, ULBs do not have climate change related data. These inadequacies lead to inability to take up appropriate adaptation projects.
- **Lack of financial resources:** Most ULBs do not have financial resources to develop new urban planning projects in a systematic manner to include Climate aspects.
- **Lack of coordination among agencies:** There is no systematic coordination by ULBs with various agencies and organisations to gather and organize data in various forms. (E.g. Many ULBs do not have satellite data (GIS mapping).

[2] *Under the Constitution of India, water is a State subject*

[3] *NIUA Report - https://smartnet.niua.org/sites/default/files/resources/NIUA-PEARL%20Good%20Practices%20Water%20Supply%20%26%20Sanitation.pdf*

4 General financial instruments

Cities play a key role in the design and development of their infrastructure and thus represent a potential promoter or deterrent to the sustainable development of urban centres. The development and operation of urban infrastructure is traditionally financed by public resources. Therefore, investments in sustainable urban infrastructure are constrained by fiscal and budgetary limitations at all levels of government. (OECD, La Fabrique de la Cite, 2012) In order to better understand alternative financing schemes for green infrastructure, the following discusses governmental and non-governmental instruments, both recoverable and non-recoverable, for the development and maintenance of sustainable urban infrastructure projects. Within the non-governmental instruments, schemes involving private and civil society participation are discussed.

4.1 Government instruments

4.1.1 Taxes

Property taxes and income taxes can be stable sources of revenue for the implementation and operation of sustainable infrastructure projects. Property tax has been a major source of municipal revenue in India as in other countries (Ahluwalia, et al., 2019). However, the potential of property tax is far from realised in India. State governments can neglect property tax as a source of revenue because of administrative challenges of coverage, assessment, valuation and the political difficulty of enforcement.

Municipal tax collection is often the only perceived option for public financing. The city's tax collection structure needs to be reviewed and reconsidered to avoid deterrence or perverse incentives that limit sustainable urban development.

Due to the limitations of these sources and the competition with multiple social, environmental and political needs, other sources of resources should be explored and utilised to the greatest extent possible.

4.1.2 Fees, permits and charges

- Fees, permits and charges are another potential source of revenue for financing the development and operation of sustainable infrastructure projects. These municipal revenue generation mechanisms can be one-off or recurrent. The most common ones at the municipal level are described below:Differentiated land development permits to contain urban sprawl
- Building rights or permits
- Traffic charges in congested areas
- Parking fees and parking meters
- Tariffs and charges for drinking water services
- Tariffs and charges for sanitation services
- Fees and charges for cleaning and waste collection services

4.1.3 Intergovernmental contributions or funding

Another eminently public source for the implementation and operation of sustainable infrastructure is national, regional or departmental/state budgets. The primary role of central and state transfers to urban local governments is to supplement the own sources of funds of urban local governments and reduce vertical and horizontal imbalances. India, the dependence of the municipal sector on the higher levels of government has increased as manifest in an increase in transfers as a proportion of total municipal revenue (Ahluwalia, et al., 2019).

Additionally, in India there are schemes, funds or trusts with resources oriented towards sustainable development objectives, which the municipality can apply for and access provided that the project is aligned with the fund's objectives, as well as the availability of resources from the fund.

4.2 Non-governmental instruments

Identifying and accessing non-governmental sources of funding, given the scarcity of resources and competing multiple needs, is key to the development of sustainable infrastructure in municipalities. Increased access to loans and bonds would help finance greater investment in green infrastructure.

4.2.1 Donations

Grants are potential sources of non-recoverable resources for the implementation of sustainable infrastructure projects.

Private donations can come from various sources such as foundations, corporations, charitable organisations, among others. This source of resources is limited and subject to the alignment of the projects with the objectives and social or environmental indicators of the donor entity.

There are also sources of grants, usually for technical assistance activities during the project profiling and design stages, such as multilateral and bilateral agencies, banks and funds. Section 5 of this document discusses these financial institutions and potential sources of grants in more detail.

In addition, for the operation and maintenance stages of urban infrastructure, financial or in-kind donation schemes exist to achieve private or civil society participation in public service activities, thus reducing operating costs for municipal or state governments. An example of such a scheme is the adoption programmes for public areas. In the United States and Canada, for example, there are road adoption or sponsorship programmes. These schemes seek the participation of civil society or private parties in the regular cleaning of roadways. In exchange for this activity, civil organisations or private entities are provided with signs acknowledging their contribution to these areas.

4.2.2 Loans

Term lending is a visible, direct form of lending to ULBs in India. Term lending consists of loans from Government sponsored institutions or funds (part publicly owned, part privately owned) such as HUDCO or PMDO and commercial loans from Scheduled Commercial Banks (nationalized, state-owned, private).

There is a relationship between the municipality's access to loans and the municipality's own revenues. The more own revenues the city has, the higher its perceived ability to re-pay (i.e., ability to pay towards interest and repayment) and therefore its access to the debt market, including loans.

Subject to the municipality's repayment capacity, associated with its revenue generation capacity, a controlled risk regarding the use of resources and a fiscal regulation that allows the use of debt as a financing instrument, municipalities could access development loans, concessional loans or special purpose loans. (OECD, La Fabrique de la Cite, 2012)

Considering that raising debt for municipal projects usually requires the participation of intermediaries or the bank itself, it is recommended to integrate a portfolio of projects that allow better economies of scale and justify the transaction costs of this participation.

However, it is important to mention that the borrowing capacity of many municipalities is limited both by their own financial status and by financial prudence regulations. In parallel, municipalities can promote private participation in sustainable infrastructure investments through collaboration and promotion of commercial loans or specific loans that can be accessed by the private sector.

4.2.3 Guarantees

Guarantees are instruments that allow borrowers to improve their financing conditions.

Guarantees are common instruments such as political risk insurance or credit enhancement mechanisms.

As far as the financial system is concerned, there are guarantee systems made up of public or mixed guarantee funds and private reciprocal guarantee companies or societies. These entities

are a complementary vehicle to financial entities. (CAF, 2022)

4.2.4 Bonds

A bond is a debt instrument issued by a company or government to finance itself. The issuer of a bond promises to repay the money lent to the buyer of that bond, usually plus a pre-fixed interest rate, known as a coupon. They are therefore usually considered to be fixed-income instruments. (Economipedia, 2022) Infrastructure bonds are direct investment vehicles that offer institutional investors long-term investment opportunities.

Green bonds, on the other hand, represent a promising vehicle for municipalities to attract private financing. Green bonds allow private investment to be channelled into green infrastructure projects. Green bonds can be issued by governments, multilateral banks or corporations. The global municipal green bond market, valued at about US$6 billion in 2015, is a relatively small (around 15%) part of the climate-related bond market, but it is fast-growing. Major players in these markets are the MDBs and investment banks. For example, urban projects account for an estimated 20–25% in the World Bank's green bonds portfolio (IUC, 2020).

However, it is important to note that part of the conditions required for the issuance of green bonds is that the issuing institutions have an excellent credit rating. Therefore, for municipalities in emerging cities, it may be more appropriate for national governments to issue these bonds. In addition, bond issuance usually requires the assistance of intermediaries or banks, which are subject to economies of scale.

4.2.5 Carbon finance

Carbon finance originated in 1997 with the signing of the Kyoto Protocol, which resulted in the establishment of international and in some cases national emissions targets and regulations to back them up (Carbon Credits, 2022). The Clean Development Mechanism (CDM) of the protocol allows a country with an emission-reduction or emission-limitation commitment to implement an emission-reduction project in developing countries. It allows countries that have unused emission units to sell this excess capacity to countries that are over their targets through certified emission reduction (CERs). There are currently two types of carbon markets, mandatory and voluntary. Mandatory markets are based on the establishment of regulations and cap-and-trade mechanisms at national, regional or state level. The most representative mandatory carbon markets are the European Union's ETS market. North America has two mandatory regional carbon markets: the Western Climate Initiative (WCI) and the Regional Greenhouse Gas Initiative (RGGI).

Voluntary markets, on the other hand, are not regulated by any government and have developed because of the interest of project developers, investors and buyers in meeting corporate climate targets.

Under the Kyoto Protocol, India's carbon trading market bagged the second highest transacted volumes in the world by generating 30 million carbon credits in the recent past[4]. It is one of the largest beneficiaries of total world carbon trade through CDM, claiming about 31%. Considering that in India, cap-and-trade systems and their regulation are at a very early stage in the best cases, the opportunity to finance sustainable urban infrastructure is mainly identified within voluntary markets.

One of the most important components for the trading of offset certificates is the verification process. This enables the generation of quality offsets and the integrity of the voluntary market. In this regard, there are institutions such as Verra, Gold Standard and Nori, which generate mitigation verification standards and processes for the trading of offset certificates.

[4] *https://www.thestatesman.com/opinion/emissions-trading-1503045172.html*

The generation of carbon offset certificates under the voluntary market allows mobilising direct investments in actions, projects and programmes for climate change mitigation and sustainable development. Offset certificates offer a complementary source of financing for investments in sustainable urban infrastructure (Climate Focus, 2022).

4.2.6 Climate finance

Climate finance is a rather broad concept, which multilateral development banks (MDBs) have tried to narrow down. Climate finance refers broadly to the amounts committed to finance climate change mitigation and adaptation projects.

Several multilateral development banks have integrated the Common Principles for Climate Finance Tracking into the Climate Finance Tracking System and developed methodologies for defining and accounting for what is considered climate finance for adaptation and mitigation.

In terms of climate finance for adaptation, a resource is considered to contribute to adaptation when the project in question (a) is framed by a vulnerability to climate change, (b) the objective of addressing the vulnerability is stated in the project as part of the project, and (c) links between project activities and the identified vulnerability are articulated.

Climate finance for mitigation is determined based on a series of actions that reduce, limit or sequester greenhouse gas (GHG) emissions, mainly recognising investments that result in structural changes towards renewable energy and low-emission transport. Recognition of energy efficiency investments for climate change mainly occurs when there is an early life-stage replacement of existing inefficient equipment with more efficient alternatives. Multilateral banks have created a list of activities eligible for funding under what is considered climate change mitigation financing (IDB, 2019).

With their expertise, technical assistance, and structuring abilities, MDBs can play a role from the early stages of financing through to later stages of operations. In addition to direct debt and equity finance, MDBs can: provide loan guarantees; offer in-house project preparation and technical project appraisal; undertake deal structuring; and generally, support developers through high-risk phases.

4.3 Mixed Instruments and other sources of resources

4.3.1 Public Private Partnership

Public-private partnerships (PPPs) can be broadly defined as long-term contractual arrangements between an operator/company (or consortium) and a public entity. Under this arrangement, a service is provided, the provision of which usually requires investment.

Unlike traditional public procurement, where the private contractor simply designs and/or builds what the public entity requires, public-private partnerships involve greater private participation. Under PPP schemes, a private operator bids for a contract to design, finance, and manage the risks associated with the provision of the target service. In return, the private operator receives payments from the public entity or payments by the users, during the term of operation and maintenance of the infrastructure.

Generally speaking, there are two families of PPPs: concessions and private finance initiatives. These two families differ from each other mainly in the remuneration scheme of the private operator. In concessions, the remuneration comes from user payments or substantially from user payments, so that the demand risk is borne by the private operator. In contrast, in private financing initiatives, remuneration is associated with access to infrastructure and with the operator's compliance with certain performance indicators. Therefore, in the case of private finance initiatives, the demand-side risk for the private operator is much lower.

Financing through public-private partnerships allows the implementation of large infrastructure projects that would be too costly to be

implemented unilaterally by the public or private sector. At the same time, the experience and expertise that the private sector can bring to the table promotes efficiency and effectiveness in the implementation of sustainable urban infrastructure. (OECD, La Fabrique de la Cite, 2012) Cities in developing countries increasingly welcome PPPs as an instrument for bridging the infrastructure investment gap, particularly given their limited access to capital markets. For example, several mass rapid transit (MRT) PPPs have been developed or are under development in India, including for metros in Mumbai, Hyderabad, and Chennai (IUC, 2020).

4.3.2 Incremental tax financing

Tax Incremental Financing (TIF) is an economic development tool used to promote the recovery of abandoned or dilapidated urban areas. TIF allows cities to create special redevelopment districts (e.g., transportation reinvestment zone) and make public improvements in those areas to spur further development. Once a district or area is designated as TIF, property tax revenues are frozen for a period of 15-35 years at the pre-revitalisation value, referred to as "base taxes". Incremental property taxes, i.e., above the "base taxes", or a portion thereof, are received by the revitalisation agency or the municipality itself to repay the debt acquired or bonds issued. After the end of the established TIF period, the taxes flow in the traditional way as general government revenues. (OECD, La Fabrique de la Cite, 2012).

Using TIF, cities can capture value by earmarking any increase in property tax revenues over the “base” attributable to new developments into an escrow account separate from general fund revenues. Usually, TIF districts or areas initially benefit from federal or state grants or other tax incentives with which the funds obtained under the TIF scheme are supplemented to achieve revitalisation objectives. These revenues can be used to retire existing infrastructure debts or provide improvements associated with the new development. These revenues can also be further leveraged to secure new debt by using them as a pledge to issue bonds. In addition to property tax, potential increases in local sales and income tax revenues can be also used for TIF value capture.

TIF schemes are widely used in the United States. The establishment of TIF schemes requires framework legislation that can regulate these schemes. Usually, these schemes allow municipalities to borrow or issue bonds whose source of repayment is incremental property tax revenues resulting from capital investments in urban infrastructure.

4.3.3 Tax reduction schemes

One of the incentive schemes for investment in sustainable urban infrastructure with the greatest diversity of applications are tax reduction schemes, be it property taxes, income taxes, accelerated depreciation, tariff reductions or even reductions in vehicle ownership taxes.

Tax exemptions or reductions provide incentives for investments or actions by the private or civil sector in sustainable infrastructure or technologies.

An example of this is the scheme used in Mexico City, where private entities can "adopt" medians or pavements on major thoroughfares in exchange for reductions in property taxes.

4.3.4 Non-monetary sources of support

In-kind donations and volunteering are examples of non-monetary sources of support.

Volunteering is at the heart of community action and is often the most flexible and effective way to retain social and public support for the

conservation of sustainable urban infrastructure. (Centro de Agroforestería para el Desarrollo Sostenible Universidad Autónoma de Chapingo, 1998)

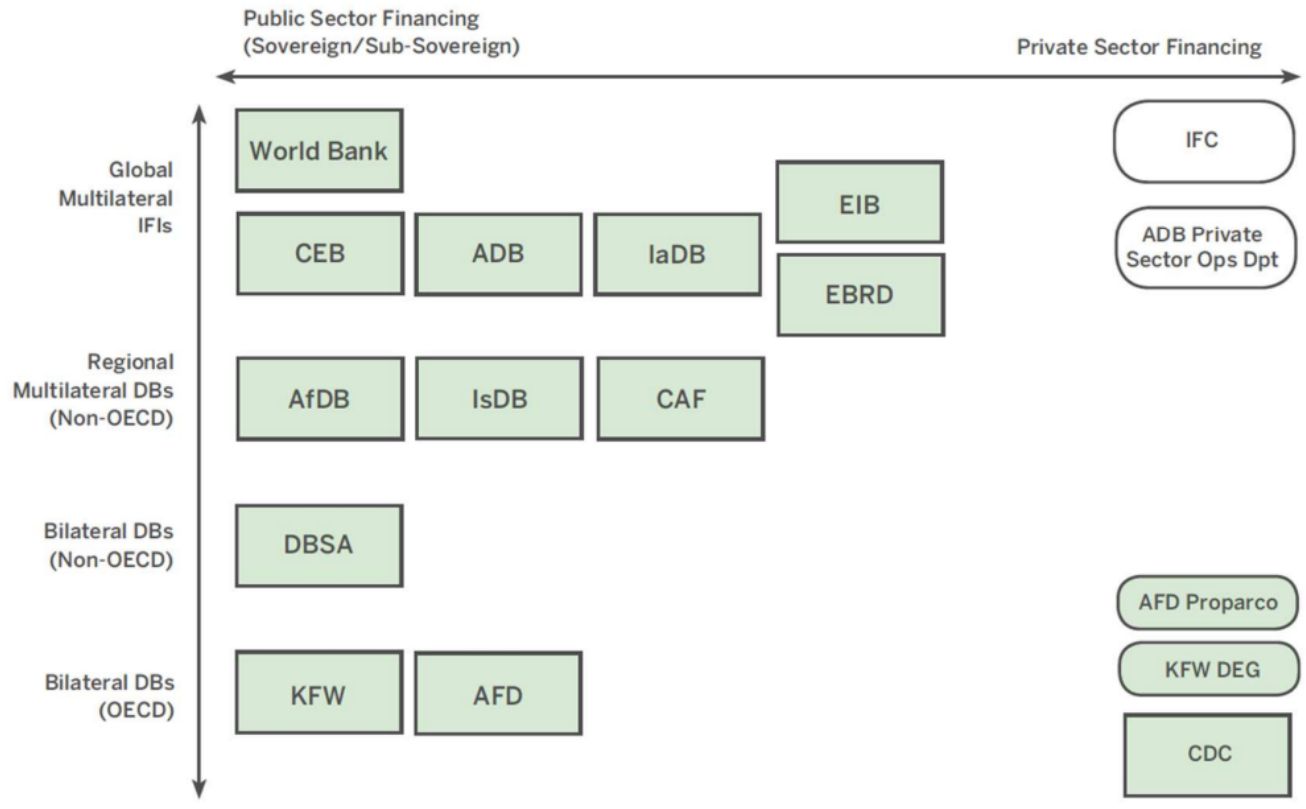
5 Financial institutions and sources of finance in India

This section presents a brief overview of the main financial institutions and sources of financing in India for sustainable infrastructure projects. International, multilateral and bilateral institutions and national institutions that offer some type of instrument that could partially or fully finance investments in sustainable urban infrastructure are presented from general to particular.

5.1 International financial institutions

5.1.1 Multilateral Development Banks

Multilateral Development Banks or MDBs are institutions that provide financial support and economic advice for economic and social development in developing countries (Banco Mundial, 2022). International Financial Institutions (IFIs) can provide both public sector financing and private sector financing. Figure 2: IFI Typology along Public vs. Private Sector Financing**Fehler! Verweisquelle konnte nicht gefunden werden.** provides an overview of various actors in the global development finance landscape.



Source: Future Cities Catapult (2014)

Figure 2: IFI Typology along Public vs. Private Sector Financing

World Bank

The World Bank is a multinational organisation specialising in finance and aid. Its purpose is to help meet development challenges and reduce poverty through low-interest loans, interest-free credit at the bank level and economic support to developing nations. The World Bank Group has 189 member countries. It is made up of 5 institutions:

- IBRD (International Bank for Reconstruction and Development, which lends money to middle-income and low-income governments with borrowing capacity).
- IDA (International Development Association) provides interest-free loans and grants to the poorest countries. IBRD and IDA together make up the World Bank.
- IFC (International Finance Corporation) is the largest global development institution focused on the private sector. It finances investments and mobilises international capital and advises governments and businesses.
- MIGA (Multilateral Investment Guarantee Agency) was established in 1988 to promote foreign direct investment in developing countries to promote economic development, reduce poverty and improve people's lives. It provides policy guarantees to investors and lenders
- ICSID (International Centre for Settlement of Investment Disputes) provides conciliation and arbitration in international investment disputes.

The World Bank in India

Source: *https://projects.worldbank.org/en/projects-operations/projects-summary?countrycode_exact=IN*

As of July 2022, the World Bank reports 113 active projects. Many of these are related to sustainable urban infrastructure in the areas of water, energy, urban planning and development, digitalisation and smart technologies. A few examples are listed below:

1. ***Karnataka Urban Water Supply Modernization Project***. This project aims to provide city-wide access to a continuous piped water supply in the eligible cities in the state of Karnataka, and to strengthen service delivery arrangements at the city level.

2. ***Madhya Pradesh Urban Development Project.*** This project aims to enhance the capacity of MPUDC to improve coverage of key urban services and increase the revenue of participating urban local bodies. This project will have two components: (a) institutional development; and (b) urban investments. The first component, institutional development is to support the MPUDC, the Municipal Reforms Cell (MRC), and the participating Urban Local Body (ULBs) to build their capacities to improve coverage of urban services in the state.

3. *Chennai City Partnership: Sustainable Urban Services Program.* This project aims to strengthen institutions and improve quality and financial sustainability of selected urban services in the Chennai Metropolitan Area (CMA).

4. *Jharkhand Municipal Development Project.* The project aims to provide improved access to basic urban services and management capacity in participating Urban Local Bodies (ULBs) in Jharkhand. This project has three components: 1) Urban Infrastructure Improvement, 2) Institutional Development and 3) Project Management and Implementation Support.

Textbox 1: World Bank

Asian Development Bank

It is a is a regional development bank established on 19 December 1966, which is headquartered in the Ortigas Center located in the city of Mandaluyong, Metro Manila, Philippines. The bank also maintains 31 field offices around the world to promote social and economic development in Asia. The bank admits the members of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP, formerly the Economic Commission for Asia and the Far East or ECAFE) and non-regional developed countries. From 31 members at its establishment, ADB now has 68 members.

ADB's public sector financial products are extended to governments and public sector entities, such as state-owned enterprises, in all developing member countries (DMCs). ADB uses a classification system to determine the eligibility of DMCs to borrow from its Ordinary

CapitalResources (OCR), at near-market terms, or at concessional OCR loan (COL) terms, or to receive grants from the Asian Development Fund (ADF).

Following are some financial products offered by ADB:

- Loans: Most OCR lending is at the London interbank offered rate (LIBOR). LIBOR-based lending (LBL) gives borrowers a high degree of flexibility. It offers a choice of currency and interest rates as well as a wide selection of repayment terms and the ability to change the original loan terms during the life of the loan. Concessional OCR lending is also available at very low interest rates to help reduce poverty in ADB's poorest DMCs. ADB also offers local currency loans to reduce currency mismatches in DMCs. Borrowers can change the interest rate basis during the life of the loan.
- Grants. ADB's Asian Development Fund (ADF) offers grants that help reduce poverty in its poorest borrowing countries.
- Technical Assistance: Technical assistance helps DMCs formulate development strategies, implement projects, improve capacity, promote technology transfer, and stimulate regional cooperation.
- Debt Management Products: ADB's public sector debt management products allow DMCs or their guaranteed entities to reduce economic volatility and borrowing costs, improve access to capital markets, and free up scarce financial resources for economic development. These come in the form of interest rate swaps, cross currency swaps, and local currency swaps.

The Asian Development Bank in India

Source: https://www.adb.org/projects/country/ind

As of July 2022, the Asian Development Bank reports 208 active projects in India. Of these, 35 correspond to water and other urban infrastructure and services. A few examples which could be of interest in the context of the Morgenstadt Initiative are listed below:

1. ***Strengthening Climate Change Resilience in Urban India***. The programme aims to improve institutional capacities of the Government of India to identify, plan, invest in, and respond to climate change and disaster-related risks in vulnerable cities and towns across India. The key objectives of the TA are to (i) mainstream urban climate change resilience in policies, strategies, and plans at the national, state, and city levels; (ii) strengthen structural and non-structural investments in selected cities; and (iii) build strong government institutions across the central, state, and local levels.

2. ***Karnataka Integrated Urban Water Management Investment Program***. The program aims to improve water resource management in urban areas in a holistic and sustainable manner. Investment support will be provided to modernize and expand urban water supply and sanitation (UWSS) while strengthening relevant institutions to enhance efficiency, productivity, and sustainability in water use.

3. ***Building-Coastal Resilience through Nature-Based and Integrated Solutions***. The project is technical assistance program that will support DMCs based on demand and potential impact and will explore linkages with other ADB programs.

4. ***Bihar Urban Development Investment Program.*** The investment program will improve and expand the water and sewerage infrastructure in the four towns and help urban local bodies (ULBs) of the four towns. The infrastructure owners to ensure discipline and structures for operations that would result in sustainable O&M.

5. ***Strengthening Integrated Flood Risk Management.*** The technical assistance aims to strengthen the design and implementation of Integrated Flood Risk Management (IFRM) solutions, enhancing knowledge and application of IFRM strategies in DMCs. The TA will provide targeted technical support for program and project preparation and promote more holistic IFRM solutions, including basin-scale and nature-based solutions.

Textbox 2: Asian Development Bank

5.1.2 Multilateral financial institutions

Multilateral financing institutions are banks and funds also focused on financing developing countries, but differ from multilateral development banks, as defined by the World Bank, in that they have a smaller membership structure and specialise more in certain sectors and activities.

An example of a multilateral financing institution is the European Investment Bank.

European Investment Bank

The European Investment Bank is the bank of the European Union and operates throughout the EU and in more than 150 other countries. It was founded in 1958 and its shareholders are the EU Member States. The EIB contributes to improving the quality of life by supporting public and private sector investment projects, either directly or indirectly through local financial intermediaries. The EIB finances economic, environmental and social infrastructure development; private sector development; climate change mitigation and adaptation.

The EIB's products include medium and long-term loans on attractive terms, loans combined with grants or subsidies, and advisory services to facilitate and accelerate investment. The EIB offers loans above EUR 25m directly. For smaller loans, it opens credit lines to financial institutions which, in turn, lend the money to creditors. Approximately 90% of its funds go to EU countries.

The European Investment Bank in India
Source: https: //www.eib.org/en/projects/all/index.htm
As of July 2022, the European Investment Bank reports 35 projects in which it has invested since its inception in India. Of particular interest in the framework of the project ideas identified in this document are:
1. ***India solar power - Tamil Nadu solar energy***. The project is an allocation under the SBI INDIA SOLAR POWER framework loan. The loan will contribute to financing two photovoltaic (PV) power plants of 216 MW and 72 MW (including grid connection) which are part of the same development but implemented under different special purpose vehicles (SPVs).
2. ***IIFCL ENERGY SUSTAINABILITY & CLIMATE ACTION FL.*** The operation consists of a framework loan for the support of small to medium sized renewable energy and energy efficiency investments in India.

Textbox 4: European Investment Bank

5.1.2 Aid Coordination Groups

USAID

USAID is the United States Agency for International Development. It was created in 1961. It is one of the world's leading aid agencies. Its focus is on results with a dual purpose: promoting US interests and improving life in the developing world.

USAID works in more than 100 countries. Its main objectives are currently:

- Promoting Global Health
- Supporting global stability
- Providing humanitarian assistance
- Catalysing innovation and partnership
- Empowering women and girls

In 2020 alone, USAID disbursed more than $22 billion globally for emergency and development assistance. Of this total, approximately $1 billion went to the energy, environmental protection and water sectors.

Sectors supported include energy, environment and infrastructure. USAID's Climate Strategy 2022-2030 focuses on reducing global

greenhouse gas emissions and helping partner countries build resilience to climate change.

USAID partners with Government of India to support clean energy and environmental reform; combat climate challenges; increase access to health for the most vulnerable; improve the livelihoods of women and girls; improve education outcomes; encourage open, inclusive, and secure digital ecosystems and inclusive economic growth; and bolster the COVID-19 response in India and across the world.

USAID in India

Source: *https://www.usaid.gov/india/our-work*

USAID's main active projects in India are focused on supporting a strategic partnership that promotes shared U.S.-Indian interests. These programmes are identified as relevant to the assignment:

1. USAID Helps the Government of India Implement Energy-Efficient Solutions.

USAID supported the first large-scale rollout of electric vehicle public-charging infrastructure with 60 public charging stations installed in three Indian cities in 2020. USAID support also helped the Government of India develop a national energy-conservation building code and increased the energy efficiency of over 10,000 buildings.

2. USAID Improves Water and Sanitation for Underserved Communities.

USAID is working with slum communities in 15 cities to improve waste management, increase health awareness, and improve delivery of water and sanitation facilities among the underserved.

3. USAID Leverages Innovative Finance in Transition to Clean Energy.

In March 2021, USAID and the U.S. International Development Finance Corporation (DFC) announced joint sponsorship of a new $41 million loan portfolio guarantee designed to bolster Indian micro, small and medium enterprises' (MSMEs) ability to invest in rooftop solar panel installation. The loans will enable MSMEs to access reliable clean power and reduce energy costs, while enabling India to decarbonize its industrial sector and generate new green jobs.

Textbox 5: USAID

UKPACT

UK PACT (Partnering for Accelerated Climate Transitions) is a programme of the UK's International Climate Finance (ICF) portfolio. The programme is jointly led and funded by the Foreign, Commonwealth and Development Office (FCDO) and the Department for Business, Energy and Industrial Strategy (BEIS). The UK is committed to tackling climate change and is investing £11.6 billion through ICF over five years to March 2026.

The aim of the programme is to implement and increase the carbon emission reduction ambitions of eligible countries, in line with their Nationally Determined Contributions (NDCs). All UK PACT projects work to accelerate partner countries' transition to low-carbon development.

UK PACT delivers impact through a combination of a) grant funding for capacity building and b) rapid mobilisation and transfer of experience and skills.

The mechanisms through which UKPACT achieves these objectives are threefold:

- Country programmes
- Shared skills and secondments
- Green Recovery Challenge Fund

Country Programmes provide grant funding for capacity development projects in line with priorities identified in collaboration with partner countries. These capacity building projects are delivered by selected implementing partners (such as NGOs, businesses, academia). The

projects work in close collaboration with key government stakeholders at local, regional and national levels.

Country programmes currently exist in China, Colombia, Indonesia, Kenya, Malaysia, Mexico, Nigeria and South Africa.

The *Skills Sharing* Mechanism provides short-term transfer of skills and knowledge between UK experts and partner country governments to help them achieve ambitious decarbonisation targets. Under this mechanism, work is carried out to provide advice and strengthen capacity and knowledge in multiple climate mitigation sectors. Experts are deployed on a demand-driven basis directly from partner countries to provide rapid and targeted support in the areas of most strategic importance.

Also, under this mechanism UK PACT can provide longer-term *secondments* (6 months to 2 years) in key government institutions. Secondments offer the temporary transfer of staff through the UK government to the governments of UK PACT partner countries, either through UK government officials or local experts recruited through the UKPACT programme.

The third mechanism, the *Green Recovery Challenge Fund* (GRCF) seeks projects that support the acceleration of the low-carbon transition for eligible countries in Latin America, Sub-Saharan Africa and Asia.

Calls for projects are published periodically under different objectives and themes. As of 2022, projects have been supported on the themes of electrification of mobility, energy transition and nature-based solutions. This year's calls are on MRV tools for forests, land use and agriculture and greening of financial systems.

Applications to the GRCF is a two-step process: Expression of interest followed by a full proposal for shortlisted applicants. Only organisations registered as non-profit organisations are eligible to be the Lead Implementing Partner of a proposal/consortium. For-profit organisations can participate in the call for proposals as partners within a consortium.

UKPACT in India

Source: *https://www.ukpact.co.uk/projects*

Under the UKPACT programme as of July 2022, 5 projects have been identified, four of which have been funded by the Green Climate Recovery Fund and all 5 are about mobilising capital for projects that contribute to climate compliance and ambition in India. Some of the most relevant UKPACT projects in India include the following objectives:

1. Institutional capacity building framework program to accelerate adoption of electric mobility in public transport in India.

Complementing the Smart City Mission of India, this project aims to overcome the projected significant institutional capacity gaps in a future where EVs are expected to be an important component of smart cities. With support from the Kakinada Smart City Corporation, the project aims to develop a comprehensive institutional capacity and skills development program for electric mobility with a focus on public transport – and testing in Kakinada Smart City.

2. Strategy and action plan for electrification of public transport and intermediate public transport in Indian cities.

This project aims to create a strategy and action plan for electrification of buses and intermediate public transport in two cities in India – Ahmedabad and Mehsana. It also aims to create stakeholder networks to implement the action plan and undertake capacity building of public agencies and intermediate public transport operators.

Textbox 6: UKPACT

GIZ

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) is an enterprise of the Federal Republic of Germany working in the field of international cooperation for sustainable development worldwide.

GIZ works mainly on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ) in more than 130 countries in Africa, Asia, Latin America and implements projects in the Mediterranean, the Middle East, Europe, the Caucasus and Central Asia.

GIZ offers technical assistance through national or international experts and partners on a short- or long-term basis, mainly focused on strengthening the internal capacities of partner institutions.

Some of the themes supported by GIZ are: climate, environment, natural resource management, economic development and employment, governance and democracy, project management, rural development, security, reconstruction and peace, social development, sustainable infrastructure: water, energy, transport, among others. (GIZ, 2022).

GIZ in India

Source: *https://www.giz.de/en/worldwide/368.html*

For over 60 years, GIZ has been working jointly with partners in India for sustainable economic, ecological, and social development. The thematic areas of GIZ in India are: i) Energy; ii) Environment, Climate Change and Biodiversity; iii) Sustainable Urban and Industrial Development and iv) Sustainable Economic Development. GIZ has 12 active programs in the area of sustainable infrastructure in India:

1. Sustainable Urban Development – Smart Cities (SUD-SC).

The project supports approaches for sustainable urban development in the area of integrated planning, provision of pro-poor housing and basic services with particular focus on water, wastewater and solid waste management. The project follows a multi-level, multi-actor approach, strengthening actors at national, state and municipal levels.

2. Climate Smart Cities

In close cooperation, Deutsche GIZ and the MoHUA develop methods to integrate climate aspects into the Smart Cities Mission in a result-oriented manner. In three partner cities, focused efforts in selected fields of municipal services will be implemented and monitored. These will be upscaled to other Smart Cities and multiply the effects to achieve the climate goals by the government.

3. Establishing an open platform for innovation in Green Urban Mobility in India (Living Lab, develoPPP).

In close partnership with Bosch Ltd. India, the project has established the Living Lab as a multi-stakeholder platform in Bengaluru. It promotes a methodology that can be replicated across Indian cities to foster collaboration on innovations in the area of green urban mobility.

Textbox 7: GIZ

KFW

KfW is one of the world's leading promotional banks. Its financing and promotional services are aligned with the UN 2030 Agenda and contribute to the achievement of the 17 Sustainable Development Goals (SDGs).

To this end, it provided funds totalling €107 billion in 2021 alone. Of this amount, 33% was used for climate and environmental protection. It finances its promotional business almost entirely through the international capital markets. The focus areas for KFW's promotion and financing are:

- Promotion of small and medium-sized enterprises and start-ups
- Provision of share capital
- Housing energy rehabilitation programmes

KFW in India

Source: *https://www.kfw-entwicklungsbank.de*

India is one of Germany's "global development partners". On behalf of the German Federal Government, KfW promotes programmes and projects aimed at advancing renewable energy sources and energy efficiency, sustainable urban development and transport systems, and environmental protection and resource conservation. Climate change mitigation and combatting poverty are the top priorities. India has been supported with crisis response programmes during the coronavirus pandemic. The following are some examples of projects supported by KFW in India:

1. Promotion of energy-efficient residential buildings in India (investment).

The project comprises the provision of a credit line of up to EUR 250 million to the State Bank of India (SBI) to finance loans for energy-efficient, new urban buildings. The project is intended to contribute to energy conservation and the reduction of greenhouse gas emissions in India's residential building sector (module objective). In this way, the project contributes to a broad-based, technically and economically efficient as well as socially and ecologically sustainable energy supply (DC program objective).

2. Climate-resilient reconstruction after flood disaster in Kerala II.

KfW is providing an FC development loan (low-interest loan) in the amount of EUR 80 million as a credit line to the Public Works Department, which is to be implemented in the Kerala State Transport Program. The FC development loan thus supports the Government of Kerala's goal of a green, sustainable and resilient Kerala and also contributes to SDG 9 - Resilient infrastructure and sustainable industrialization, as well as SDG 13 - Take immediate action to address climate change and its impacts.

3. Climate Credit Kerala

The proposed FC module is to support the targeted reform efforts through Policy Based Lending (PBL). This instrument will support the government's plans to implement structural and forward-looking reforms embedded in the Rebuild Kerala Initiative and a reform program currently being prepared by the World Bank. The overall objective of the FC module is to improve the resilience of the state of Kerala to the future impacts of natural disasters and the effects of climate change.

Textbox 7: KFW

- Support for measures to protect the environment
- Educational financing for private clients.
- Financing programmes for municipalities and regional promotional banks
- Export and project finance.
- Promotion of developing countries and emerging economies
- Financing and advisory services for companies in developing countries and emerging economies

The KFW Group consists of three entities. KfW IPEX Bank supports the German and European economies with project and export financing. DEG (Deutsche Investitions- und Entwicklungsgesellschaft), which finances companies worldwide, mainly private companies active in developing countries and emerging economies. And the KFW Development Bank supports development in developing countries and emerging economies by promoting climate and environmental protection on behalf of the German federal government.

KfW Development Bank support is tailored to the different requirements and conditions of the respective partner country. The financing model chosen depends on the size of a country's debt, its economic output and level of development, the performance capacity of the project partner, as well as the type of project. Funding models include grants and pure loans. The conditions for these types of loans are particularly favourable (interest, term). The Development Bank supports programmes in Africa, Asia, Latin America and South Eastern Europe. Financial Cooperation

(FC) is guided by the country strategies developed by the Federal Ministry for Economic Cooperation and Development and the development strategies created by the partner country. (KFW Development Bank, 2022)

AFD

The Agence Française de Développement (AFD) group consists of three entities: the Agence Française de Développement (AFD), in charge of public sector and NGO financing, research and training in sustainable development; Proparco, focused on private sector financing; and Expertise France, the technical cooperation agency. The group is responsible for the implementation of France's development and international solidarity policy. It does this through its public sector and NGO funding activities, research work and publications, training in sustainable development and awareness-raising with the aim of fostering transitions towards a fairer and more resilient world.

The AFD works in 115 countries, in the French overseas territories, as well as in territories in crisis.

AFD supports projects and programmes on climate (with the ambition to reach 100% Paris Agreement activity), gender equality, biodiversity, peace, education and health, thus contributing to the achievement of the Sustainable Development Goals. The AFD with a wide range of innovative financial tools. Among them are identified:

- Lending. Within lending, AFD has sovereign loans (loans requested or backed by countries), non-sovereign loans (to local authorities, public institutions and NGOs, without government guarantee), loans to private sector companies with public service functions, concessional loans (with below-market interest rates), loans with variable maturities and repayment terms (e.g. "counter-cyclical" loans indexed to the international price of a commodity). As of 2018, 83% of AFD's funding was in the form of loans.
- Funding for non-profit organisations (NGOs) and civil society organisations. The AFD has a funding programme for French civil society organisations, as well as funding for organisations with projects
- requiring an investment of less than €300,000, which are
- supported through the Micro Projects Agency.
- Fund for the Transfer of Expertise and Experiences through which technical cooperation programmes and project preparation studies in developing countries are financed.
- Guarantees for the reduction of the risk assumed by local banks when allocating a loan, in order to facilitate access to finance for small businesses and microfinance institutions.
- The AFD 2050 Facility supports some 30 developing countries, including the most vulnerable and high emitting countries, in their transition to a low-carbon and resilient development model. The mechanism supports technical cooperation activities and capacity building. The mechanism is implemented together with institutional support from partner countries, such as government ministries, universities, research centres and think tanks, and stakeholders from the public and private sectors and civil society.
- The Sunref programme supports economic actors in developing and emerging countries with loans, investment grants and technical assistance to finance companies' green transition projects. Through Sunref, projects linked to energy efficiency, renewable energy, natural resource management and environmental protection can be financed.
- The AGREENFI Facility provides local financial institutions with financial resources and technical assistance for

the agricultural and rural development sectors.

Project preparation funds are used to finance feasibility studies and technical assistance to prepare mainly future investment projects with climate co-benefits. These funds are managed by AFD, but financed by other donors, mainly from the European Union.

In addition to financial tools, AFD develops research, training and awareness-raising activities. (AFD, 2022)

AFD in India

Source: *https://www.afd.fr/en/carte-des-projets?page=all&view=start*

A partner of India since 2008, AFD works in agreement with Indian authorities to promote green and inclusive growth. It operates through loans to state and public enterprises as well as through technical assistance programs. AFD's goal is to support sustainable urban development, energy transitions, and ecological preservation in India through an integrated and innovative approach. The following are some examples of projects supported by AFD in India:

1. *Supporting sustainable use of water resources in Pondicherry*

The project aims to provide an uninterrupted supply of water to Pondicherry's inhabitants. Rehabilitation of water infrastructure and innovative technological solutions are at the heart of the project. AFD will also provide technical assistance to the PWD in preparing different studies necessary for: i) devising a sanitation plan for those areas that are not connected to the system; ii) technical capacity building for an efficient management of the facilities and iii) the provision of the required management tools.

2. *Promoting sustainable low-carbon mobility in Nagpur*

AFD is supporting the sustainable urban mobility policy of Nagpur. It involves the construction of a light metro, which will meet the new needs generated by the city's economic growth. This will result in a safe, efficient, affordable and low-carbon transport system. The project will focus on the measurement of climate impacts related to urban mobility.

3. *Helping Kochi sustainably restructure its urban mobility*

AFD supports the city of Kochi in the construction of a light metro and the restructuration of its urban mobility. An innovation-driven project that greatly contributes to transforming Kochi into a Smart City.

Textbox 8: AFD

5.1.3 Specialised environmental or climate finance funds

Global Environmental Facility (GEF)

The Global Environment Facility was established at the Rio Earth Summit in 1992. Since then, it has provided more than $21.7 billion in grants and mobilised an additional $119 billion in co-financing for more than 5,000 projects and programmes. It is the largest multilateral trust fund focused on enabling developing countries to invest in nature and supports the implementation of major international environmental conventions. In other words, the GEF provides grant and co-financing support to enable developing countries and countries with economies in transition to meet the objectives of environmental conventions such as the United Nations Framework Convention on Climate Change (UNFCCC), the Stockholm Convention on Persistent Organic Pollutants, the Convention on Biological Diversity and others. These international conventions provide the GEF with strategic guidance for the operation of its financial mechanisms.

GEF funds are provided by participating donor countries and are made available to developing countries and countries with economies in transition. Funds approved by its Board are transferred through 18 agencies (including the IDB, CAF and the World Wildlife Fund among others) to governmental and non-governmental institutions implementing projects and programmes in recipient countries.

GEF in India

Source: *https://www.thegef.org/projects-operations/country-profiles/india*

India is a member of a constituency comprised of the following countries: Bangladesh, Bhutan, India, Maldives, Nepal, Sri Lanka. As of July 2022, the GEF reports 103 projects in its portfolio in India, in addition to other regional/global projects where India is also a recipient. The projects and programmes are mainly focused on climate change, biodiversity and waste management. Some of the projects approved in the area of sustainable infrastructure are listed below:

1. *Sustainable Cities Impact Program*

This programme aims to support cities pursue integrated urban planning and implementation that delivers impactful development outcomes with global environmental benefits (GEBs).

2. ***Electrifying Mobility in Cities: Investing in the Transformation to Electric Mobility in India***

This programme aims to enable the GoI and relevant stakeholders to make the transformative shift to de-carbonize transport systems, catalyse access to finance for a large-scale adoption of EV across vehicle segments and reduce air pollution in cities by promoting scale-up of electric mobility in India.

Textbox 9: GEF

Green Climate Fund (GCF)

The Green Climate Fund is the world's largest climate fund, with a mandate to help developing countries scale up and realise their Nationally Determined Contribution (NDC) ambitions towards low-emission and climate resilient pathways.

The Green Climate Fund's resources come mainly from country contributions. The first resource mobilisation in 2014 saw USD 8.310 million in confirmed commitments. The first GCF-1 replenishment raised USD 9.865 million in confirmed commitments. Since its inception, it has financed more than 100 projects through different funding mechanisms.

The GCF can structure its financial support through a flexible mix of grants, concessional debt, guarantees or equity instruments to leverage blended finance and attract private investment for climate action in developing countries.

The GCF is mandated to invest 50% of its resources in mitigation and 50% in adaptation in grant equivalent. At least half of its adaptation resources must be invested in the most climate-vulnerable countries.

GCF operates through a network of more than 200 accredited entities and delivery partners that work directly with developing countries for project design and implementation. The fund's partners include international and domestic commercial banks, multilateral, regional and national development finance institutions, equity fund institutions, United Nations agencies and civil society organisations.

Some of the accredited entities in India through which it is possible to apply for resources from the Green Climate Fund are IDFC Bank, IEISL, NABARD, SIDBI , among others.

The GCF does not implement projects directly, but through partnerships with Accredited Entities. Accredited Entities are responsible for submitting funding requests to the GCF and then overseeing, managing and monitoring the overall projects and programmes approved by the GCF. Accredited Entities are not required to act as direct implementers of funding proposals. Implementing Entities may also do so on behalf of the Accredited Entities by channelling funds and implementing the funded activity. In these

cases, Accredited Entities maintain oversight of the Implementing Entities' GCF-related activities.

Accredited entities develop funding proposals, in close consultation with the Designated National Agencies or focal points, according to the different climate finance needs of the country.

There are broadly four mechanisms for applying for/receiving GCF funding. The first is through proposals for funding. The second is under Requests for Proposals (RFPs) or specific pilot programmes issued by the GCF itself. The third is called the Simplified Approval Process (SAP), which is for high-impact projects with investment amounts of up to $25 million. To be subject to SAP, a concept note must be submitted through an accredited entity with direct access and in coordination with the Designated National Agency. The fourth mechanism is through the Project Preparation Facility (PPF). Through the PPF, the GCF provides financial and technical assistance for the preparation of proposals for project and programme funding.

Green Climate Fund in India

Source: *https://www.greenclimate.fund/countries/india#overview*

As of July 2022, the Green Climate Fund reports 6 projects supported in India. The following are some examples of projects supported by AFD in India:

1. *Line of Credit for Solar rooftop segment for commercial, industrial and residential housing sectors*

The programme will enable access to long-term and affordable financing for the construction of 250 MW of rooftop solar capacity in India and thereby reduce emissions by 5.2 million tonnes of CO2 equivalent over 20 years. This pioneering private sector-driven initiative will unlock private sector investment in the rooftop solar market and pave the way toward a sustainable bankable model in India and beyond.

2. *India E-Mobility Financing Program*

This project will provide tailored financing solutions to electric vehicle (EV) owners and operators including in ancillary areas, such as charging infrastructure, that will rapidly bring the long-term cost of EV ownership to a level comparable to conventional vehicles. The project will also mobilise significant amounts of private sector institutional capital to support India's e-mobility transition. This investment is GCF's first purely private sector transport programme in the e-mobility sector.

3. *Green Growth Equity Fund*

This programme is India's first of its kind climate-focused fund. It will invest in low-carbon and climate-resilient platforms across the energy value chain. This includes renewable energy generation, energy efficient technologies, low carbon transport and resource conservation, including water and waste management. The programme provides equity and grants to accelerate the uptake of Indian green infrastructure projects.

Textbox 10: Green Climate Fund

Adaptation Fund

The Adaptation Fund finances projects and programmes that help vulnerable communities in developing countries adapt to climate change. Initiatives are based on countries' needs, views and priorities.

The Fund is largely financed by government and private donors, and by a contribution of two per cent of the proceeds from Certified Emission Reductions (CERs) issued under the Protocol's Clean Development Mechanism projects.

Since 2010, the Adaptation Fund has committed more than US$ 850 million to climate change adaptation and resilience projects and programmes, including more than 123 concrete and localised projects.

Adaptation projects and programmes are implemented through national, regional and multilateral implementing entities accredited by the Adaptation Fund Board to receive direct financial transfers from the Fund.

Some of the multilateral implementing entities through which it is possible to apply for

Adaptation Fund resources are the World Bank, the IDB, various UN programmes such as UNDP, UNIDO and UNEP, among others. NABARD is the Fund's national implementing entity in India and programmes are implemented together with local organizations.

The Adaptation Fund has several financial support mechanisms, mainly grants for projects that increase resilience and decrease vulnerability to climate change. Also, within the fund there are also mechanisms, mainly grants of different amounts for innovation in climate change adaptation or for project preparation. Among the mechanisms for preparedness are project preparation grants and project scaling-up grants, as well as technical assistance grants for the development or strengthening of environmental, social and gender policies.

The Adaptation Fund is partnering with the Climate Technology Centre and Network (CTCN),

which is the operational arm of the UNFCCC Technology Mechanism. The CTCN can support early-stage feasibility assessments for the deployment of specific adaptation technologies, market studies, recommendations for regulatory reform and other technical analyses that can help strengthen the design of a project or programme. (Adaptation Fund, 2022)

Adaptation Fund in India

Source: *https://www.adaptation-fund.org/projects-programmes/*

Rather than pursuing just one or two larger projects with the overall funding allocated by the Fund, NABARD's approach is unique in adaptation by piloting diverse models and establishing the needed networks and experiences to share knowledge to make wider change across the large country. As of July 2022, the Adaptation Fund reports 6 projects supported in India. All of them are under implementation. A few examples of projects supported under the Fund are:

1. *Conservation and Management of Coastal Resources as a Potential Adaptation Strategy for Sea Level Rise.*

The project received a grant of USD 0.6 million with the aim to overcome the consequences of salinization and other impacts of the coastal area due to sea level rise and seawater inundation due to increased cyclonic storms and storm surges through appropriate adaptation strategies such as restoration of degraded mangroves and demonstration of Integrated Mangrove Fishery Farming System (IMFFS).

2. *Climate Proofing of Watershed Development Projects in the States of Tamil Nadu and Rajasthan.*

The project received a grant of USD 1.3 million with the objective to improve climate resilience and build adaptive capacities of the communities to climate change in the rain-fed areas of Tamil Nadu and Rajasthan.

3. *Climate smart actions and strategies in northwestern Himalayan region for sustainable livelihoods of agriculture-dependent hill communities.*

The project received a grant of USD 0.9 million with the objective to improve the adaptive capacity of rural small and marginal farmers including hill women in North Western Himalayan region by introducing a combination of Climate Smart Farming Technologies along with required social engineering and capacity building processes.

Textbox 11: Adaptation Fund

NAMA Facility

The NAMA Facility was announced during the 2012 climate negotiations in Doha, Qatar, the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the Department for Business, Energy and Industrial Strategy (BEIS) of the United Kingdom (UK) jointly established this facility. Since then and to date, several institutions have provided funds to finance seven bidding rounds and a special eighth round called the Ambition Initiative in 2021. Currently the main donors to the NAMA Facility are BMU, BEIS, the Danish Ministry of Climate, Energy and Utilities (KEFM), the European Commission and the Children Investment Fund Foundation (CIFF).

The objective of the NAMA Facility is to accelerate low-carbon development to keep temperatures well below two degrees Celsius by financing measures that shift challenging sectors in a country towards a sustainable future.

The NAMA projects that are funded are selected through a call for proposals for NAMA support

projects. This is a public tender process conducted by the NAMA Facility's Technical Support Unit (TSU) that is open to all delivery partners and remains open for three to four months each year.

Projects shortlisted through the annual call for proposals process are subsequently subjected to an "in-depth assessment". Projects that

successfully pass the in-depth assessment are recommended for resources, mainly technical assistance, for the detailed preparation phase. With this support, the final NAMA proposal is integrated and subjected to a detailed evaluation by the NAMA Facility's board of directors, which makes the final decision on the provision of funds for implementation. (NAMA Facility, 2021)

NAMA Facility in India

Source: https://www.nama-facility.org/projects/

In India, there is one NAMA supported project which is active is on its 5th call.

Waste Solutions for a Circular Economy.

The project aims to achieve a low-carbon transformation of the Indian waste sector by scaling up and de-risking investments and strengthening the regulatory framework, thus ensuring uptake of the Reduce, Reuse, Recycle concept and leveraging the strengths of the informal recycling sector. In addition, the NSP facilitates the implementation of extended producer responsibility (EPR) through platforms for the coordinated engagement of various stakeholders. The project is implemented in five model cities: Bengaluru, Coimbatore, Tiruchirappalli, Varanasi and Goa (state), and potentially two additional cities creating model Source Segregation Systems for MSW, setting up semi-mechanized MRFs and upscaling existing recycling facilities.

Textbox 12: NAMA Facility

IKI

The International Climate Initiative (IKI) is an important part of the German government's international climate finance commitments. The IKI has been run by the Federal Ministry of Economics and Climate Protection since 2022. The funding programme works together with its founding department, the Federal Ministry for the Environment (BMUV) and the Federal Foreign Office. With the IKI, the three ministries are jointly supporting solutions in developing and emerging countries to ambitiously implement and develop the nationally determined contributions to climate protection anchored in the Paris Agreement. With regard to biodiversity, the IKI also supports its partner countries in achieving the objectives of the Convention on Biological Diversity (CBD).

IKI project activities range, for example, from advising political decision-makers to developing skills and technology partnerships for risk hedging through innovative financial instruments. This also includes studies, advice on project preparation for infrastructure development and investment instruments for climate protection or the preservation of biodiversity. To date, the IKI has approved more than 800 climate and biodiversity projects in over 60 countries worldwide with a total funding volume of EUR 5 billion (2008-2021).

The IKI supports its partner countries in four ways. On the one hand, there are the thematic ideas competitions, which include the large thematic selection procedures (theme calls) and the two small project programmes IKI Small Grants and IKI Medium Grants. The fourth support instrument is the country calls in which projects are selected for two thematic priority areas through a call for ideas in close coordination with the partner government.

With the exception of the IKI Small Grants, all calls for ideas have two stages. A selection is

made from the submitted sketches, and they are asked to create a detailed project proposal. The final funding decision is then made on the detailed project proposal. The competitive nature of the funding process and the involvement of non-governmental implementing organisations are key features of IKI that distinguish it from classical development cooperation. IKI funds do not flow to government institutions in partner countries.

IKI in India

Source: *https://www.international-climate-initiative.com/en/search-project/*

The Morgenstadt Global Smart Cities Initiative is the IKI project under which this study and the pilot project for the city of Kochi are being developed. As of July 2022, 87 IKI supported projects were identified in India under the themes of energy, climate finance, water, forest protection, among others. Of them 40 are active projects. Some of the most relevant projects in India are:

1. *EcoLogistics: Low carbon freight for sustainable cities.*

The project supports environmentally friendly rules and practices that directly contribute to mitigating the impacts of climate change and to the achievement of ambitious NDCs in the partner countries. It creates greater awareness of the issue among local and national governments to this end, develops action plans and gives other cities an example of how to act. The project also strengthens institutional resources and competencies by involving all interest groups, making national policy recommendations and developing a self-monitoring instrument for the movement of goods and commodities.

2. *Commercialization of Solar Energy in Urban and Industrial Areas in India (ComSolar).*

The project supported the development and demonstration of innovative business models for commercialising solar energy in both urban and industrial zones. To this end, it developed a strategy for marketing solar energy and supporting the implementation of the National Solar Mission, which aims to install solar power plants generating an output of 100 GW by 2020. Activities included feasibility studies, technology transfer, information campaigns and comprehensive capacity building for the project partners.

3. *Generating Energy from Waste Water and Organic Waste (Waste to Energy).*

The project reduced greenhouse gas emissions in the Indian city of Nashik by using sewage and organic waste to produce energy. One of the intentions of the project was to demonstrate a technical solution that is reproducible and financially feasible in densely populated urban areas and meets the Indian government's climate change targets. The demonstration project brought together a range of actors in Nashik who designed, built and operated a plant in which sewage and organic waste undergo anaerobic fermentation, enabling materials to be recovered and energy generated.

Textbox 13: IKI

6 National and Regional financial institutions and sources of finance

6.1 Governmental Schemes (Project Relevant)

6.1.1 Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

Initiated by Ministry of Housing and Urban Affairs, AMRUT scheme focuses to establish infrastructure that could ensure adequate robust sewage networks and water supply for urban transformation by implementing urban revival projects. The mission components include activities like:

- Decentralised, networked underground sewerage systems, including augmentation of existing sewerage systems and sewage treatment plants
- Rehabilitation of old sewerage system and treatment plants
- Recycling of water for beneficial purposes and reuse of wastewater
- Construction and improvement of drains and storm water drains in order to reduce and eliminate flooding

6.1.2 Suchitwa Mission

Suchitwa Mission is the Technical Support Group (TSG) in Waste Management sector under the Local Self Government Department, Government of Kerala. It is responsible for providing technical and managerial support to the Local Self Governments of the State. Also responsible for conceptualizing, action planning, conducting creative workshops, organizing training programmes, initiating sector related studies, bringing out occasional papers, initiating action research, conducting monitoring and such other activities in Waste Management Sector. The Mission is also the Nodal agency for implementing Swachh Bharat Mission (Urban), Swachh Bharat Mission (Rural) and Communication and Capacity Development Unit (CCDU) in the State.

6.1.3 Solar Subsidy Scheme

The Solar Subsidy Scheme is initiated by Kerala State Electricity Board Limited for group housing society projects and residential welfare associations, with a capacity up to 500 kW, the central government will provide a subsidy of 20%. If a customer wishes to install the plant investing the whole amount, they can choose to avail up to 40% of plant cost as subsidy.

- State subsidy Amount - Balance after consumer payment and CFA
- Central subsidy Amount - 40% for the first 3kW and 20% on remaining 7kW
- Size of the Rooftop Solar System - Up to 10kW
- Price for the customer - 12% of capital cost, if monthly consumption is 120 units, 20% for 150 units and 25% for 200 units
- Sector - Residential rooftop solar system

6.1.4 Electric Vehicle Policy Kerala 2019

The electric vehicle policy of the Government of Kerala outlines special incentives and concessions to attract investments in EV manufacturing and infrastructure. The policy includes financial incentives for setting up Charging and Swapping stations that includes Capital Subsidy of 25% of the value of the charging station equipment/machinery up to a maximum of INR 10,00,000 for Direct-Current (DC) Chargers (100V and above) (for first 100 stations) and INR 30,000 for Direct-Current (DC) Chargers (below 100V) (for first 300 stations).

6.1.5 Pooled Finance Development Fund (PFDF)

In order to enhance the access of ULBs to capital markets, the Government of India approved the

Pooled Finance Development Fund Scheme in 2006. The Ministry of Urban Development provides the enabling policy environment, tax free provisions and the credit enhancement fund, the operationalizing of the PFDF rests with the individual states, by setting up the State Level Pooled Finance Entity (SPFE) which provides the institutional framework for pooled finance. Several states such as Andhra Pradesh, Karnataka, Nagaland, Orissa, Rajasthan, Tamil Nadu, Kerala and Assam have set up SPFE to implement the pooled financing scheme.

6.1.6 Building Energy Efficiency Programme (BEEP)

EESL is implementing the Buildings Energy Efficiency Programme to retrofit commercial buildings in India into energy efficient complexes. Through these future ready solutions, EESL is creating a market for clean energy in India. Government of India has issued an instruction to all Departments and Ministries in August 2017 to ensure all the buildings become energy efficient. Till date, EESL has completed building energy efficiency projects in 10,344 buildings including Railway stations. Energy Audits shows energy saving potential to the tune of up to 30-50% in these buildings. The major interventions in these buildings are in area of lighting and air-conditioning systems

6.1.7 Street Lighting National Programme (SLNP)

Government of India launched Street Lighting National Program (SLNP) to replace conventional streetlights with smart and energy efficient LED street lights across India. EESL replaces the conventional streetlights with LEDs at its own costs (without any need for municipalities to invest) and the consequent reduction in energy and maintenance cost of the municipality is used to repay EESL over a period of time. The contracts that EESL enters into with municipalities are typically of 7 years duration where it not only guarantees a minimum energy saving (of-typically 50%) but also provides free replacements and maintenance of lights at no additional cost to the municipality.

Till date, EESL has installed over 1.14 Crore LED streetlights in ULBs and Gram Panchayats across India. This has resulted in estimated energy savings of 7.72 billion kWh per year with avoided peak demand of 1,286 MW, GHG emission reduction of 5.32 million t CO2 per year and estimated annual monetary savings of INR 5,395 crore in electricity bills of municipalities.

Under SLNP, 1576 Urban Local Bodies (ULBs) have been enrolled, out of these ULBs, work has been completed in 1060 ULBs. EESL is also implementing LED Street lighting projects in Gram Panchayats on the same service model as the SLNP for municipalities with the objective to promote the use of efficient lighting in rural areas. So far, EESL has installed 26 lakh LED streetlights in rural areas of Andhra Pradesh, Jharkhand, Goa and Telangana.

The LED streetlights are installed after a detailed survey of the existing infrastructure is undertaken. The survey inter-alia looks at the infrastructure gaps, verification of inventory and mapping locations for setting up CCMS (Centralized Control and Monitoring System).

6.2 Other Sources of Domestic Finance

6.2.1 Member of Legislative Assembly Local Area Development Funds (MLA-LAD)

MLA-LAD are constituency development funds provided by India's states to their MLAs (Members of the Legislative Assembly). Each MLA can use their Fund for small development projects in their constituency.

6.2.2 Members of Parliament Local Area Development Scheme (MPLADS)

Members of Parliament Local Area Development Scheme (MPLADS) is a scheme formulated by Government of India that enables the members of parliaments (MP) to recommend developmental work in their constituencies with an emphasis on creating durable community assets based on locally felt needs.

6.2.3 Rebuild Kerala Development Programme (RKPD)

The mandate of Rebuild Kerala Initiative is to develop, coordinate, facilitate and monitor the Rebuild Kerala Development Programme (RKDP) through a participatory and inclusive process. The RKDP constitutes the State's strategic roadmap for a Green and Resilient Kerala. The RKDP encompasses crosscutting and sector-based policy, regulatory and institutional actions as well as priority investment programs that are critical for resilient and sustainable recovery and rebuilding of the State. It aims to catalyse rebuilding of Kerala in a way that addresses key drivers of floods and other natural disasters and climate change risks and strengthens preparedness against future disasters. Integrated Water Resource Management, Water Supply, Sanitation, Urban, Transportation are part of the key sectors identified in the RKDP. Apart from these key sectors, other cross-cutting sector like Disaster Risk Management & Resilience and Environment and Climate Change shall form the foundational elements for development in the identified priority areas of RKDP.

6.2.4 Kerala Infrastructure Investment Fund Board (KIIFB)

Government of Kerala established KIIFB as its principal funding arm. The objective of KIIFB is to channelize fund for critical and large public infrastructure projects in Kerala. KIIFB is mobilising and channelling funds for facilitating planned, hassle-free and sustainable development of both physical and social infrastructure including major land acquisition needs that are integral to development ensuring all round wellbeing and prosperity, using financial instruments approved by Securities & Exchange Board of India (SEBI) and Reserve Bank of India (RBI).

6.2.5 Housing and Urban Development Corporation (HUDCO)

HUDCO started a window for financing the development of urban infrastructure called 'Urban Infrastructure Finance Wing' in the FY 1989-90. The core or priority sector infrastructure facilities include projects in the sectors of water supply, sewerage, drainage, solid waste management, roads, electricity, smart cities, industrial infrastructure, etc in the urban areas. HUDCO entered in the area and provided long term loans (upto 20 years) to the ULBs for meeting the capital requirement and moratorium during the construction period on cash flow basis. HUDCO already provides financial assistance under various governmental schemes like Smartcity missions, AMRUT, Swachh Bharat etc. Additionally, HUDCO also provides loan assistance to Municipal corporations/councils.

7 Recommendations

MGI identified 10 **project ideas** during the year 2020 of which three project ideas were clubbed in to one project for further development as a pilot project. All **project ideas** thus identified have potential for implementing on a larger scale and can contribute to sustainable urban development. These project ideas need further studies and actions to bring them to implementation stage. Master-plan development projects are in the nature of conducting broad based studies and analyses. Whereas other project ideas need to be substantiated through definition of clear scop and feasibility studies. These studies provide technical feasibility of implementation, economic viability aspects and investment needs. The subsequent stage is to identify sources of finance and financing mechanisms to implement these through project owning entities. This section has evaluated project ideas from the perspective of large-scale implementation. These project ideas have been clubbed according sectors and types although some project ideas are cross cutting in nature (having two or more applicable sectors). This part of the report has adopted an approach on the lines of financing sustainable smart cities.

Characteristics of project ideas define the optimal financing mechanisms for projects. It may be observed that while some projects can result into revenue generation, while others may not generate any revenue. Investment plans mainly depend upon variety of factors and revenue generation possibilities and volume plays significant role. Financing options have considered both domestic as well as international financing sources of finance. This report has elaborated funding mechanisms as per the thematic groups mentioned below.

The project ideas have been categorized into the following subgroups:

- Energy
- Green buildings / green infrastructure
- Water supply and wastewater treatment
- Urban planning (master plan developments)

The discussion in this section has been restricted to these types of projects.

7.1 Energy

MGI identified three different energy project ideas for Kochi city. These projects are from diverse areas within the energy group. The first project is related to solar PV assisted desalination (electricity generation), whereas the next one on conducting energy audits and the third relates to setting up infrastructure for electric vehicles charging on a pilot scale. Under the normal circumstances, energy efficiency (EE) or renewable energy (RE) projects generate revenue (indirectly in the case of EE and directly in the case of RE). On the commercial scale, these projects are often economically viable, however, pilot projects need support in the form of soft funds or even grants. These pilot projects need equipment and machinery with varying expenditure and scale. We provide a list of projects as follows:

- Decentralized solar desalination and rainwater harvesting
- Energy efficiency audits for public and commercial buildings
- Pilot project for controlled charging for electric vehicles

Decentralized solar desalination and rainwater harvesting – This is a cross-cutting project with combination of energy and water sectors in focus. Seawater desalination is a proven technology, but energy consumption is relatively high and brine disposal an unsolved issue in large-scale plants. As Kochi has a lot of sun, it is proposed to combine a decentralized seawater desalination plant with PV electricity production.

The project also proposes to combine the desalination plant with a rainwater harvesting facility. This project is not aimed at GHG emission reduction, but at the improvement of water supply and thus living conditions. The project is expected to reduce loss of water in distribution. There is a good possibility of securing participation from a private sector participant. There is a revenue generation possibility as mentioned below:

- Revenue generation from water charges. Economic returns for private investor (provided adequate water charges can be recovered).
- Possibility of surplus electricity generation (can provide extra revenue).

We recommend that the pilot project be financed out of grants from KMC. Indicative means of financing may be as follows:

	Percentage Share
Kochi Municipal Corporation	80.00%
NGOs (Local and international)	20.00%
Total	**100.00%**

Note: Individual % shares for partner organizations can differ depending upon the prevailing situations.

KMC can bring its contribution from the cash revenues such as local taxes (e.g. property tax). Private sector partner may provide contribution in cash and may expect returns from sale of surplus electricity.

As this is a cross-cutting project we provide details from the water perspective:

Kerala Water Authority (KWA) is planning to produce drinking water from saline/sea water. KWA has partnered with the Fisheries Department and the National Institute of Ocean Technology (NIOT) to establish a Desalination plant in the state's nine coastal districts. A desalination plant of capacity 1 MLD is proposed near Munambam Harbour in Kochi as a pilot study.

Jal Jeevan Mission (JJM) is envisioned to provide safe and adequate drinking water through individual Functional Household Tap Connections (FHTCs) by 2024 to all households in rural India. JJM will be based on a community approach to water.

Energy efficiency audits for public and commercial buildings – The project proposes to conduct energy audits of public office buildings and private commercial buildings in the city of Kochi. The main objective of the project is to ultimately lead to implementation of energy efficiency improvement measures. As public and commercial buildings are the largest energy consumers and examples for private building owners, an Energy Efficiency Initiative focusing on public and commercial buildings is proposed. As a first step of such an initiative, energy audits of all public buildings should be carried out.

Based on the assessment of the energy audit results, a plan for energy efficiency investments in public buildings can be developed, starting with the low-hanging fruits with the best relation of energy savings to costs. It is proposed to publish the audits and plan online to raise awareness of energy efficiency and demonstrate the willingness of the city council and the state government to increase the energy efficiency.

As such energy audits will not generate any revenue for public or commercial buildings. Electricity savings can be achieved only after investing in energy efficiency measures.

Therefore, energy audits need grant funding. In the case of private sector commercial buildings, an ESCO can conduct an investment grade audit with a view to implementing energy saving measures. ESCO can recover cost of energy audit from the savings generated.

It is possible to finance energy audits project as follows:

	Percentage Share
Kerala State Electricity Board (KSEB)	90.00%
International / national NGOs	10.00%
Total	**100.00%**

It is essential that KSEB finances larger part of the cost of the project of energy audits. The balance many could be raised through international NGOs.

- It may be possible to secure higher level of interest in the case of ESCO led investment grade energy audit which may result into EE project (preferably with private sector owner of a commercial building).
- Kerala EMC has listed more than 45 energy audit firms and appropriate firms may be selected to implement audit project.
- It is possible to work with all commercial buildings (clubbed under one group) to form a dedicated energy efficiency improvement project which could be financed by Indian Renewable Energy Development Agency (IREDA). Technical assistance may be sought from Bureau of Energy Efficiency (BEE) of Ministry of Power.
- International NGOs may also be approached for joint implementation provided the organisation has an ongoing support for such activities in place.

Pilot project for controlled charging for electric vehicles - The project envisages developing EV charging infrastructure on a pilot scale for the evaluation of controlled charging of EVs. 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. The EV infrastructure development plan must consider to the expected growth of EVs depending on their types (two, three, and four-wheelers, cars, trucks, and busses). Business models and payment systems for public EV charging points must be developed as well as investment sources identified. The project proposes to set up EV charging stations with related technologies for controlled charging (to evaluate additional load in the power grid by EV charging without controlled charging in comparison with controlled charging could be evaluated. The project could be directly linked to the "smart grid initiative" in Kochi with the goal to develop a strategy for grid stabilising EV charging

- The research and demonstration project needs public funding. The size of the project can be adapted to the available budget.
- This project needs grant support as there is no revenue generation from this pilot project. The project is envisaged to be fully financed by KSEB. However, there is a possibility to secure investment from private sector participants. Private sector charging station manufacturers can participate in the project. Such a project can be formulated on the lines of public private partnership project. The private sector company may be allowed to commercialize the technology in the subsequent phase.
- Local / international NGOs may also provide a partial grant.

Recommended financing options through International Financial Institutions (IFIs) for Energy projects

Funding Mechanism identified	Recommendations
USAID - USAID Leverages Innovative Finance in Transition to Clean Energy	USAID may consider support to financing of solar assisted desalination plant through guarantee scheme. However, the assistance may be applicable to the private sector MSME unit.
IKI (German Government)	It may be explored to develop a detailed structured programme in the area of solar PV assisted desalination plants and associated capacity building and seek appropriate financial assistance from IKI
WB - Karnataka Urban Water Supply Modernization Project	The World Bank provides financial assistance to state level infrastructure projects. A request has to be made by the State Government through Department of Economic Affairs (DEA), Ministry of Finance (MoF), Government of India (GoI) to the Bank with a detailed Water Masterplan (to be developed by KWA) including projects of large scale solar PV assisted desalination plants in the state.

7.2 Green buildings/green infrastructure

Green building / green infrastructure is an emerging area of development in India. While there has been construction of green buildings after 2000 in India. Sohrabji Godrej Green Business Centre is the first LEED Platinum certified building in India. A typical commercial green building costs about 5% to 7% higher (residential one around 2% to 3% higher) than a conventional building. Financing of green buildings gets classified under "construction finance" and most private sector developers finance such buildings out of their own resources (equity) and from borrowings (debt) from housing finance institutions (HFIs) and / or commercial banks.

MGI identified four project ideas under green building / green infrastructure sub-sector. Kochi city has substantial scope to construct green buildings as also to incorporate green elements in existing buildings. These project ideas are diverse in terms of concept, scope and scale are cross cutting (mitigation and adaptation). These project ideas are list as follows:

- Fishermen's Settlement
- Green Building Initiative
- Urban Heat Island Mitigation Strategies
- Ecological apartment building

Fishermen's settlement - This project aims to develop and implement a holistic concept for a settlement for the fishermen and their families. The construction of houses / buildings is expected to be outside the coastal regulation zone but as close to the workplaces as possible. In this way, damage caused by regular flooding is to be avoided and at the same time the shortest possible commuting distances are to be made available. The project proposes to use existing construction methods and materials. Their suitability would be checked in advance. The project would aim to secure private sector participation from the stage of concept development. Apart from climate change benefits as mentioned above, we expect better living conditions and stability to fishing community could help long term well-being (safe homes).

The project could be financed out of the budgets of Kochi Municipal Corporation (KMC) and grants from Indicative investment plan is as follows:

	Percentage Share
Kochi Municipal Corporation	80.00%
NGOs (Local and international)	20.00%
Total	**100.00%**

- KMC may bring its contribution in kind by providing land to the project. Alternatively, KMC may provide contribution in cash derived from local taxes and other income. KMC may prepare detailed project report and seek approval from its
- Local / international NGOs may provide their contributions

As mentioned earlier, a private sector construction company can be a partner organisation and can provide service for fee.

If the project is to be implemented on a large scale (over the state, as Kerala has a long coastline), then State government may explore a possibility of raising long term funding from an IFI (In this case funding will be provided only by the state government). In addition, a private sector construction company may also play important role as a partner. Government may appoint the private sector construction company to provide construction services to the state government.

Green building initiative - This project aims to integrate more green spaces into the city to make it more resilient to heavy weather events and to improve the urban climate. The project envisages to implement combination of urban greening and urban farming to create a double added value, with food production as an additional value to the sponge city effect. The Kochi municipality already started an initiative to bring more trees into the city to improve the urban climate. There is a huge potential to implement green areas in many other Indian cites as the starting position and benefit would be similar for them compared to Kochi. Main project activities include greening of facades, greening of roofs, urban agriculture on buildings and urban agriculture on urban areas.

- The project proposes using need based greening measures mentioned which can be partly financed by owners of buildings and partly from KMC. However, KMC share may be less than 10%.
- International NGOs may be requested to participate in the project being a green project.

Financing of green buildings has two sides, 1) that for construction company to undertake construction of green building (as discussed above); 2) that for customers of green building units. Individuals acquiring apartments in new green buildings also need financing. Over the past few years new financing approaches have been developed which include “green mortgages”.

Urban Heat Island Mitigation Strategies - This project ideas aims to implement a pilot that works as a proof of concept for strategies to mitigate climate change and UHI in Kochi. The pilot combines measures of increased ventilation and vegetation in a localized area: The rejuvenation of a canal, ideally close to the coastline, with accompanying vegetation on its sideways and on surrounding buildings. The increasing number of inhabitants will lead to further densification, construction activity and sealing, which will also increase the effect. It is proposed to implement a pilot project that works as a proof of concept for strategies to mitigate climate change and UHI in Kochi. This project is not expected to generate revenue and hence needs grant finance. Voluntary support from the community will also help the project.

- The project could be financed by Kochi Municipal Corporation (KMC).
- NGOs may be approached for seeking funding support and participation in the project.

Ecological apartment building – This project envisages implementation of demonstration apartment building, covering various green features such as rooftop solar PV electricity generation, rainwater harvesting, heat resilient construction, own sewage treatment plant for the building, etc. In view of the constraints of the Kochi city, solutions are needed to reduce the consumption of water and energy and to adapt to climate change

- The proposed pilot project is expected to be financed out of the grant funding from KMC (budget of KMC) and financial resources of a private developer. It may be observed that the private developer is expected to recover the construction cost from the occupants of the apartments (who purchase these apartments).
- Private developers are generally reluctant to invest in green buildings as the benefits of energy savings accrue to occupants of apartments (split incentive phenomenon). The grant fund can be used to meet a part of the design and certification costs.
- Large scale state level projects: National Housing Bank (NHB), in partnership with KfW, Germany, started promoting energy efficiency in the housing sector. This was a first of its kind initiative in the Country. NHB in 2010-11, launched the Energy Efficient Housing Refinance Scheme, aimed at encouraging energy efficiency in the residential sector.

Agence Francaise de Developpement (AFD) provides an integrated approach to environmental finance, combining a financial and technical assistance approach to promoting green growth. Under its Sustainable Use of Natural Resources and Energy Finance (SUNREF) label, AFD supports the development of innovative green investments through environmental credit lines for local financial institutions specifically in developing countries where financing green growth is a challenge. AFD launched the SUNREF Affordable Green Housing India programme in partnership with the National Housing Bank (NHB), India's apex financial institution in housing finance, with support from the European Union (EU). SUNREF India has provided financing of 112 million EUR to the NHB, through an AFD credit line of 100 million EUR, along with an EU grant of 12 million euros. Out of the EU grant, 9 million EUR will be used as an investment grant to reduce the loan cost for final borrowers of the credit line and 3 million EUR Technical assistance will be used for marketing of the facility sub-project origination and preliminary screening and capacity building etc. The 100 million EUR credit facility is to support NHB in providing long term affordable funding to the green housing sector by refinancing home buyers and developers of eligible green building projects certified by local labels via banks and housing finance companies.

SUNREF India provides technical assistance on energy and environment efficiency in the housing sector by promoting two existing local green housing labels, Green Rating for Integrated Habitat Assessment (GRIHA) and Indian Green Building Council (IGBC).

State Bank of India (SBI) signed a loan agreement (in 2019) with KfW, the German development bank, for EUR 250 million (about Rs 1,958 crore) for establishing an energy-efficient housing programme in India. Under the programme, both builders and home buyers will be financed for developing and purchasing energy-efficient residential projects that achieve at least 25 per cent energy savings in comparison to standard reference buildings.

Recommended financing options through International Financial Institutions (IFIs) for large scale green building / green infrastructure projects

Funding Mechanism identified	Recommendations
International Finance Corporation (IFC)	IFC is the private sector finance arm of The World Bank. IFC provides financial assistance to private sector project in the form of equity capital, debt and guarantees. Large scale green buildings project taken up by a private sector construction company may get qualified for investment by IFC. Besides, IFC has green building rating system called EDGE (https://edgebuildings.com/). IFC may be open to supporting public private partnership (PPP) projects.
KFW - Promotion of energy-efficient residential buildings in India (investment).	KfW has provided a line of credit to SBI (see in the preceding paragraphs) to finance green affordable housing. This finance is available for both developers as well as home buyers. Respective borrowers need to approach SBI with a request for debt finance.
IKI – German government	It may be explored to develop a detailed structured programme in the area of green buildings with specific capacity building components for seeking financial assistance under IKI program.

7.3 Water supply and wastewater treatment

Water supply and wastewater projects are infrastructure-based projects and hence require extensive capital investment. Water being the state subject, state level organization is responsible for implementation. Municipal corporation undertakes supply and distribution function (often in association with state level organization). Kerala Water Authority (KWA) is the focal institution in the state. Water projects are planned over long term horizon (5 to 10 years) and often master plan is developed prior to initiating various projects.

MGI has identified two projects as follows:

- Kochi integrated Water Master Plan
- Decentralized solar desalination and rainwater harvesting

Water projects have impact on sustainable development goal (SDG) 6 which is related to water and sanitation.

Following passage indicate financing approaches and investment plan for these projects:

Kochi integrated Water Master Plan – The project proposes to prepare a Master Plan document which will be the basis for all water-related infrastructure planning. The Master Plan will include maps of current infrastructure (water supply, sewage, stormwater drainage, surface water, groundwater, data of recent floods, climatic data) and plans for future development. Coordinated planning in this field becomes crucial due to seasonal and regional water scarcity (becoming more frequent with climate change).

Kochi Municipal Corporation (KMC) and local / international. Indicative plan could be as follows:

	Percentage Share
Kochi Municipal Corporation (KMC)	95.00%
Local / international NGOs	5.00%
Total	**100.00%**

Subsequent to the approval of the master plan, individual projects (under the Water Master Plan) will require large number of resources. These large-scale projects may be financed through following one or more sources or financial institutions:

- State and central government agencies OR
- Municipal Bonds or green bonds (for environment-oriented projects) OR
- Public Private Partnership (PPP) approach OR

- International Financial Institutions (such as The World Bank, The Asian Development Bank) OR
- Blended finance approach

Decentralized solar desalination and rainwater harvesting – Rainwater harvesting (on a pilot scale) needs grant funding as the project is in the experimental in nature. (Solar PV assisted desalination component has already been discussed in the Section 7.1). Rainwater harvesting is a simple technology and has minimum components and requires only a pump to draw water and filter system. Community level rainwater harvesting project will need multiple collection points and segregated storage or central storage. Financing of the project has already been discussed in Section 7.1 and the following paragraphs provide details KWA initiative and JJM:

Kerala Water Authority (KWA) is planning to produce drinking water from saline/sea water. KWA has partnered with the Fisheries Department and the National Institute of Ocean Technology (NIOT) to establish a Desalination plant in the state's nine coastal districts. A desalination plant of capacity 1 MLD is proposed near Munambam Harbour in Kochi as a pilot study.

Jal Jeevan Mission (JJM) is envisioned to provide safe and adequate drinking water through individual Functional Household Tap Connections (FHTCs) by 2024 to all households in rural India. JJM will be based on a community approach to water and will include extensive Information, Education and communication as a key component of the mission.

<u>Indicative</u> other means of financing for water projects:

- Tariffs and charges for water and sanitation services as a resource for financing water infrastructure projects (Tariff levels in India are on the lower side and collection of water charges often a sensitive topic).
- Access to loans (of IFIs) by KWA for public water projects.
- Governmental contributions (Central and State)
- Donations by multilateral or bilateral development institutions, foundations, and charitable organisations

<u>Recommended financing options through International Financial Institutions (IFIs) for water projects</u>

Funding Mechanism identified	Recommendations
The World Bank (WB) - Karnataka Urban Water Supply Modernization Project	The World Bank provides financial assistance to state level infrastructure projects. A request may be made by the State Government through Department of Economic Affairs (DEA), Ministry of Finance (MoF), Government of India (GoI) to the World Bank to support state-wide water desalination + rainwater harvesting projects clubbed along with other water supply and distribution projects. These projects should be developed after receiving approval (from the state government) for the water master plan for the whole state.

Asian Development Bank (ADB)-Karnataka Integrated Urban Water Management Investment Program	It may be possible to request ADB for a loan (for which a proposal is developed by the State Government and submitted through Department of Economic Affairs (DEA), Ministry of Finance (MoF), Government of India (GoI) to ADB) to implement large scale water supply projects in the state of Kerala including all desalination and rainwater harvesting projects. These project need to be developed only after receiving approval (from the state government) for the water master plan for the whole state (covering Kochi as also other cities as appropriate).
IKI – German Government	It may be explored to develop a detailed structured programme in the area of solar PV assisted desalination plants and associated capacity building and seek appropriate financial assistance from IKI

7.4 Urban planning

Urban planning is a technical and political process that is focused on the development and design of land use and the built environment, including air, water, and the infrastructure passing into and out of urban areas. Urban planning is also known as regional planning, town planning, city planning, or rural planning. Urban planning encompasses the preparation of plans for and the regulation and management of towns, cities, and metropolitan regions. Urban planning is concerned with the social, economic, and environmental consequences of delineating spatial boundaries and influencing spatial distributions of resources[5]. These projects are integral part of city planning and are implemented over a long period. These projects have sectoral sub-elements such as water related planning, buildings and other infrastructure related planning (town planning), transportation planning, etc.

MGI identified the following project ideas under this thematic group (urban planning):

- Integrating Climate Services into the Kochi GIS-Map
- Kochi integrated Water Master Plan
- Holistic Spatial Data

These projects have common feature in terms of need for fund which is needed in the form of a **grant**. These projects are not expected to generate direct revenue in the short term. All these projects need extensive amount of data handling in various forms. On the other hand, these projects differ in the areas in terms of sectors (climate services and water).

Integrating Climate Services into the Kochi GIS-Map – The main objective of this project is to integrate information on future climate predictions together with assessment and information tools into the Kochi GIS-map that is currently in development. The project idea proposes to add data of climate change induced effects, preferably from open data sources. This project needs substantial coordination efforts with Kochi Municipal Corporation (KMC), Ministry of Housing and Urban Affairs (Town and Country Planning Organisation) and other data sources / organisations. This project may result in to social benefits such as better town planning could result in lower flooding and lesser damages due to flooding.

Kochi integrated Water Master Plan - Key output of this project is a Master Plan document which will be the basis for all water related infrastructure planning. It includes maps of current infrastructure (water supply, sewage, storm water drainage, surface water, groundwater, data of recent floods, climatic data) and plans for future development. Already the process of developing the Master Plan will be beneficiary for the city, as different institutions will have to coordinate their activities and exchange information.

[5] *https://www.sciencedirect.com/topics/social-sciences/urban-planning*

Holistic spatial data – This project envisages coordinated collection of spatial data (GIS) as basis for planning and maintenance as well as for coordinated infrastructure development. Key output is a database which is easily available and which is updated regularly.

These projects may be financed through the following financing mechanisms and sources:

- Central and state government contributions /allocations to KMC.
- Local tax collections by KMC (property tax and other municipal taxes)
- Cash or in-kind contributions from international NGOs or donors
- Technical assistance received from International Financial Institutions (IFIs) such as the World Bank (WB) or Asian Development Bank (ADB)

Recommended financing options through International Financial Institutions (IFIs) for urban projects

Funding Mechanism identified	Recommendations
AFD - Supporting sustainable use of water resources in Pondicherry	It is possible to explore funds from AFD under its on-going and planned bilateral programs. For AFD Water - A priority area of intervention in India It supports public institutions with technical assistance. AFD has supported projects in wide range of sectors in India.
GIZ – 1. Sustainable Urban Development – Smart Cities; 2 - Climate Smart Cities	It may be possible to seek assistance from GIZ GIZ offers technical assistance through national or international experts and partners on a short- or long-term basis, mainly focused on strengthening the internal capacities of partner institutions
ADB - Karnataka Integrated Urban Water Management Investment Program	It may be possible to request is made by the State Government through Department of Economic Affairs (DEA), Ministry of Finance (MoF), Government of India (GoI) to ADB for a loan to implement large scale water supply projects in the state of Kerala after receiving approval (from the state government) for the water master plan for the whole state (covering Kochi as also other cities as appropriate). ADB may provide need-based technical assistance to development of a master plan.
WB - Karnataka Urban Water Supply Modernization Project	The World Bank provides financial assistance to state level infrastructure projects. A request has to be made by the State Government through Department of Economic Affairs (DEA), Ministry of Finance (MoF), Government of India (GoI) to the Bank after completion of development of the water master plan for the state (not just one city) by KWA.

It may be observed that two project ideas ("Integrating Climate Services into the Kochi GIS-Map" and "Holistic Spatial Data") are similar in nature and both are data driven. These projects are expected to lead to enhanced data set with more added features and more useful features. As such these projects do not require extensive equipment and machinery and need mainly software and computers and associated equipment for GIS data capture. These projects need funds in the "grant" form and do not expect to generate immediate revenue stream.

7.5 Approach for identification of funding sources for projects

Principal sources of finance for a typical municipal project include general municipal budget (mainly local taxes such as property tax and other local taxes), allocations from central and state governments, grants and in some rare cases borrowings. On the other hand, it is expected that "Smart City Projects" would envisage tapping new emerging sources of fund and use different mechanisms. This report has prepared a small approach to identification of funding sources.

As mentioned earlier, there are various stages of projects right from project concept development to feasibility study. Some of these milestones have to be achieved prior to commencing identification of funding sources. Some of the steps include:

- Problem definition
- Define alternative solutions and select the optimum one
- project concept / idea generation
- Project profile development
- Pre-feasibility study
- Selection of partners
- Project feasibility study preparation
- Programme implementation design

It is essential to identify funding sources before or on completion of the programme implementation design stage. Sources of funding also depends upon the nature of the project being developed and its initial partners. If a project is not expected to generate revenue, more of grant funding is the only solution. Thus, sources of funds which provide grant funding are suited for such projects.

The approach comprises selecting sources of funding using the following set of questions. Each question can lead to probable source(s) of finance.

- Does Kochi Municipal Corporation (KMC) have adequate un-allocated funds (out of all its budgetary allocations including state and central governments allocations) which can be used to finance the project?
- Are there programmes and sources available which provide required portion of grant funding to the project?
- Does the project generate direct (or indirect) revenue?
- Is the municipal corporation willing to enter in to an energy performance contact with an ESCO? (In the case of an energy efficiency improvement project)
- Is the municipal corporation willing to work jointly with a private sector organization under the PPP structure / approach?
- Is the municipal corporation able to acquire debt?
- Can the municipal corporation issue bonds?

This guiding approach may be useful to identifying funding sources. The process of securing finance, in fact, commences once sources are identified. Substantial efforts go in approaching these sources and submitting proposals in the format needed by each source. This discussion also brings in focus the role of local community in municipal smart city projects.

Participation by the local community:

Support of the local population in any municipal project is essential to the success of these projects. This support from the local community can be provided through

- Active participation of "residents' associations": Residents' associations can provide positive and constructive comments on the project documents circulated by municipal corporations. Besides, collective decisions on important matters also help making speedy progress of a project.
- "In-kind" support: Often projects may need support in forms other than cash. Consider the project of community residential complex for fishermen community. In this case community can provide construction materials or labour.
- Cash contribution (self-financing): all projects may not be financed by municipal corporations. Some projects may have to be financed by community themselves as such projects bring direct benefits to residents themselves. Consider projects such as installing solar rooftop electricity generation systems or

implementing measures to make an existing building into a green building. In these cases, benefits directly accrue to occupants of buildings. Hence residents need to finance these projects themselves.

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