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*Creating Innovative Solutions for a Sustainable Future*

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# Global Urban Solutions for Sustainable Smart Cities in an Indian Context

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**Knowledge Product 1 -  
Urban Living Lab for Smart and Sustainable Cities**

**November 2021**



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### Suggested citation

TERI (2021). Global Urban Solutions for Sustainable Smart Cities in an Indian Context. Knowledge Product 1, Urban Living Lab for Sustainable and Smart Cities. New Delhi: TERI.

### Editorial and Design

TERI Press

### Published by

The Energy and Resources Institute, 2021

For More Information



MINISTRY OF FOREIGN AFFAIRS  
OF DENMARK



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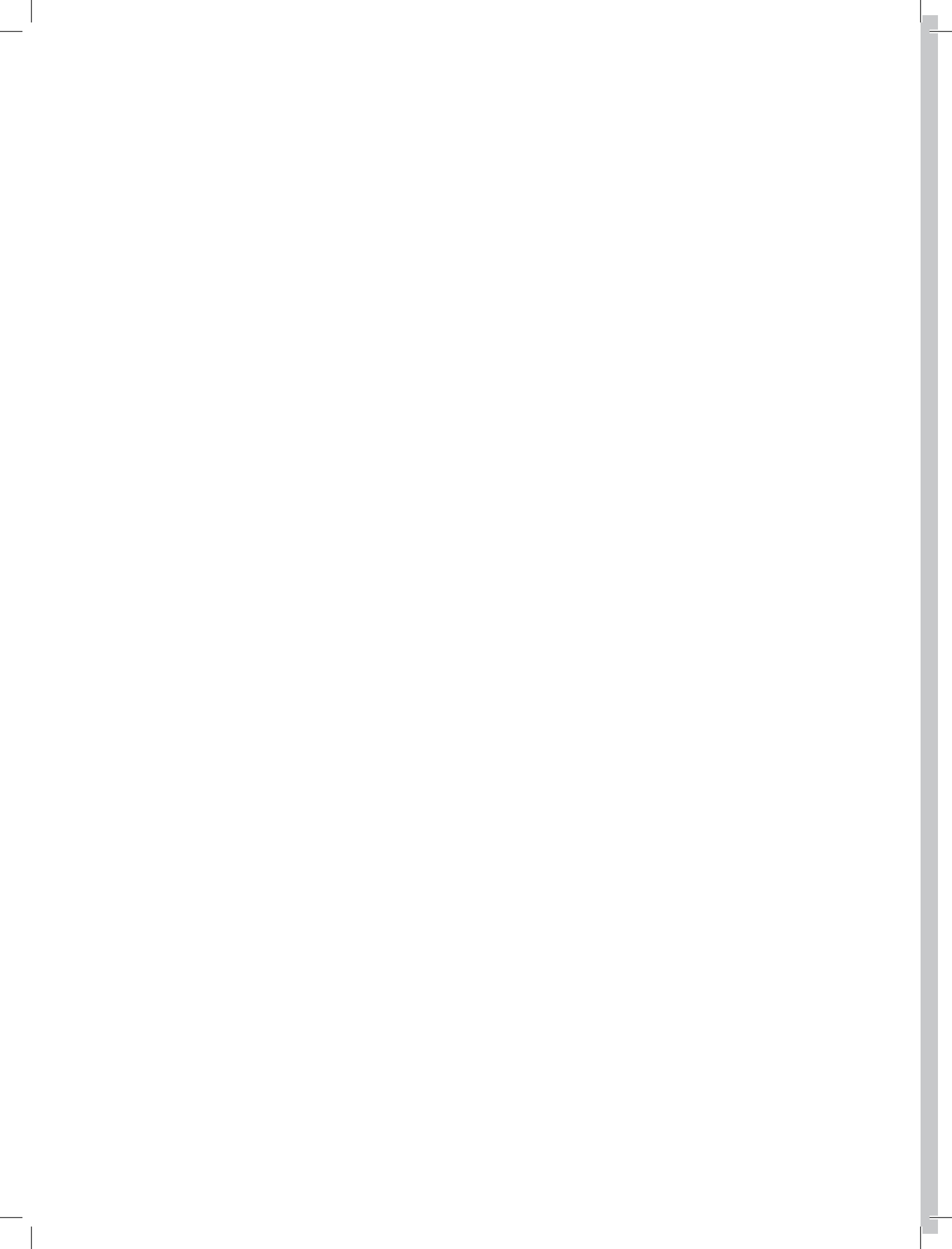
## PREFACE

In alignment with the Government of India's mission to build smart and sustainable cities in India, a Memorandum of Understanding (MoU) was signed (on 16 January, 2019) between the Royal Danish Embassy and the Imagine Panaji Smart City Development Limited (IPSCDL) to jointly establish an Urban Living Lab (ULL) in Panaji, Goa, and subsequently, the Danish Ministry of Foreign Affairs, Royal Danish Embassy, New Delhi initiated the Urban Living Lab on Sustainable and Smart Cities in India (ULL) project in 2019 -20. This MoU is based on an earlier MoU on Sustainable and Smart Urban Development signed between the governments of Denmark and India in April 2018. The Project has been initiated in Panaji with the scope to extend to all the smart cities. As a Knowledge Partner to the ULL, The Energy and Resources Institute (TERI) aims to provide knowledge inputs for the implementation of ULL in Indian cities. The objective is to enhance the capacities of the existing smart cities through knowledge-sharing and integration of global sustainable solutions. In this regard, TERI is developing two Knowledge Products as outcomes of this Knowledge Partnership.

This first Knowledge Product or KP 1 has been conceptualized to identify global urban projects that utilize innovative approaches to address different urban challenges. Consequently, KP1 highlights 100 global and national urban projects that can provide a roadmap for Indian cities to streamline knowledge, strengthen planning mechanisms, and mobilize financial resources for addressing urban challenges and achieving sustainable development. While the document draws lessons from both national and international urban projects, it can be useful for policymakers and urban practitioners as an inspiration for identifying and adapting sustainable urban solutions which adhere to the priorities of their cities and are suitable in the local context.

### **Acknowledgements:**

The KP 1 has been prepared by the experts from the Transport and Urban Governance Division of TERI. The team is grateful to the Danish Ministry of Foreign Affairs, Royal Danish Embassy, New Delhi for their guidance and financial support in developing the document. Of mention are the Urban Living Lab Project Partners – Oxford Policy Management and Tandem Research – for providing their valuable insights and inputs that have been incorporated into this document. We also extend our sincere thanks to the TERI Press and Communications teams for their efforts in editing, design, translation, and outreach of the document.



# 1

## BACKGROUND

### 1.1 Urban Context of India

Urban areas drive the social and economic development in countries across the world. In 2018, 4.2 billion people or 55 % of the world's population lived in urban areas, and by 2050, the urban population is expected to reach 6.5 billion (UNDESA, 2018). Therefore, to achieve sustainable development, transforming the way we build and manage our urban spaces is critical. Urban development should be guided by an approach that creates a balance between the built and natural systems. Policymakers should invest in infrastructure development and economic growth to improve the quality of living of the citizens and create livelihood opportunities. They should also address environmental concerns, such as, flooding, clean air and water, and renewable energy to build communities that are resilient to climate change. The pressing priority is thus a comprehensive outlook of, sensitization towards, and integration of sustainable solutions that address the needs of cities and states.

Globally, there have been several initiatives to promote sustainable city development through efficient resource utilisation, low-carbon growth, climate and disaster resilience, and smart governance. The UN General Assembly adopted the Urban Agenda in 2015 as a specific Sustainable Development Goal (SDG 11) which calls upon governments to make their cities and settlements inclusive, safe, resilient, and sustainable. The Paris Climate Agreement recognised cities as key subnational entities for effective climate action. The UN Conference on Housing and Human Settlement or Habitat III adopted the New Urban Agenda (NUA) to address the challenges of urbanisation and to achieve the SDG 11. India is a party to all these commitments, and the national urban missions are aligned with these global agendas.

The Government of India (GoI) has launched several urban transformation schemes such as the Atal Mission for Rejuvenation and Urban Transformation (AMRUT), the Swachh Bharat Mission – Urban (SBM-U), Pradhan Mantri Awas Yojana - Urban (PMAY-U) and the flagship Smart Cities Mission (SCM) to make cities liveable, sustainable, smart and inclusive. The Smart Cities Mission was initiated in 2015 by the Ministry of Housing and Urban Affairs (MoHUA) with an objective to renew, retrofit and redevelop 100 cities across the country through a focus on smart solutions for core infrastructure development and good governance (MoHUA, 2015). In addition to this, the MoHUA has also developed an 'Ease of Living Index' and the 'ClimateSmart Cities Assessment Framework' (CSCAF) to further promote steps in consonance with the global targets for resilient and sustainable development.

The Urban Living Lab (ULL) on Sustainable and Smart Cities in India is expected to contribute to the GoI's investments in addressing the challenges and realising the potential of India's growing cities. The objective of the ULL is to have sustainable and liveable smart cities through integration of global sustainable solutions. The ULL will aid in implementation of the GoI's Smart City Mission covering 100 Smart Cities and approximately 100 million people. To further this agenda, based on a Memorandum of Understanding (MoU) signed (on 16 January, 2019) between the Royal Danish Embassy and the Imagine Panaji Smart City Development Limited (IPSCDL) (drawn from an earlier MoU between Denmark and India governments in 2018) to jointly establish an Urban Living Lab (ULL) in Panaji, Goa, the Danish Ministry of Foreign Affairs, Royal Danish Embassy, New Delhi initiated the Urban Living Lab on Sustainable and Smart Cities in India (ULL) project in 2019 -20.

Royal Danish Embassy, New Delhi is supporting the establishment of an Urban Living Lab in Panaji, Goa. Subsequently, the ULL can also be extended to all the Smart Cities in India. As a Knowledge Partner to the ULL, TERI aims to provide knowledge inputs for the implementation of ULL in Indian cities.

## 1.2 Framework for Identification of Urban Solutions

The Knowledge Product 1 (KP1) on **Global Urban Solutions for Sustainable Smart Cities in an Indian Context** by TERI provides a range of global and national sustainable solutions and innovative strategies that cities can adopt in the local context. These urban solutions have been extracted from different online sources through extensive desktop research, and in consultation with various thematic experts. Further, they have been identified in line with the targets and indicators of the SDGs (such as SDG 11, 16 and 17); objectives of the SCM; sectors, parameters and benchmarks of the CSCAF; and other global and national-level benchmarks for urban sustainability. Correspondingly, the sustainable urban solutions have been segregated under the following sectoral and cross-sectoral themes:

- Data-driven Urban Planning and Governance
- Climate Adaptation and Urban Flood Management
- Water Resource Management
- Urban Mobility
- Solid Waste Management
- Energy Optimization
- Urban Environment

The KP1 includes 100 urban solutions under these 7 broad themes that address different aspects and challenges of urban areas. It is worth mentioning that this is not an exhaustive list under these 7 broad themes and the identified solutions can fall under one or more of these themes, especially with Data-driven Urban Planning and Governance and Urban Environment being cross-cutting themes. KP1 highlights global and national urban solutions that can provide a roadmap for Indian cities to streamline knowledge, strengthen planning mechanisms, and mobilize financial resources for addressing urban challenges and achieving sustainable development. Moreover, these urban solutions can also guide cities towards achievement of other international targets, such as those of the Sendai Framework for Disaster Risk Reduction 2015-30 and India's Nationally Determined Contributions (NDCs).



A framework has also been devised under the KP1 to help the cities identify relevant urban solutions. As an example, Table 1 briefly describes a few thematic focus areas/challenges, and relevant global and national level targets and benchmarks for the Urban Mobility theme.



**Table 1: Utilizing the broad framework of identification of sustainable urban solutions for Panaji**

City-specific Themes	Thematic Focus Areas and Challenges*				Relevant SDG Targets and Indicators**				Relevant CSCAF Categories and Indicators***				
Theme	a	b	....	....	SDG 1	SDG 2	....	SDG 17	1.	2.	3.	4.	5.
Sustainable urban solution	✓	✓			✓	✓		✓	✓		✓	✓	
Description of the Criteria													
<b>* Thematic Focus Areas and Challenges</b>	Specific challenges for cities can be identified for each theme based on the local context. The letters a, b, .... represent the specific challenges with respect to the different themes.												
<b>** Relevant SDG Targets and Indicators</b>	The SDGs were adopted by all United Nations Member States in 2015 <sup>1</sup> . They are a collection of 17 global goals (with accompanying targets and indicators) intended to be achieved by the year 2030. The targets relevant for each theme can be identified for the purpose of this exercise (SDG 1, SDG 2, ..... , SDG 17).												
<b>*** Relevant CSCAF Sectors and Indicators</b>	The Smart Cities Mission of the MoHUA has initiated the CSCAF as a step towards holistic and climate-responsive urban development <sup>2</sup> . Relevant CSCAF indicators across the following five categories of the framework can be highlighted for each theme – 1. Energy and Green Buildings; 2. Urban Planning, Green Cover and Biodiversity; 3. Mobility and Air Quality; 4. Water Management and; 5. Waste Management.												
<ul style="list-style-type: none"> <li>Each tick indicates that the urban solution addresses that specific focus area/challenge or contributes towards the highlighted SDG target. It should be noted that the ticks indicated as part of this table are representational.</li> </ul>													
As an example, below indicated are the focus areas/challenges for the Urban Mobility theme for Panaji city, relevant SDG targets and indicators, and relevant CSCAF sectors and indicators that can be matched with the sustainable urban solutions.													
City-Specific Theme	Theme-specific concern areas and challenges identified for Panaji by the ULL				SDG Indicators relevant for Urban Mobility				Relevant CSCAF Sectors and Indicators				
URBAN MOBILITY	a) Pedestrianization				<ul style="list-style-type: none"> <li><b>SDG 3:</b> SDG 3.6.1 Reduce Traffic Incidents</li> <li><b>SDG 7:</b> SDG 7.3.1 Reduce Energy Use Intensity</li> <li><b>SDG 9:</b> SDG 9.1 Develop Resilient &amp; Inclusive Infrastructure</li> <li><b>SDG 11:</b> SDG 11.2.1 Access to safe, affordable, accessible and sustainable Public Transport</li> <li><b>SDG 12:</b> SDG 12.C Reduce the usage of fossil fuel</li> <li><b>SDG 13:</b> SDG 13.2 Reduce GHG emissions</li> <li><b>SDG 17:</b> SDG 17.16 Partnerships for Sustainable Development</li> </ul>	<ul style="list-style-type: none"> <li><b>Mobility and Air Quality Indicator 1:</b> Clean Technologies Shared Vehicles</li> <li><b>Mobility and Air Quality Indicator 2:</b> Availability of Public Transport</li> <li><b>Mobility and Air Quality Indicator 3:</b> Coverage of Non-Motorized Transport network (pedestrian and bicycle)</li> <li><b>Mobility and Air Quality Indicator 4:</b> Level of Air Pollution</li> </ul>							
	b) Cycling												

1 United Nations Development Programme. (2020). Sustainable Development Goals. Retrieved March 2021, from UNDP: <https://www.undp.org/content/undp/en/home/sustainable-development-goals.html>

2 National Institute of Urban Affairs. (2020). ClimateSmart Cities Alliance. Retrieved March 2021, from Smartnet - National Institute of Urban Affairs: <https://smartnet.niua.org/csc/national-csc-alliance.html>

# 2

## DATA-DRIVEN URBAN PLANNING AND GOVERNANCE



Planning and management of urban areas is one of the defining challenges of the 21st century. If managed well, cities can act as engines of growth and provide better physical infrastructure, quality housing, improved safety and healthcare, and socioeconomic development (TERI, 2009). Data is an essential component of this planning and development process as it enables city authorities to make informed decisions related to physical, social and economic aspects. Moreover, it also helps them better respond to uncertainties such as climate change.

### Seoul Open Data Plaza: Seoul, South Korea

(Reference # 83)

**Keywords:** Open Data Sharing, Data Exchange Platform, Data Literacy

**Started:** 2012

**Project Owner:** Seoul Metropolitan Government

The 'Seoul Open Data Plaza' is a unified open data portal that aims to enhance the public understanding of municipal policies as well as generate new opportunities for authorities, enterprises and researchers. It provides public access to large amounts of data on aspects such as demographics, general administration, public health and environment.

**Relevant SDGs:** 8, 9, 11, 16, 17

### Map Kibera: Nairobi, Kenya

(Reference # 55)

**Keywords:** Crowdsourcing Data, Community Engagement and Empowerment, Data-use Cases

**Started:** 2009

**Project Owner:** Map Kibera Trust

Map Kibera is a community information project, that involves the community in mapping the informal settlements, participatory GIS sessions, and working with local organisations to identify and address key community issues. It leverages mobile phone and GIS technology to engage communities in data collection, reporting and publication of information.

**Relevant SDGs:** 3, 5, 8, 10, 11, 16, 17

### Copenhagen Connecting: Copenhagen, Denmark

(Reference # 90)

**Keywords:** Smart City Operations, Crowdsourcing Data, Open Data Sharing, Data Exchange Platform

**Started:** 2013

**Project Owner:** Copenhagen Solution Lab

Copenhagen Connecting is a collaborative project that brings together citizens, businesses, government and research organizations to build data-collecting infrastructure and an open platform for the city. It pools data from smart sensors across the city to target optimized traffic flows, crowd control, emission reduction and other end-uses.

**Relevant SDGs:** 7, 8, 9, 11, 12, 13, 16, 17

### Integrated Operations Centre: Bristol, U.K.

(Reference # 67)

**Keywords:** Smart City Operations, Crowdsourcing Data, Open Data Sharing, Data Exchange Platform

**Started:** 2017

**Project Owner:** Bristol City Council

The Integrated Operation Centre is a city-wide management and service-delivery centre for Bristol that brought together teams from multiple sectoral organisations for real-time management of different urban functions (such as the city's traffic network to make adjustments to signals and keep the traffic moving). It also includes an open information platform for public engagement.

**Relevant SDGs:** 8, 9, 11, 16, 17

**City Data for India: Bhubaneswar, India**

(Reference # 106)

**Keywords:** *Data Quality and Certification, Open Data Sharing, Data Infrastructure***Started:** 2016**Project Owners:** The Tata Trusts and WCCD

The City Data for India initiative is a data certification program for internationally standardized and comparable open city data. This certification allows cities to compare their progress with other cities and set realistic benchmarks and targets to improve city planning, infrastructure investment and operational performance management.

**Relevant SDGs:** 8, 9, 11, 16, 17**Intelligent Transport Management System:****Ahmedabad, India** (Reference # 61)**Keywords:** *Data-use Cases, Crowdsourcing Data, Public Transport, Intelligent Transportation Systems***Started:** 2017**Project Owner:** Smart City Ahmedabad Development Limited

The Intelligent Transport Management System was implemented in Ahmedabad to improve the efficiency of its BRT and AMTS bus services using a cashless open loop card system. In addition to automated fare collection, the one-stop system manages bus resources, bus maintenance, transport information, and personnel by analysing data sets collected from different IoT tools.

**Relevant SDGs:** 8, 9, 11, 16, 17**The Wellbeing Project: Santa Monica, U.S.A.**

(Reference # 63)

**Keywords:** *Community Engagement and Empowerment, Crowdsourcing Data, Social Development***Started:** 2017**Project Owner:** City of Santa Monica

The Wellbeing Project is a community-focused urban governance initiative that leverages multiple data points on individual and community wellbeing (affordability, mobility, stress, and equity) to inform public policies. It includes a Wellbeing Index, which provides periodic inputs to city officials on the existing strengths, gaps, challenges and potentials of the city.

**Relevant SDGs:** 1, 3, 8, 10, 11, 16, 17**Pune WISE: Pune, India**

(Reference # 65)

**Keywords:** *Community Engagement and Empowerment, Crowdsourcing Data, Municipal Budgeting***Started:** 2016**Project Owner:** Pune Municipal Corporation

Pune WISE (Ward Infrastructure Services and Environment) is an ICT-supported tool that grades different wards and informs the citizens about the status of infrastructure and services in their ward as well as the budget allocations made. It has been designed to make the municipal budgeting process responsive to citizens' needs, easier to understand and participatory.

**Relevant SDGs:** 6, 8, 9, 11, 16, 17**BOS:311 (Citizens Connect) Mobile Application:****Boston, U.S.A.** (Reference # 17)**Keywords:** *Community Engagement, Public Services Delivery, Transparency and Accountability,***Started:** 2016**Project Owner:** City of Boston

The BOS:311 is a mobile application that allows residents to quickly report public works and service needs such as potholes, road blockades or streetlight failures via their phones. It also enables them to track the active status of assignments including list of workers engaged and expected time for task completion.

**Relevant SDGs:** 3, 6, 9, 11, 16, 17**Virtual Singapore: Singapore**

(Reference # 88)

**Keywords:** *Open Data Sharing, Digital City Model, Re- search and Development***Started:** 2014**Project Owner:** Government of Singapore

Virtual Singapore is a dynamic three-dimensional (3D) city model and collaborative data platform that enables the public, businesses, government and research agencies to conduct testbedding of concepts and services, derive insights, develop solutions and run simulations using a digital city model of Singapore.

**Relevant SDGs:** 8, 9, 11, 16, 17

<b>I Paid a Bribe: Bangalore, India</b> (Reference # 49)
<b>Keywords:</b> <i>Transparency and Accountability, Community Engagement and Empowerment</i>
<b>Started:</b> 2010 <b>Project Owner:</b> Janaagraha
I Paid a Bribe is an online anti-corruption platform that uses a crowd-sourcing model to collect data on bribe reports and corruption across government departments. It uses the data to analyse trends, decipher work flows and advocate for changes of business processes within city departments, to gradually eliminate opportunities for retail corruption altogether.
<b>Relevant SDGs: 8, 9, 11, 16, 17</b>

<b>Land Bank: Kansas City, U.S.A.</b> (Reference # 51)
<b>Keywords:</b> <i>Land Records, Transparency and Accountability, Community Engagement and Empowerment</i>
<b>Started:</b> 2012 <b>Project Owner:</b> City of Kansas City
The Land Bank of Kansas City is a Digital Land Records Management System that hosts an inventory of plots and buildings in the city with associated detail on the type, ownership, location, age and tenure status. It also features a platform for sale, purchase, lease or renting of properties including details on permissible uses as per the city development plan.
<b>Relevant SDGs: 1, 8, 9, 11, 16, 17</b>

<b>Switching on Darwin: City of Darwin, Australia</b> (Reference # 19)
<b>Keywords:</b> <i>Smart Environmental Sensors, Community Engagement, Public Health and Safety</i>
<b>Started:</b> 2017 <b>Project Owner:</b> City of Darwin
Switching on Darwin is a technology-driven project that uses a range of smart environmental sensors (for temperature, air quality, and noise level) together with CCTV cameras and LED street lights to provide the city council insights for managing heat, enhancing public safety, and improving service delivery. It also includes sensors to detect and notify distress signals.
<b>Relevant SDGs: 3, 5, 7, 9, 13, 11, 16, 17</b>

<b>Smart Dubai Happiness Meter: Dubai, United Arab Emirates</b> (Reference # 86)
<b>Keywords:</b> <i>Transparency and Accountability, Crowdsourcing Data, Data Dashboard and Visualization</i>
<b>Started:</b> 2015 <b>Project Owner:</b> Smart Dubai Government
Smart Dubai Happiness Meter is a city-wide, live sentiment capture engine that provides a centralised data dashboard and digital map to public and private sector entities to gauge and improve public services at different locations in the city. The dashboard also compares different service providers and gives insights on potential areas of improvement.
<b>Relevant SDGs: 3, 8, 11, 16, 17</b>

<b>Pune City Digital Strategy: Pune, India</b> (Reference # 77)
<b>Keywords:</b> <i>Digital Infrastructure Development, Data Management, Public Services Delivery</i>
<b>Started:</b> 2018 <b>Project Owner:</b> Pune Municipal Corporation
The Pune City Digital Strategy is a three-year action plan that outlined an adaptive digital maturity framework for Pune city to be followed for the years 2018-20. It focused on digital infrastructure, digital services and payments, digital engagements and collaboration, and digital enterprise. The strategy also focused on effective delivery of services to citizens.
<b>Relevant SDGs: 8, 9, 11, 16, 17</b>

<b>Smart City Masterplan, Parramatta, Australia</b> (Reference # 21)
<b>Keywords:</b> <i>Urban Planning and Management, Data and Smart Technology, Infrastructure Development</i>
<b>Started:</b> 2015 <b>Project Owner:</b> City of Parramatta
The Smart City Masterplan of Parramatta is a strategic document that provides a guiding framework for the city to leverage data and enabling technology for sound urban planning and infrastructure development. It also establishes data and smart technology as tools to actively engage the community, boost economic development and achieve environmental sustainability.
<b>Relevant SDGs: 8, 9, 11, 16, 17</b>

# 3

## CLIMATE ADAPTATION AND URBAN FLOOD MANAGEMENT



Climate change impacts have been adversely affecting cities across the globe. 70% of cities are already dealing with the effects of climate change, and nearly all are at risk (UCCRN, 2018). Densely populated areas, buildings, and infrastructure assets make cities highly vulnerable to extreme weather events, such as, storms and floods induced by climate change. Therefore, proactive implementation of strategies to manage and safeguard vulnerable sectors from the various threats is essential for keeping the infrastructure systems well-equipped.

### Minghu Wetland Park: Liupanshui, China

(Reference # 100)

**Keywords:** Flood Management, Water-Quality Management, Blue-Green Infrastructure, Wetlands

**Started:** 2009

**Project Owner:** Liupanshui Municipal Government

The Minghu Wetland Park was an ecological restoration project planned to transform a concretized river and deteriorated peri-urban site into a city-wide ecological infrastructure to provide multiple ecosystem services, including storm-water management, water cleansing, and a cherished public space. It also generated farming and fishing-based livelihood opportunities.

**Relevant SDGs:** 6, 9, 11, 13, 15

### Cloudburst Management Plan: Copenhagen, Denmark

(Reference # 18)

**Keywords:** Flood Management Strategy, Climate Adaptation and Mitigation, Blue-Green Infrastructure

**Started:** 2012

**Project Owner:** City of Copenhagen

The Cloudburst Management Plan is a city-wide master plan for adapting to extreme rainfall events that details concrete priorities, measures and responsibilities of different city departments to protect the city against heavy rain. The Plan focuses on integration of various blue-green infrastructure into the existing built environment as a sustainable long-term solution to urban flooding.

**Relevant SDGs:** 6, 9, 11, 13, 17

### Water Sensitive Rotterdam: Rotterdam, The Netherlands

(Reference # 108)

**Keywords:** Climate Adaptation, Flood Management, Blue-Green Infrastructure, Nature-based Solutions

**Started:** 2015

**Project Owner:** Municipality of Rotterdam

Water Sensitive Rotterdam is an extensive climate adaptation program that leveraged sustainable urban water management as a tool to reduce the impact of increased rainfall, extreme heat, drought and other expected changes in the climate. It involved the citizens and organizations in water management, and introduced the principles of climate policy in every plan.

**Relevant SDGs:** 6, 9, 11, 13, 16, 17

### High Point Natural Drainage System Project: Seattle, U.S.A.

(Reference # 23)

**Keywords:** Flood Management, Water-Quality Management, Blue-Green Infrastructure, Nature-based Solutions

**Started:** 2005

**Project Owner:** Seattle Public Utilities

The Natural Drainage System (NDS) of High Point neighbourhood is a large-scale urban drainage system that uses green infrastructure to capture and naturally manage stormwater using features such as swales and landscaped wetland ponds. The system also led to an increase in public green spaces and improvement in the natural biodiversity of the area.

**Relevant SDGs:** 6, 9, 11, 13, 15

<p><b>Mu City Savior: Bhubaneswar, India</b> (Reference # 64)</p>	<p><b>Socially Inclusive Climate Adaptation Project: Jakarta, Indonesia</b> (Reference # 11)</p>
<p><b>Keywords:</b> <i>Flood Management, Community Engagement and Empowerment, Public Services Delivery</i></p>	<p><b>Keywords:</b> <i>Climate Adaptation, Flood Management, Community Engagement and Empowerment</i></p>
<p><b>Started:</b> 2019</p>	<p><b>Started:</b> 2012</p>
<p><b>Project Owners:</b> BMC and BSCL</p>	<p><b>Project Owner:</b> Government of Jakarta</p>
<p>The “Mu City Savior” is an IoT-based flood management solution that captures crowdsourced data on flooding hotspots to notify and prompt the city authorities for action. It uses a smartphone application to gather inputs from the citizens and a data dashboard to inform the authorities on the location, cause, scale and frequency of flooding for appropriate response.</p>	<p>The Socially Inclusive Climate Adaptation for Urban Revitalization Project was planned to reduce the climate risks of low-income residents living in low-lying areas of the city (vulnerable to extreme rainfall, floods and sea-level rise) and rehabilitate them into subsidized high-rise apartments. The residents were also provided multiple tenure options and alternate livelihood opportunities.</p>
<p><b>Relevant SDGs:</b> 6, 9, 11, 16, 17</p>	<p><b>Relevant SDGs:</b> 1, 6, 8, 9, 10, 11, 13, 17</p>
<p><b>Helsinki City Flood Strategy: Helsinki, Finland</b> (Reference # 79)</p>	<p><b>GCC Disaster Management Plan: Chennai, India</b> (Reference # 44)</p>
<p><b>Keywords:</b> <i>Flood Management, Climate Adaptation, Emergency Response, Blue-Green Infrastructure</i></p>	<p><b>Keywords:</b> <i>Disaster Management, Flood Management, Climate Adaptation, Standard Operating Procedures</i></p>
<p><b>Started:</b> 2008</p>	<p><b>Started:</b> 2017</p>
<p><b>Project Owner:</b> City of Helsinki</p>	<p><b>Project Owner:</b> Greater Chennai Corporation</p>
<p>The Helsinki City Flood Strategy was envisaged as an umbrella paper for managing heavy rain flooding and sea flooding events. The strategy included tasks ranging from building flood embankments to developing a flood information bank. All tasks were entrusted to various departments of the City, and a preliminary schedule for all the tasks was also prepared.</p>	<p>The Greater Chennai Corporation (GCC) Disaster Management Plan is framed as a set of guidelines for the city disaster preparedness, prevention, and mitigation. The plan takes into account, the vulnerabilities of the city based on its geography, past history of disasters and its social and environmental aspects to provide standard operating procedures for different departments.</p>
<p><b>Relevant SDGs:</b> 6, 9, 11, 13, 17</p>	<p><b>Relevant SDGs:</b> 6, 9, 11, 17</p>
<p><b>Skt. Kjelds Climate Neighborhood: Copenhagen, Denmark</b> (Reference # 98)</p>	<p><b>Space to Grow: Chicago, U.S.A.</b> (Reference # 89)</p>
<p><b>Keywords:</b> <i>Flood Management, Blue-Green Infrastructure, Nature-based Solutions</i></p>	<p><b>Keywords:</b> <i>Flood Management, Community Engagement and Empowerment, Blue-Green Infrastructure</i></p>
<p><b>Started:</b> 2011</p>	<p><b>Started:</b> 2013</p>
<p><b>Project Owner:</b> City of Copenhagen</p>	<p><b>Project Owner:</b> Healthy Schools Campaign</p>
<p>The Skt. Kjelds Climate Neighborhood is a comprehensive urban development project that was planned to demonstrate how the city can be designed using green and blue solutions to handle rainwater (together with smaller private initiatives such as green roofs and rain gardens) for a Climate-Resilient Neighbourhood strategy.</p>	<p>Space to Grow is a blue-green infrastructure development program that integrates stormwater management infrastructure into school playgrounds as a low-cost and space-saving flood management solution. The green schoolyards feature rain gardens, permeable asphalt, permeable pavers, water storage under parking lots and turf fields, and permeable rubber play surfaces.</p>
<p><b>Relevant SDGs:</b> 6, 9, 11, 13, 17</p>	<p><b>Relevant SDGs:</b> 6, 9, 10, 11, 13, 17</p>

**C-FLOWS: Chennai Flood Warning System: Chennai, India** (Reference # 58)

**Keywords:** *Disaster Management, Flood Management, Climate Adaptation, Early-Warning System*

**Started:** 2019

**Project Owner:** NCCR

C-FLOWS is a GIS-based flood warning system for Chennai that can predict flooding due to heavy rainfall, sealevel rise and increase in water levels in the surrounding rivers. The system uses a hydrodynamic model to collate data such as water level in waterbodies and rainfall as well as elevation at different spots to forecast floods up to two weeks in advance.

**Relevant SDGs:** 6, 9, 11, 13, 17

**Rain City Strategy: Vancouver, Canada** (Reference # 99)

**Keywords:** *Flood Management, Climate Adaptation and Mitigation, Blue-Green Infrastructure, Nature based Solutions, Water-Quality Management*

**Started:** 2019

**Project Owner:** City of Vancouver

The Rain City Strategy is a green infrastructure development plan that aims to capture (infiltrate, evapotranspirate, and/or reuse) and clean (treat) 90% of Vancouver's annual rainwater using a combination of green infrastructure and conventional pipe systems. It intends to restore the natural water cycle by allowing water to return to plants, trees, aquifers and streams.

**Relevant SDGs:** 6, 9, 11, 13, 15, 17

# 4

## WATER RESOURCE MANAGEMENT



Water resource management systems are necessary for carrying out various urban activities. However, with the intensification of urbanization, judicious management of fresh water is increasingly becoming critical. Equally important is the treatment of wastewater and stormwater to remove impurities and harmful substances before it reaches aquifers or rivers, lakes, estuaries, and oceans. Therefore, to ensure sustainable water management solutions, policymakers and Urban Local Bodies (ULBs) must take actions to holistically address these challenges.

### The LEAKman Project: Copenhagen, Denmark (Reference # 53)

**Keywords:** Fresh Water Supply, Real Time Monitoring, Smart Metering, Public Services Delivery

**Started:** 2016

**Project Owners:** LEAKman Partner Agencies

The LEAKman project brought together technology providers, water utilities, and research institutions together to develop solutions for reducing transmission losses of freshwater supply systems - through pressure management, active leakage control, pipeline management and rehabilitation, as well as speed and quality of repairs to improve the level of service of water utilities.

**Relevant SDGs:** 6, 9, 11, 12, 17

### WaterWiSe Smart Water Grid Project: Singapore (Reference # 6)

**Keywords:** Fresh Water Supply, Real Time Monitoring, Smart Metering, Public Services Delivery

**Started:** 2016

**Project Owner:** NRF Singapore

Water WiSe is a cloud-based water monitoring system that integrates hardware and software components to detect leaks remotely and predict pipe bursts for long-term maintenance of water distribution networks. It is capable of gauging a number of hydraulic and water quality indicators such as pressure, acoustics, flow rate, and pH in real-time.

**Relevant SDGs:** 6, 9, 11, 12, 17

### Water Supply Grid System: Gujarat, India (Reference # 95)

**Keywords:** Fresh Water supply, Real Time Monitoring, Failsafe Operation, Public Services Delivery

**Started:** 2017

**Project Owner:** Surat Municipal Corporation

The Water Supply Grid System of Surat is a smart network infrastructure with multiple water works and alternate distribution systems designed to reduce disruptions in the freshwater supply system (caused due to failure of individual water works). In case one distribution system fails, water can be supplied to the city from others. It also monitors water quality and leakage.

**Relevant SDGs:** 6, 9, 11, 12, 13, 16

### Smart Water Metering System: Seosan, South Korea (Reference # 47)

**Keywords:** Fresh Water Supply, Real Time Monitoring, Smart Metering, Public Services Delivery

**Started:** 2016

**Project Owner:** Seosan City Municipality

The Smart Water Metering System has been established in Seosan to reduce water leakages and consequently improve revenue water ratio through use of smart meters, wireless data sensors and IT based decision support systems. The system optimizes water resource management through monitoring, problem-diagnosis, and efficiency improvements.

**Relevant SDGs:** 6, 9, 11, 12, 16



**Intelligent Wastewater Handling: Copenhagen, Denmark** (Reference # 80)

**Keywords:** *Wastewater Management, Real Time Monitoring, Flood Management*

**Started:** 2008

**Project Owner:** Rambøll

The Intelligent Wastewater Handling system of Copenhagen has been designed to reduce the occurrence of floods and enhance the capacity of wastewater treatment through use of smart rain sensors. It operates the pumping stations and drainage valves automatically, via rain radars to optimize the flow and mix of water.

**Relevant SDGs:** 6, 9, 11, 12, 13

**Deep Tunnel Sewerage System (DTSS): Singapore** (Reference # 3)

**Keywords:** *Wastewater Management, Wastewater Reclamation, Energy-efficiency*

**Started:** 2008

**Project Owner:** Public Utilities Board, Singapore

The Deep Tunnel Sewerage System (DTSS) is a cost-effective, energy-efficient wastewater infrastructure which uses deep tunnels to convey used water by gravity to centralized water reclamation plants (WRPs) located in the coastal areas. The water is then treated and purified into ultra-clean, high-grade reclaimed water.

**Relevant SDGs:** 6, 9, 11, 12, 13

**Adyar Poonga Lake Restoration: Chennai, India** (Reference # 31)

**Keywords:** *Urban Water Body Management, Flood Management, Pollution Management*

**Started:** 2008

**Project Owner:** TNUIFSL

The Adyar Poonga Lake Restoration project was designed to rehabilitate the deteriorated lake as an ecological infrastructure for flood management, pollution control and recreation. For this, ecological profile of the lake was revived, sewage and solid waste disposal points were checked, and it was recalibrated as a retention and infiltration pond for storm water.

**Relevant SDGs:** 6, 9, 11, 12, 13, 15, 17

**Aarhus River Project: Aarhus, Denmark** (Reference # 93)

**Keywords:** *Urban Water Body Management, Flood Management, Climate Adaptation, Blue-Green Infrastructure, Waterfront Development*

**Started:** 2005

**Project Owner:** Municipality of Aarhus

The Aarhus River Project was planned to resurface the covered river, improve its water quality, reduce flooding, and support recreational activities along Lake Brabrand, the Aarhus River and the Port of Aarhus. It focused on integration of blue-green infrastructure, construction of floodwater retention/treatment areas, climate adaptation, and creation of engaging waterfront spaces.

**Relevant SDGs:** 6, 9, 11, 12, 13, 17

**Utilization of City Sewage Wastewater: Mangalore, India** (Reference # 37)

**Keywords:** *Wastewater Management, Wastewater Reuse, Industrial Development*

**Started:** 2000

**Project Owner:** Mangalore City Corporation

The Mangalore City Corporation has developed this program for utilization/reuse of the city's treated domestic wastewater by water-intensive industries located in the city's Special Economic Zone. The program leverages the capital set aside by industries for procurement of water to operate and maintain wastewater treatment plants and pumping stations.

**Relevant SDGs:** 6, 11, 12, 17

**Integrated Smart Water Management System for Sanitation: Paris, France** (Reference # 52)

**Keywords:** *Wastewater Management, Flood Management, Real Time Monitoring*

**Started:** 2008

**Project Owner:** City of Paris

Integrated Smart Water Management System for Sanitation is a real-time control system for management of stormwater pollution caused by combined sewer overflows. It limits mixing of stormwater runoff with sewage water through smart sensors that control pumping stations to distribute hydraulic load and reduce overflow flooding. It also provides flow forecasts for the network.

**Relevant SDGs:** 6, 9, 11, 12, 13

**Net-zero Energy Wastewater Treatment Plant: Gresham, U.S.A.** (Reference # 109)

**Keywords:** *Wastewater Management, Waste to Energy, Solar Energy, GHG Emissions Reduction*

**Started:** 2012

**Project Owner:** City of Gresham

The Gresham Wastewater Plant is a 20 million-gallons-per-day net-zero energy wastewater treatment facility that generates 92 % of its own electricity requirement from biogas, naturally produced by wastewater (in the form of methane). The remainder 8 % is generated through solar power. The Plant also has an option to send clean energy back to the grid.

**Relevant SDGs:** 6, 9, 11, 12, 13, 17

**Jakkur Lake Rejuvenation: Bengaluru, India** (Reference # 35)

**Keywords:** *Urban Water Body Management, Community Engagement and Empowerment, Biodiversity*

**Started:** 2009

**Project Owner:** Bruhat Bengaluru Mahanagara Palike

The Jakkur Lake Rejuvenation project was undertaken to improve the ecological condition of the lake and restore its natural function as a stormwater retention and treatment infrastructure. A combination of upgraded sewage treatment plants and constructed wetlands were used to clean the Lake. It also provided livelihood opportunities to fishermen and improved the local biodiversity.

**Relevant SDGs:** 6, 9, 11, 12, 13, 15, 17

**Liquid Waste Management Plan: City of Port Alberni, Canada** (Reference # 22)

**Keywords:** *Wastewater Management, Pollution Management, GHG Emissions Reduction*

**Started:** 2013

**Project Owner:** City of Port Alberni

The Liquid Waste Management Plan for the City of Port Alberni details long-term, comprehensive strategies for the city to deal with all the aspects of municipal wastewater including municipal sewerage systems, individual on-site systems, industrial discharges, and non-point pollution sources. It also promotes a participatory approach for the management of wastewater.

**Relevant SDGs:** 6, 9, 11, 12, 13, 17

**Aarhus ReWater: Aarhus, Denmark** (Reference # 1)

**Keywords:** *Wastewater Management, Resource Extraction, Waste to Energy, GHG Emissions Reduction*

**Started:** 2013

**Project Owner:** Aarhus Vand

Aarhus Vand has designed a state-of-the-art wastewater treatment and resource recovery plant named Aarhus ReWater to sustainably treat wastewater, extract valuable resources from it, and generate green energy. The facility can extract nutrients, chemicals, metals and plastics among other resources in addition to the production of reclaimed water and biogas for heat and electricity.

**Relevant SDGs:** 6, 7, 8, 9, 11, 12, 13, 17

# 5

## URBAN MOBILITY



The transport sector plays a fundamental role in the economic growth and development of cities. Mobility flows have become a key dynamic in the rapid urbanisation process of Indian cities with the urban transport infrastructure constituting the skeleton of the urban form (UN-Habitat, 2013). Sustainable mobility should relate to 'a system where every individual or commuter category in the city is able to fulfil his or her mobility needs in a quick, affordable, safe, reliable, comfortable, energy-efficient and environmentally benign manner' (TERI, 2009).

### Green Light for Midtown: New York, U.S.A.

(Reference # 34)

**Keywords:** *Pedestrianization, Traffic Management, Public Space Management, Living Lab*

**Started:** 2009

**Project Owner:** City of New York

Green Light for Midtown was a pedestrianization project, that was designed to improve pedestrian safety and traffic flow as well as increase cultural and commercial value of an iconic public space for the city, the Broadway Street. The project also provided for testbedding of interim projects and ideas to gauge their functionality and the public's perception.

**Relevant SDGs:** 3, 9, 11, 17

### Superblocks: Barcelona, Spain

(Reference # 43)

**Keywords:** *Pedestrianization, Traffic Management, Public Space Management, Community Engagement*

**Started:** 2016

**Project Owner:** Municipality of Barcelona

The Superblocks are multi-block areas, that are designed to create greener, more engaging and pedestrian-friendly public spaces by limiting through traffic along a group of streets and moving them around the periphery. They include additional public squares, seating areas and tree-lined green avenues with more open space for citizens to interact and engage in socio-cultural activities.

**Relevant SDGs:** 3, 9, 11, 13, 15, 17

### Raahgiri: Gurugram, India

(Reference # 27)

**Keywords:** *Pedestrianization, Traffic Management, Health and Recreation, Public Space Management*

**Started:** 2013

**Project Owner:** Raahgiri Foundation

Raahgiri Day is a recurring short-term pedestrianization initiative that is conducted every weekend for a few hours in the morning through temporary closure of a network of streets to cars so that citizens can engage in various community leisure and recreational sports activities. Retail shops/restaurants also actively engage in the event that generates more footfall.

**Relevant SDGs:** 3, 11, 17

### Istanbul Historic Peninsula Pedestrianization: Istanbul, Turkey (Reference # 40)

**Keywords:** *Pedestrianization, Traffic Management, Public Space Management, Urban Green Spaces*

**Started:** 2010

**Project Owner:** Embarq Turkey

The Istanbul Historic Peninsula Pedestrianization project was planned to restore the quality of public spaces in the city's heritage areas and increase its tourism and commercial footfall along with reductions in pollution and increase in green areas. Pedestrian and vehicular routes were planned based on resident surveys and discussion with local business owners in the inner city.

**Relevant SDGs:** 3, 9, 11, 15, 17

<b>EV Charging Infrastructure: Oslo, Norway</b> (Reference # 107)
<b>Keywords:</b> <i>Electric Vehicles, GHG Emission Reduction, Community Engagement, Public Policy</i>
<b>Started:</b> 2008 <b>Project Owner:</b> Oslo City Council
Oslo City Council has developed an extensive EV Charging Infrastructure with 400 charging points as part of a 10-point plan to improve the air quality and reduce CO <sub>2</sub> emissions from the transport sector. The plan also includes incentives for EV adoption - such as, no import tax, no VAT, free parking, free passing through the toll rings, access to bus lanes, and free transport on ferries.
<b>Relevant SDGs: 7, 9, 11, 12, 13, 17</b>

<b>Nørreport Station Redevelopment: Copenhagen, Denmark</b> (Reference # 29)
<b>Keywords:</b> <i>Cycling, Pedestrianization, Traffic Management, Public Space Management</i>
<b>Started:</b> 2010 <b>Project Owner:</b> City of Copenhagen
The Nørreport Station Redevelopment project was designed to transform a congested and unsafe vehicular movement-dominated train station into an open public space with clear focus on the needs of pedestrians and cyclists. Natural people-flows across the square were studied to identify locations most convenient for placing the passages, shelters, parking and other convenience.
<b>Relevant SDGs: 3, 9, 11, 12, 13, 17</b>

<b>Cycle Superhighways Capital Region: Copenhagen, Denmark</b> (Reference # 36)
<b>Keywords:</b> <i>Cycling, Traffic Management, Health and Recreation, Community Engagement</i>
<b>Started:</b> 2010 <b>Project Owner:</b> Capital Region of Denmark
The Cycle Superhighway is a network of cross-municipal bicycle infrastructure that is designed to increase the modal share of cycling through direct, accessible, comfortable and safe cycling routes for commuters. It includes well-maintained, high-quality asphalt bike lanes, separated traffic, high-quality public convenience, aesthetic routes and clear signages.
<b>Relevant SDGs: 3, 9, 11, 12, 13, 17</b>

<b>Comprehensive Bicycle Master Plan: Pune, India</b> (Reference # 76)
<b>Keywords:</b> <i>Cycling, Traffic Management, Health and Recreation, Community Engagement</i>
<b>Started:</b> 2017 <b>Project Owner:</b> Pune Municipal Corporation
The Comprehensive Bicycle Master Plan for Pune is a subset of the city's Municipal Development Plan, that provides detailed implementation strategies for developing an extensive infrastructure network for cyclists and pedestrians, and involving them in the monitoring and maintenance of the infrastructure. It also includes provision for public bicycle sharing systems.
<b>Relevant SDGs: 3, 9, 11, 12, 13, 17</b>

<b>SFpark Pilot Program: San Francisco, U.S.A.</b> (Reference # 81)
<b>Keywords:</b> <i>Smart Parking, Traffic Management, Real Time Monitoring, Smartphone Application</i>
<b>Started:</b> 2009 <b>Project Owner:</b> City of San Francisco
SFpark is a digital solution and smartphone application that optimizes utilization of parking spaces in the city by collecting and distributing real-time information about available nearby parking spaces and their charge to the drivers. It also reduces congestion on street by eliminating the need for drivers to stray in search for parking spaces and by demand-based pricing.
<b>Relevant SDGs: 3, 9, 11, 17</b>

<b>Public Cycle Sharing System: Chennai, India</b> (Reference # 14)
<b>Keywords:</b> <i>Cycling, Traffic Management, Health and Recreation, Last-Mile Connectivity</i>
<b>Started:</b> 2019 <b>Project Owner:</b> Corporation of Chennai
The Public Cycle Sharing System has been established in Chennai to improve the last-mile connectivity and catchment of public transport modes such as the public bus service or metro through low-cost NMT network of cycles that can be used to commute from home and work to public transport stations. It has been planned to also reduce congestion and vehicular emissions.
<b>Relevant SDGs: 9, 11, 12, 13, 17</b>

<b>BIG Bus Network: Bangalore, India</b> (Reference # 110)
<b>Keywords:</b> <i>Public Transport, Traffic Management, Fleet Optimization, Intelligent Traffic Systems</i>
<b>Started:</b> 2013
<b>Project Owner:</b> BMTC
The Bangalore Intra-City Grid (BIG) bus network project was initiated to reorganize city bus routes to increase efficiency and enhance the level of service. The Project involved 4 stages – existing situation assessment, data collection, network modelling and route optimization. The Project primarily required redistribution of existing bus fleet on routes based on public demand.
<b>Relevant SDGs:</b> 3, 9, 11, 17

<b>Janmarg - BRTS: Ahmedabad, India</b> (Reference # 104)
<b>Keywords:</b> <i>Public Transport, Traffic Management, NMT Infrastructure, Intelligent Traffic Systems</i>
<b>Started:</b> 2009
<b>Project Owner:</b> Amdavad Municipal Corporation
The Janmarg - BRT system of Ahmedabad is designed to connect busy places in the city while avoiding busy roads through an integrated network of median bus lanes and NMT facilities along BRT lanes. It is aimed to create a city-wide network of BRT (as opposed to select/limited corridors) similar to that of the metro for increasing reach and ridership of the system.
<b>Relevant SDGs:</b> 3, 9, 11, 12, 17

<b>Chengdu e-Travel: Chengdu, China</b> (Reference # 8)
<b>Keywords:</b> <i>GHG Emission Reduction, Carbon Credits, Community Engagement</i>
<b>Started:</b> 2017
<b>Project Owner:</b> Chengdu Municipal Government
The Chengdu e-Travel is a smart digital platform and benefit-all carbon-reduction programme that encourages car owners to voluntarily reduce the usage of cars in exchange for redeemable carbon credits. It calculates the 'carbon assets' generated from car owners' emission reductions, and uses market mechanisms to exchange credits for low-carbon products or even cash.
<b>Relevant SDGs:</b> 3, 11, 12, 13, 17

<b>Public Parking Policy 2016: Pune, India</b> (Reference # 75)
<b>Keywords:</b> <i>Smart Parking, Traffic Management, Real Time Monitoring</i>
<b>Started:</b> 2016
<b>Project Owner:</b> Pune Municipal Corporation
The Public Parking Policy of Pune is a strategy document that categorizes the city into multiple parking districts for optimization and management of on-street and off- street parking facilities. It plans to integrate smart technologies like parking meters to manage the dynamic rates based on parking demands and smart cards for interoperability and the public's convenience.
<b>Relevant SDGs:</b> 3, 9, 11, 17

<b>Sustainable Mobility Plan: Prague, Czech Republic</b> (Reference # 70)
<b>Keywords:</b> <i>Urban Transportation Planning, Public Transport, Freight Transport, GHG Emission Reduction</i>
<b>Started:</b> 2015
<b>Project Owner:</b> Polad' Prahú
The Sustainable Mobility Plan of Prague is a comprehensive transportation strategy that includes measures to enhance the connectivity, accessibility, efficiency and sustainability of all the transportation modes/systems in the city - including personal, public, non- motorized and freight transport. It also includes strategies to leverage their interlinkages with the land-use.
<b>Relevant SDGs:</b> 3, 8, 9, 11, 12, 13, 16, 17

<b>Traffic and Mobility Plan: Capital Region, Denmark</b> (Reference # 13)
<b>Keywords:</b> <i>Urban Transportation Planning, Public Transport, Personal Transport, GHG Emission Reduction</i>
<b>Started:</b> 2019
<b>Project Owner:</b> Capital Region of Denmark
The Traffic and Mobility Plan aims to create a coherent, reliable, effective and green mobility system for the capital region through focus on 5 strategic development themes - improved public transport, attractive shared mobility, more bicycle commuters, mobility hubs that support interconnectivity, and user-centric traffic information and mobility services.
<b>Relevant SDGs:</b> 3, 8, 9, 11, 12, 13, 16, 17

# 6

## SOLID WASTE MANAGEMENT



Waste generated through various urban activities can have negative impact on the environment and cause health hazards for the residents, such as increase in water pollution and the spread of infectious diseases. Multi material and multi-source management approaches to handle waste management challenges are thus more effective in environmental and economic terms than a material specific and source specific approach. Therefore, effective municipal solid waste management is an essential element for sustainable and liveable cities.

### Sustainable Street Markets and Parks Project: Lapa: Sao Paulo, Brazil (Reference # 28)

**Keywords:** Biodegradable Waste Management, GHG Emission Reduction, Waste Reuse

**Started:** 2015

**Project Owner:** Municipality of Sao Paulo

The Sustainable Street Markets and Parks Project has been implemented to locally treat organic waste (e.g., fruits, vegetables, green garden waste) generated in 900 street markets around the city at decentralized compost parks and cut emissions on transport for disposal at a landfill. It aims to achieve a reduction of 87% GHG emissions as compared to disposal at a landfill.

**Relevant SDGs:** 3, 8, 11, 12, 13, 17

### Pneumatic Trash Collection System: New Songdo City, South Korea (Reference # 71)

**Keywords:** Domestic Waste Management, GHG Emission Reduction, Waste Reuse, Pollution Management

**Started:** 2004

**Project Owner:** POSCO

The Pneumatic Trash Collection System in Songdo is designed to minimize human interaction, pollution and littering of waste due to manual collection and vehicular transport, and to increase waste recycling, upscaling and waste-to-energy generation. It deposits trash from homes to a central dump autonomously where energy from the waste is captured and used to heat buildings.

**Relevant SDGs:** 3, 7, 8, 9, 11, 12, 13, 17

### Junk Run: Auckland, New Zealand (Reference # 50)

**Keywords:** Inorganic Waste Management, Construction Waste Management, Waste Reuse and Upscale

**Started:** 2005

**Project Owner:** Junk Run

Junk Run is an innovative rubbish and junk removal service that collects inorganic residential, commercial, demolition or construction waste on demand, and reuses, recycles or upscales them to direct them away from landfills. It also reduces the need for individuals or organizations to engage in transport or recycling of waste while generating value for them in return.

**Relevant SDGs:** 8, 9, 10, 11, 12, 13, 17

### Better Use of Construction Waste: Kolding, Denmark (Reference # 94)

**Keywords:** Construction Waste Management, Waste Reuse and Upscale, Research and Development

**Started:** 2019

**Project Owner:** Kolding Municipality

Better Use of Construction Waste is a project that involves private companies, developers and educational institutions in 'laboratories' designed to test new ideas for repurposing construction waste. It aims to develop innovative solutions for reuse, recycle and upscale of waste in the buildings sector and create new business models focused on circular economy.

**Relevant SDGs:** 7, 8, 9, 11, 12, 13, 17

**Bio-Methanation Plant at Koyambedu Market: Chennai, India** (Reference # 68)

**Keywords:** Biodegradable Waste Management, GHG Emission Reduction, Waste to Energy

**Started:** 2005

**Project Owner:** CMDA

The Bio-methanation Plant at the Koyambedu Wholesale Vegetable Market was setup to process organic waste generated from the market on-site and generate waste to electricity in the process, and eliminate the need to transfer or dump the waste at a landfill. The electricity generated by the plant is sent to the grid and the residue is sold as manure.

**Relevant SDGs:** 3, 7, 8, 9, 11, 12, 13, 17

**Bio-Methanation Plant for Choitram Mandi: Indore, India** (Reference # 84)

**Keywords:** Biodegradable Waste Management, GHG Emission Reduction, Waste Reuse, Waste to Fuel

**Started:** 2017

**Project Owner:** Indore Municipal Corporation

A 20 MTPD capacity Bio-methanation plant (Bio-CNG Plant) has been established at the Choithram Mandi (a wholesale fruit and vegetable market) to process all the fruit and vegetable waste generated on-site. Approximately 800 kg of Bio-CNG is generated by the plant on a daily basis, and this is used to operate approximately 15 city buses managed by the local transport authority.

**Relevant SDGs:** 3, 7, 8, 9, 11, 12, 13, 17

**Solar-Powered Garbage Bins: Kenora, Canada** (Reference # 32)

**Keywords:** Municipal Waste Management, GHG Emission Reduction, Smart Bins

**Started:** 2011

**Project Owner:** City of Kenora

Kenora has adopted solar powered Big Belly Bins for collecting recyclables at different locations, that use self-compaction technology to reduce the volume of waste at source and smart sensors to notify the authorities for pick up when full, to significantly reduce the collection time and number of trips. It reduces both municipal expenditure as well as the GHG emissions.

**Relevant SDGs:** 3, 7, 8, 9, 11, 12, 13, 17

**iTrash Station: Taipei, Taiwan** (Reference # 48)

**Keywords:** Inorganic Waste Management, GHG Emission Reduction, Waste Recycle, Carbon Credits

**Started:** 2018

**Project Owner:** Taipei Smart City

iTrash Station is a smart waste disposal system in Taipei that encourages individuals to recycle by offering them credit in exchange for cans and plastic bottles on their EasyCard, a smartcard that is used for payment on the Taipei Metro, other public transportation systems in the city, and at various commercial outlets. It also notifies the storage status to the management in real time.

**Relevant SDGs:** 3, 7, 8, 9, 11, 12, 13, 17

**Vera park: Helsingborg, Sweden** (Reference # 85)

**Keywords:** Inorganic Waste Management, Waste Reuse and Upscale, Research and Development

**Started:** 2011

**Project Owner:** NSR

Vera Park is an innovation hub and incubation centre for waste handling that brings private and public companies together with the universities to jointly develop and test/pilot environmentally sound techniques for waste reuse, recycling and upscaling. The Park promotes innovations for lowering emissions and generating value from a range of inorganic wastes.

**Relevant SDGs:** 7, 8, 9, 11, 12, 13, 17

**Vehicle Tracking and Monitoring System for SWM: Indore, India** (Reference # 59)

**Keywords:** Municipal Waste Management, Real-time Monitoring, GPS-based Vehicle Tracking

**Started:** 2017

**Project Owner:** ISCDL

ISCDL has Implemented a GPS-based Vehicle Tracking and Monitoring System for garbage collection vehicles to improve solid waste handling and operational efficiency in real-time. The system is operated through a Command Control and Communication Centre that also monitors cameras at waste processing sites and integrated weigh-bridge vehicle monitoring systems.

**Relevant SDGs:** 9, 11, 12, 13, 16, 17

**Smart Garbage Management System: Pune, India**  
(Reference # 78)

**Keywords:** *Municipal Waste Management, Real-time Monitoring, GPS-based Vehicle Tracking*

**Started:** 2015

**Project Owner:** Pune Municipal Corporation

The Smart Garbage Management System uses GPS enabled garbage trucks, bins with smart sensors and an interactive mobile application with central dashboard to improve and smoothen ground-level mechanisms for waste collection, processing and recycling. The mobile application allows citizens to monitor and provide feedback. It also enables collection route optimization.

**Relevant SDGs:** 9, 11, 12, 13, 16, 17

**EcoPark: Hong Kong**

(Reference # 39)

**Keywords:** *Inorganic Waste Management, Waste Re-use and Upscale, Research and Development*

**Started:** 2007

**Project Owner:** Environmental Protection Department of Hong Kong

EcoPark is a business park for environmental engineering that provides long-term land at affordable cost and supporting infrastructure to private waste recycling businesses, with a view to reduce their set-up costs and channelize that investment towards advancement in technologies and recycling processes. The plant also creates market linkages for them through matchmaking.

**Relevant SDGs:** 7, 8, 9, 11, 12, 13, 17

**Zero Waste 2040: Vancouver, Canada**

(Reference # 25)

**Keywords:** *Municipal Waste Management, Waste to Resource, GHG Emission Reduction*

**Started:** 2018

**Project Owner:** City of Vancouver

Zero Waste 2040 is a long-term vision document for Vancouver that provides strategies to achieve the goal of zero waste using three approaches – a) Avoid/Reduce: through avoiding and reducing waste, b) Reuse: keeping materials in circulation as long as possible; and c) Recycle & Recover: recycling, composting and producing renewable energy from materials that remain.

**Relevant SDGs:** 3, 8, 9, 11, 12, 13, 15, 16, 17

**Zero Waste Bornholm: Bornholm, Denmark**

(Reference # 112)

**Keywords:** *Plastic Waste Management, Waste to Resource, GHG Emission Reduction*

**Started:** 2018

**Project Owners:** BOFA – Denmark

Zero Waste Bornholm is a joint public-private partnership program that is engaged in the development of circular waste management solutions through demonstration projects in Bornholm. It includes a number of research projects focused on management of household plastic waste, recycling of plastic foils in supermarkets, as well as recycling solutions for coffee capsules.

**Relevant SDGs:** 3, 8, 9, 11, 12, 13, 15, 16, 17



# 7

## ENERGY OPTIMIZATION



With the population expanding in urban areas, there are serious implications on energy consumption and subsequent GHG emissions. The changing climate, lifestyle and economic development combined with the demographic patterns of cities will significantly affect the energy demand and will drain the existing energy infrastructure (TERI, 2009). Cities need to focus on measures for reducing energy usage, ascertaining higher energy access, implementing energy-efficient solutions, and encouraging the use of renewable energy sources.

### Energy Leap: Copenhagen, Denmark

(Reference # 92)

**Keywords:** *Energy-Efficient Buildings, Passive Design, Renewable Energy, Energy Retrofitting*

**Started:** 2015

**Project Owner:** City of Copenhagen

Energy Leap is a collaborative project between the City of Copenhagen and major building owners that is working towards improving the energy efficiency in public and private buildings through screening of energy consumption pattern in property portfolios; optimization of energy-consuming systems in buildings; and energy retrofitting based on insights from data and experts.

**Relevant SDGs:** 4, 7, 8, 9, 11, 12, 13, 17

### EcoGrid 2.0: Bornholm, Denmark

(Reference # 91)

**Keywords:** *Smart Energy Grid, Renewable Energy, Real Time Monitoring, Community Engagement*

**Started:** 2016

**Project Owner:** Danish Energy Agency

EcoGrid is a Smart Grid project that encourages residential users to adapt and optimize their energy usage costs based on real-time monitoring of electricity prices (based on peak). This encourages them to use heavier appliances during off-peak hours and reduces peak load, which in turn reduces the amount of generation and transmission assets required to provide electricity.

**Relevant SDGs:** 7, 8, 9, 11, 12, 13, 17

### Sunset Park Solar: New York, U.S.A.

(Reference # 9)

**Keywords:** *Solar Energy, Community Engagement and Empowerment, GHG Emission Reduction*

**Started:** 2018

**Project Owner:** NYCEDC

Sunset Park Solar is a community solar project that allows renters, homeowners, and small businesses to go solar without installing anything on their roof, through subscription to a large common solar energy system, installed on the roof of a public building. It eliminates their need to purchase cost/space-intensive individual units and allows them more flexibility to switch.

**Relevant SDGs:** 4, 7, 8, 9, 11, 13, 16, 17

### Fujisawa Sustainable Smart Town: Tokyo, Japan

(Reference # 73)

**Keywords:** *Solar Energy, Wind Energy, Passive Design, Emergency Response, GHG Emission Reduction*

**Started:** 2014

**Project Owner:** Panasonic

The Fujisawa Sustainable Smart Town is a community-wide microgrid project that features 1,000 solar, wind and hydrogen powered homes with advanced Home Energy Management Systems designed to reduce CO<sub>2</sub> emissions, water usage, and power failure in case of disasters. The town also has the ability to run off-grid for 3 days (using renewables) in the case of an emergency.

**Relevant SDGs:** 7, 8, 9, 11, 12, 13, 16, 17

**Solar Roof Mapping Project: Tel Aviv, Israel**  
(Reference # 24)

**Keywords:** *Solar Energy, Solar Potential Mapping, Geospatial Analysis, Community Engagement*

**Started:** 2018  
**Project Owner:** Tel Aviv Municipality

The Solar Roof Mapping Project was initiated in Tel Aviv to map the rooftop solar energy production potential of buildings across the city and inform their owners about the possible cost-benefits of switching to solar. It was designed help them adopt renewable energy systems with additional information on suitable system types, suppliers and available financial assistance.

**Relevant SDGs: 4, 7, 9, 11, 13, 17**

**Zero Carbon School: Thane, India**  
(Reference # 82)

**Keywords:** *GHG Emission Reduction, Solar Energy, Passive Design, Rainwater Harvesting*

**Started:** 2013  
**Project Owner:** Thane Municipal Corporation

Thane has developed a refurbished Zero Carbon School using passive design, energy-efficient appliances, solar energy and rainwater harvesting systems to demonstrate the application of low-emission urban development strategies and a replicable model for public buildings in the city to go carbon-neutral. It also includes tree plantations and on-site waste management.

**Relevant SDGs: 4, 6, 7, 9, 11, 12, 13, 17**

**100 % Solar City: Diu, India**  
(Reference # 45)

**Keywords:** *Solar Energy, GHG Emission Reduction, Community Engagement, Public Services Delivery*

**Started:** 2018  
**Project Owner:** Diu Municipal Council

Diu has developed a 9-MW solar park over 50 hectares of barren land and installed solar panels on the rooftops on 79 government buildings to generate 100 % of its annual electricity requirement through low-cost solar energy. This helped Diu check its energy import from other states, cut its GHG emissions and reduce its residential power tariff by 15 %.

**Relevant SDGs: 7, 8, 9, 11, 13, 16, 17**

**Aspern Smart City Research: Vienna, Austria**  
(Reference # 7)

**Keywords:** *Renewable Energy, Energy Efficiency, Climate Response, Living Lab, Community Engagement*

**Started:** 2013  
**Project Owner:** Siemens Austria

Aspern Smart City in Vienna is a living laboratory for research into the future of urban energy (including energy efficiency, renewable energy and climate-response) that conducts applied research using smart grids, smart buildings, ICT-based systems and user feedback. It utilizes real data from 111 participating households to test and actively optimize systems based on their usage pattern.

**Relevant SDGs: 4, 7, 8, 9, 11, 12, 13, 16, 17**

**LED Street Light Retrofit: Quezon, Philippines**  
(Reference # 42)

**Keywords:** *Energy Efficiency, LED Street Lighting, GHG Emission Reduction, Public Services Delivery*

**Started:** 2011  
**Project Owner:** Quezon City

Quezon City implemented the LED Street Light Retrofit project to replace its old energy-intensive street lights with LEDs to lower its electricity utility costs, improve the quality of streetscape lighting, enhance public safety, and reduce its carbon emissions. Conversion of 25,000 streetlights to LEDs through this project reduced energy use by 20 to 50 %.

**Relevant SDGs: 3, 7, 8, 9, 11, 12, 13, 17**

**Smart lighting for Hoekenrodeplein square: Amsterdam, The Netherlands** (Reference # 54)

**Keywords:** *Energy Efficiency, LED Street Lighting, GHG Emission Reduction, Public Services Delivery*

**Started:** 2012  
**Project Owner:** City of Amsterdam

The City of Amsterdam has developed a smart lighting system for a public square using adaptive lighting, combined with cameras and a public WiFi network to enhance safety, reduce energy usage and optimize energy savings. The system adjusts the intensity of individual lights based on the weather, type of events in the vicinity and crowd presence.

**Relevant SDGs: 3, 7, 8, 9, 11, 12, 13, 17**

**Large-Scale LED Streetlighting Project: Jaipur, India**  
(Reference # 12)

**Keywords:** Energy Efficiency, LED Street Lighting, GHG Emission Reduction, Public Services Delivery

**Started:** 2015

**Project Owner:** Government of Rajasthan

The Large-Scale LED Streetlighting Project in Jaipur aims to replace all conventional streetlights with high efficacy LEDs to reduce municipal energy consumption and budget expenditure on energy while also reducing GHG emissions. Based on an initial baseline energy assessment, the project will result in 77% annual energy savings compared to the baseline data.

**Relevant SDGs:** 7, 8, 9, 11, 12, 13, 17

**COLABORE: Salvador, Brazil**  
(Reference # 10)

**Keywords:** Low-Impact Construction, Renewable Energy, Community Engagement and Empowerment

**Started:** 2015

**Project Owner:** Municipality of Salvador

The Municipality of Salvador envisioned COLABORE as the first low-energy public co-working space for micro-enterprises, individual micro-entrepreneurs, start-ups, or people, who aim to develop social impact solutions for the city. The space includes a solar energy system, rainwater storage system, natural lighting and ventilation system and low energy construction materials.

**Relevant SDGs:** 4, 6, 7, 8, 9, 10, 11, 12, 13, 16, 17

**Amsterdam Climate Neutral 2050: Amsterdam, The Netherlands**  
(Reference # 16)

**Keywords:** Climate-Neutral Strategy, Energy Efficiency, GHG Emission Reduction

**Started:** 2019

**Project Owner:** City of Amsterdam

The Amsterdam Climate Neutral 2050 is a strategy roadmap that sets out long-term vision for energy transition and emission reduction in Amsterdam. It outlines measures to reduce energy usage and CO<sub>2</sub> emissions through collaborative actions across 4 energy intensive sectors – Built Environment, Mobility, Power Generation and Supply, and Harbour and Industry.

**Relevant SDGs:** 7, 8, 9, 11, 12, 13, 16, 17

**Donside Hydro Generating Station: Aberdeen, Scotland**  
(Reference # 2)

**Keywords:** Small Hydro Power, Community Engagement and Empowerment, GHG Emission Reduction

**Started:** 2016

**Project Owner:** Aberdeen Community Energy

Donside Hydro is a community-operated urban hydro-power generating station that uses an Archimedean screw turbine to harness energy from a local river. The station generates electricity sufficient for 130 houses and surplus for the national grid. It diverts a portion of water from the river into a turbine, without obstructing the river like a dam or weir.

**Relevant SDGs:** 7, 8, 9, 11, 12, 13, 16, 17

**Energy Islands: Denmark**  
(Reference # 41)

**Keywords:** Offshore Wind Energy, Energy Islands, GHG Emission Reduction

**Started:** 2020

**Project Owner:** Energinet

Denmark is engaged in the development of two Energy Islands in the North Sea and in the Baltic Sea that can pool power from multiple offshore wind farms and feed them directly to the national grid. Green power from the two energy islands can address the increasing energy consumption from heat pumps, electric vehicles and heavy industries in a climate-neutral manner.

**Relevant SDGs:** 7, 8, 9, 11, 12, 13, 17

**Smart Hydro Power: Rosenheim, Germany**  
(Reference # 87)

**Keywords:** Small Hydro Power, Community Engagement and Empowerment, GHG Emission Reduction

**Started:** 2013

**Project Owner:** Smart Hydro Power

Smart Hydro Power has developed a plug-and-play hydrokinetic turbine for Rosenheim to generate electricity from the nearby river Inn. The relatively low-cost device can be suspended in the water using supports cables and does not require any dams, high investment infrastructure or change in the river's course or flow. It also has a potential to be scaled-up using additional turbines.

**Relevant SDGs:** 7, 8, 9, 11, 12, 13, 17

# 8

## URBAN ENVIRONMENT



Urban natural and built environments provide economic, social, and cultural opportunities. However, poor levels of environmental quality due to air pollution, improper waste and water management can pose serious threats and reduce the quality of life. Urban green spaces especially play an important role in addressing such issues and other public health concerns as they improve the wellbeing of individuals and communities. Planning for affordable, liveable, and inclusive spaces is thus essential for developing a holistic urban environment.

### Biodiver City: Malmö, Sweden

(Reference # 69)

**Keywords:** *Green Roofs and Walls, Public Parks, Community Engagement and Empowerment*

**Started:** 2012

**Project Owner:** Vinnova

BiodiverCity was a collaborative project that involved ecologists, architects, entrepreneurs, and developers in the development of green yards, roofs and walls in different locations around the city to enhance the urban biodiversity and green cover. It also included urban agriculture practices with edible plants, and generated market linkages for harvested produce.

**Relevant SDGs:** 9, 11, 13, 15, 16, 17

### The GreenThumb Program: New York, U.S.A.

(Reference # 26)

**Keywords:** *Community Garden, Public Parks, Community Engagement and Empowerment*

**Started:** 1978

**Project Owner:** City of New York

GreenThumb is a large-scale gardening and urban-farming program that encourages local communities to get involved in the maintenance of neighbourhood parks by providing them free space, training and supplies to harvest fruits and vegetables, and marketplaces to sell them. It helps the city maintain its green cover and generate alternate livelihoods for the community.

**Relevant SDGs:** 4, 8, 11, 13, 15, 17

### Community in Bloom: Singapore

(Reference # 60)

**Keywords:** *Community Garden, Public Parks, Community Engagement and Empowerment*

**Started:** 2005

**Project Owner:** National Parks Board of Singapore

Community in Bloom is a community gardening program that groups resident gardening enthusiasts from the local communities together with public officers to design, develop and maintain neighbourhood gardens. The program also conducts free workshops and events for community gardeners to build their capability, sell their produce and sustain their gardens.

**Relevant SDGs:** 4, 8, 11, 13, 15, 16, 17

### Digterhaven (The 5 Gardens): Sønderborg, Denmark

(Reference # 74)

**Keywords:** *Public Parks, Rain Gardens, Flood Management, Climate Adaptation*

**Started:** 2014

**Project Owner:** Sønderborg Municipality

Digterhaven is a group of 5 rain gardens that have been designed as nature-based climate adaptation infrastructure to store excess flood water and utilize it for maintaining recreational greens. They include small paths curved in between the pools and designated places for barbecues, herb gardens, playgrounds, and other community activities.

**Relevant SDGs:** 9, 11, 13, 15, 17

<b>Les Parisculteurs (Paris-farmers): Paris, France</b> (Reference # 20)	<b>Barcelona Air Quality Improvement Plan: Barcelona, Spain</b> (Reference # 33)
<b>Keywords:</b> <i>Urban Agriculture, Public Parks, Community Engagement and Empowerment</i>	<b>Keywords:</b> <i>Air Pollution Management, Public Health Improvement, Real Time Monitoring</i>
<b>Started:</b> 2016	<b>Started:</b> 2015
<b>Project Owner:</b> City of Paris	<b>Project Owner:</b> City of Barcelona
<p>The Les Parisculteurs program was initiated to encourage urban agriculture and sustainable food production through development of shared gardens, green roofs, and urban farms on land owned by the City of Paris or interested community organizations. It invites resident groups, private companies, and start-ups to develop the sites and generate produce for the local markets.</p>	<p>The Barcelona Air Quality Improvement Plan is a strategy document that details short-term and long-term actions for different city agencies to combat air pollution. Actions are grouped into six basic themes: mobility, energy, port/airport, urban services, communication and transparency of information. It also includes a calendar for nitrogen dioxide and PM10 (fine particles) reduction.</p>
<b>Relevant SDGs: 8, 9, 11, 12, 13, 15, 16, 17</b>	<b>Relevant SDGs: 3, 9, 11, 13, 17</b>
<b>Monitoring Air Quality through Smart Poles: Bhopal, India</b> (Reference # 72)	<b>Urban Regeneration – Sabarmati River: Ahmedabad, India</b> (Reference # 97)
<b>Keywords:</b> <i>Environmental Monitoring, Pollution Management, Street Lighting, Smart Services Delivery</i>	<b>Keywords:</b> <i>Riverfront Development, Blue-Green Infrastructure, Flood Management, Public Spaces</i>
<b>Started:</b> 2017	<b>Started:</b> 2003
<b>Project Owner:</b> Smart City Bhopal	<b>Project Owner:</b> SRFDCL
<p>Bhopal has developed smart poles and intelligent streetlights with built-in environmental sensors across the city to aggregate real-time data on air quality and develop immediate and long-term actions to curb air pollution. The poles also include bundled smart services such as Wi-Fi access for citizens, smart LED lights and charging facilities for electric vehicles.</p>	<p>Urban Regeneration program of Sabarmati River was a riverfront development project that included four key objectives – to develop waterfront spaces and parks for the citizens; to reduce the flow of sewage and keep the river pollution free; to provide a site for permanent rehousing of informal settlements along the riverbed; and to reduce the risk of erosion and flooding.</p>
<b>Relevant SDGs: 3, 7, 9, 11, 13, 17</b>	<b>Relevant SDGs: 3, 6, 8, 9, 10, 11, 13, 15, 16, 17</b>
<b>AIR Plan: Ahmedabad, India</b> (Reference # 4)	<b>Green Your Laneway: Melbourne, Australia</b> (Reference # 38)
<b>Keywords:</b> <i>Air Pollution Management, Public Health Improvement, Real Time Monitoring</i>	<b>Keywords:</b> <i>Vertical Gardens, Pocket, GHG Emission Reduction, Heat Island Mitigation, Community Engagement</i>
<b>Started:</b> 2017	<b>Started:</b> 2017
<b>Project Owner:</b> Amdavad Municipal Corporation	<b>Project Owner:</b> City of Melbourne
<p>The Ahmedabad AIR Plan is a health-based program that focuses on health risk communication with population vulnerable to air pollution, and on immediate and long-term actions to increase their preparedness. It includes a set of continuous air quality monitors that provide real-time information for coordinating actions to reduce the health impact of air pollution.</p>	<p>The City of Melbourne introduced the Green Your Laneway program to help transform the city's laneways into green infrastructure for mitigating urban heat island effects, capturing carbon emissions and managing storm water using vertical gardens and pocket parks. The project also involved the city's residents in selecting suitable laneways through an interactive online map.</p>
<b>Relevant SDGs: 3, 9, 11, 13, 17</b>	<b>Relevant SDGs: 3, 9, 11, 13, 15, 17</b>

<b>Baan Mankong Program: Thailand</b> (Reference # 30)	<b>Local Biodiversity Strategy and Action Plan: Kochi, India</b> (Reference # 46)
<b>Keywords:</b> <i>Social Housing Project, Community Engagement and Empowerment</i>	<b>Keywords:</b> <i>Natural Environment Management, Biodiversity Conservation, Urban Parks and Forests</i>
<b>Started:</b> 2003 <b>Project Owner:</b> Ministry of Social Development and Human Security, Thailand	<b>Started:</b> 2020 <b>Project Owner:</b> Kochi Municipal Corporation
<p>The Baan Mankong Program uses a community-driven approach to survey and map informal settlements across the city and develop plans for comprehensively upgrading them. Based on the plan, it issues infrastructure subsidies directly to the community to upgrade their houses and the flexibility to choose location and tenure options based on their priorities and job locations.</p>	<p>Kochi has prepared a Local Biodiversity Strategy and Action Plan to mainstream biodiversity conservation into its urban planning – through focus on mapping of agricultural land, identification of new cultivable land, conservation of paddy fields, transitioning to a low emission city and protecting green spaces. The plan also includes strategies for participatory planning.</p>
<b>Relevant SDGs: 3, 6, 8, 9, 10, 11, 13, 15, 16, 17</b>	<b>Relevant SDGs: 11, 12, 13, 15, 16, 17</b>

## CONCLUSION

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*Knowledge Product 1: Urban Living Lab for Smart and Sustainable Cities* can be a useful reference material for city authorities, policymakers and multidisciplinary urban practitioners to identify and develop smart and sustainable solutions across different sectoral and cross-sectoral themes for cities. For this, it is imperative to consider cities not as silos, but as systems with all sectors working in harmony with each other. To further align cities with the global sustainable agenda, cities need to collaborate with each other and work towards achieving the SDGs. This will create a holistic approach to enhance the quality of infrastructure development, sustain natural resources and optimize governance mechanisms. Cities can thus draw inspiration from the range of global and national examples presented in KP1 and design strategies to progress their physical, social, and economic growth while protecting the environment and adapting to global environmental change.

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## ABBREVIATIONS

<b>AECOM</b>	Architecture Engineering Consulting Operations and Maintenance	<b>EV</b>	Electric Vehicles
<b>AMC</b>	Ahmedabad Municipal Corporation	<b>GCC</b>	Greater Chennai Corporation
<b>AMRUT</b>	Atal Mission for Rejuvenation and Urban Transformation	<b>GHG</b>	Greenhouse Gasses
<b>AMTS</b>	Ahmedabad Municipal Transport Service	<b>GIS</b>	Geographic Information System
<b>BBMP</b>	Bruhat Bengaluru Mahanagara Palike	<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit
<b>BMC</b>	Bhubaneswar Municipal Corporation	<b>GOI</b>	Government of India
<b>BMTC</b>	Bangalore Metropolitan Transport Corporation	<b>GPS</b>	Global Positioning System
<b>BRT</b>	Bus Rapid Transit	<b>GRI</b>	Green Rainwater Infrastructure
<b>BSCL</b>	Bhubaneswar Smart City Limited	<b>GT</b>	GreenThumb
<b>BWSSB</b>	Bangalore Water Supply and Sewerage Board	<b>HOFOR</b>	Hovedstadsområdets Forsyningsselskab
<b>CBS</b>	Copenhagen Business School	<b>HUDCO</b>	Housing and Urban Development Corporation
<b>CCP</b>	Corporation of The City of Panaji	<b>IBM</b>	International Business Machines Corporation
<b>CCTV</b>	Closed-circuit television	<b>ICT</b>	Information and Communication Technologies
<b>CDC</b>	Cloud-based Disaster Recovery Centre	<b>IMC</b>	Indore Municipal Corporation
<b>CENSAM</b>	Centre for Environmental Sensing and Modeling	<b>IOT</b>	Internet of Things
<b>CMDA</b>	Chennai Metropolitan Development Authority	<b>IRS</b>	Institute of Remote Sensing
<b>CMP</b>	Comprehensive Mobility Plan	<b>ISCDL</b>	Indore Smart City Development Limited
<b>CNG</b>	Compressed Natural Gas	<b>IT</b>	Information Technology
<b>CO<sub>2</sub></b>	Carbon Dioxide	<b>IIT</b>	Indian Institute of Technology
<b>CREATE</b>	Campus for Research Excellence and Technology Enterprise	<b>JNNURM</b>	Jawaharlal Nehru National Urban Renewal Mission
<b>CRRT</b>	Chennai Rivers Restoration Trust	<b>KLR</b>	Kerala Land Reforms
<b>CSCAF</b>	Climate Smart Cities Assessment Framework	<b>KP</b>	Knowledge Product
<b>CSR</b>	Corporate Social Responsibility	<b>KSPCB</b>	Karnataka State Pollution Control Board
<b>CUPG</b>	Centre for Urban Planning and Governance	<b>LED</b>	Light Emitting Diode
<b>C-FLOWS</b>	Chennai FLOod Warning System	<b>MSEZL</b>	Mangalore Special Economic Zone Limited
<b>DKK</b>	Danish Krone	<b>MCC</b>	Mangaluru City Corporation
<b>DTSS</b>	Deep Tunnel Sewerage System	<b>MIT</b>	Massachusetts Institute of Technology
<b>DTU</b>	Denmark Technical University	<b>MoEFCC</b>	Ministry of Environment, Forest and Climate Change
<b>EU</b>	European Union	<b>MoHUA</b>	Ministry of Housing and Urban Affairs
<b>EUDP</b>	Energy Technology Development and Demonstration Program	<b>MoU</b>	Memorandum of Understanding
		<b>MTPD</b>	Million Tonne Per Day

<b>MW</b>	Megawatt	<b>SEK</b>	Swedish Krona
<b>NCCR</b>	National Centre for Coastal Research	<b>SIAAP</b>	Syndicate Interdepartemental Pour
<b>NDC</b>	Nationally Determined Contribution	<b>SMART</b>	Singapore-MIT Alliance for Research and Technology
<b>NDS</b>	Natural Drainage System	<b>SMC</b>	Surat Municipal Corporation
<b>NEC</b>	Nippon Electric Company	<b>SONFOR</b>	Sønderborg Forsyning A/S
<b>NIC</b>	National Informatics Centre	<b>SOS</b>	Signal of Stress
<b>NIS</b>	Israeli New Shekel	<b>SPV</b>	Special Purpose Vehicle
<b>NMT</b>	Non-Motorized Transport	<b>SRFDCL</b>	Sabarmati River Front Development Corporation Ltd
<b>NOx</b>	Nitrogen Oxide	<b>TERI</b>	The Energy and Resources Centre
<b>NParks</b>	National Parks Board Singapore	<b>TMC</b>	Thane Municipal Corporation
<b>NRDC</b>	Natural Resources Defense Council	<b>TNEB</b>	Tamil Nadu Electricity Board
<b>NRF</b>	National Research Foundation	<b>TNUIFSL</b>	Tamil Nadu Urban Infrastructure Financial Services Limited
<b>NSR</b>	Nordvästra Skånes Renhållnings	<b>TRF</b>	The Raahgiri Foundation
<b>NT\$</b>	New Taiwan dollar	<b>UCCRN</b>	Urban Climate Change Research Network
<b>NUA</b>	New Urban Agenda	<b>U.K.</b>	United Kingdom
<b>NYC</b>	New York City	<b>ULB</b>	Urban Local Body
<b>NYCEDC</b>	New York City Economic Development Corporation	<b>ULL</b>	Urban Living Lab
<b>PMAY-U</b>	Pradhan Mantri Awas Yojana – Urban	<b>UN</b>	United Nations
<b>PMC</b>	Pune Municipal Corporation	<b>UN-Habitat</b>	United Nations Human Settlements Programme
<b>POSCO</b>	Pohang Iron and Steel Company	<b>UNDESA</b>	United Nations Department of Economic and Social Affairs
<b>PPP</b>	Public Private Partnership	<b>UNICEF</b>	United Nations Children's Fund
<b>PSA</b>	Principal Scientific Adviser	<b>UPROSE</b>	United Puerto Ricans' Organization of Sun- set Park
<b>PUB</b>	Public Utilities Board	<b>U.S.A.</b>	United States of America
<b>PwC</b>	Price water house Coopers	<b>USD</b>	U.S. Dollar
<b>RAND</b>	Research and Development Corporation	<b>USIP</b>	United States Institute for Peace
<b>R&amp;D</b>	Research and Development	<b>VGf</b>	Viability Gap Funding
<b>RTC</b>	Record of Rights, Tenancy and Crops	<b>WAN</b>	World Architecture News
<b>SAFAR</b>	System of Air Quality and Weather Fore-casting and Research	<b>WCCD</b>	World Council on City Data
<b>SBM-U</b>	Swachh Bharat Mission – Urban	<b>WISE</b>	Ward Infrastructure Services and Environment
<b>SCADL</b>	Smart City Ahmedabad Development Limited	<b>WRPs</b>	Water Reclamation Plant
<b>SCM</b>	Smart Cities Mission		
<b>SDG</b>	Sustainable Development Goals		
<b>SEBRAE</b>	Serviço Brasileiro de Apoio às Micro e Pequenas Empresas		



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