ADVANCING CITY CLIMATE ACTION IN MADHYA PRADESH

Towards a low-carbon, climate-resilient **BHOPAL**

Executive Summary

Bhopal City Climate Action Plan

DISCLAIMER

This document is prepared by WRI India in partnership with Environmental Planning & Coordination Organisation (EPCO), Department of Environment, Government of Madhya Pradesh to support Bhopal city in developing its Climate Action Plan. The data and information used for preparing this report have been sourced from Bhopal city, State Government departments, published sources of Government of India, etc. While due care has been taken to ensure authenticity of the data and other information used, any error in their accuracy or interpretation is absolutely unintentional.

About WRI India

WRI India is a research organization that turns big ideas into action at the nexus of environment, economic opportunity, and human well-being.

Design credits: Manasi Nandakumar (*Senior Communications Associate, WRI India*) and Ronak Naik

Source: Bhopal Smart City Development Corporation Ltd.

GULSHAN BAMRA (IAS)
PRINCIPAL SECRETARY

Department of Environment
Government of Madhya Pradesh
Mantralaya, Vallabh Bhawan, Bhopal

Preface

No evidence is required to prove that climate is changing and that too because of increased human activities which have serious repercussions on economic development and natural resource management. Various recent extreme weather events in Madhya Pradesh, urban flooding, and untimely rains have shown that developing localised mitigation and resilience strategies is the need of the hour.

Paris Agreement 2015 and Glasgow Pact 2021 have shown the commitments from the international communities for reducing or mitigating GHG emissions, however to resolve this global issue, there lie the local solutions at sub-national level, district level and city level. Hon'ble Prime Minister of India has also launched the LiFE Movement which emphasizes on change in the lifestyle and behavioural patterns of living. He has stressed on reduce, reuse and recycle concepts as also on the circular economy to be an integral part of our lifestyle and for sustainable development. Concept of inclusivity is also very much integrated with this movement.

We in Madhya Pradesh are also committed to addressing the challenge of climate change in order to pursue the state's development goals in a sustainable manner.

Taking the cue from Ministry of Housing & Urban Affairs (MoHUA) as part of Climate Smart Cities Assessment Framework, the preparation of Climate Action Plans (CAPs) of all the 7 smart cities of MP by State Knowledge Management Centre on Climate Change (SKMCCC), EPCO and WRI India are steps towards making the local authorities equipped with strengths for tackling the challenge of climate change. The city level GHG inventorisation also helps in quantifying the actions to reduce the CO_2 emissions and offsetting the current emissions.

The City level Climate Action Plans (CAPs) for all the 7 smart cities have been drafted after wide consultations and participation with city experts so as to bring all the stakeholders on board and make their say.

I appreciate the efforts of EPCO and WRI India for taking the lead in preparing the City level Climate Action Plans.

These CAPs have flagged important issues which require attention and are expected to be implemented by the local authorities & SPVs.

MUJEEBUR REHMAN KHAN (IAS)
EXECUTIVE DIRECTOR

Environmental Planning &
Coordination Organisation

Foreword

As extreme weather events unfold across the globe, the climate crisis has reached our doorstep. While India is on track to achieve the Nationally Determined Contributions, the State of Madhya Pradesh (MP) is determined to lead India's fight against this impeding crisis by policy-governance reforms and inculcating a climate action culture in the society. With MP's complex urban challenges and increasing climate risks and disasters, sustained actions ensuring cities to prepare for and develop the ability to thrive in the varying climate is crucial. In MP, the rising urban population has created a reason to be concerned about climate change, and therefore the interventions at the city level are deemed important.

In this connection, the Climate Smart Cities Assessment Framework (CSC-AF) issued by Ministry of Housing & Urban Affairs (MoHUA) plays an important role in devising the appropriate actions to keep our cities safe from the adverse impacts of climate change. This brings an opportune time to integrate the concerns of climate change into our on-going program & policies and achieve the goal of low carbon development with inclusive growth.

It has been a very good opportunity for EPCO to join the LiFE movement launched by Hon'ble Prime Minister of India during Glasgow CoP. All the concepts of LiFE have been tried and addressed in the cities while developing the plans.

It is also important for us to develop well researched strategies specific to the cities to respond effectively to the possible impacts of climate change. To address these challenges, City level Climate Action Plans (CAPs) have been developed by State Knowledge Management Centre on Climate Change, EPCO in association with WRI India. The CAPs have highlighted key concerns and strategies for actions as per the indicators outlined in the CSCAF.

I would like to acknowledge the efforts of EPCO professionals and WRI India team for their commendable work. I would also like to extend my gratitude towards UADD, all the SPVs and other stakeholders for extending their support to formulate these plans and providing necessary data and information to make these plans more robust.

(Mujeebur Rehman Khan)

Acknowledgements

Environmental Planning and Coordination Organization (EPCO) is grateful to Mr Gulshan Bamra, Principal Secretary, Government of Madhya Pradesh, Environment Department; Mr Mujeebur Rehman Khan, Executive Director EPCO; and other team members from EPCO for their continuous support and guidance at various stages of developing the inclusive-climate action plan for Bhopal city.

We extend gratitude to Commissioner, Urban Administration and Development Department (UADD) for facilitating the plan development process and providing necessary guidance. We also are grateful to Commissioner, Bhopal Municipal Corporation and Chief Executive Officer of Bhopal Smart City Development Corporation Limited for constant support in providing valuable city level inputs and facilitating data collection across all departments and parastatal agencies. We would also like to thank all officers and city experts from concerning line departments and external agencies who contributed to the development and refinement of this plan through timely provision of data and valuable insights during stakeholder consultations.

EPCO would like to thank World Resources Institute (WRI) India, especially Mr Madhav Pai, CEO, Dr OP Agarwal, Senior Advisor and Former CEO, Ms Ulka Kelkar, Director, Climate Program for providing technical support to EPCO and Bhopal city, which played a key role for developing this plan.

We would also take this opportunity to appreciate the efforts made by the study team Mr Saransh Bajpai, Mr Prateek Barapatre, Ms Ramya MA, Ms Faiza Solanki and Ms Avni Agrawal for providing their expertise to assist in the research and development of the climate action plan.

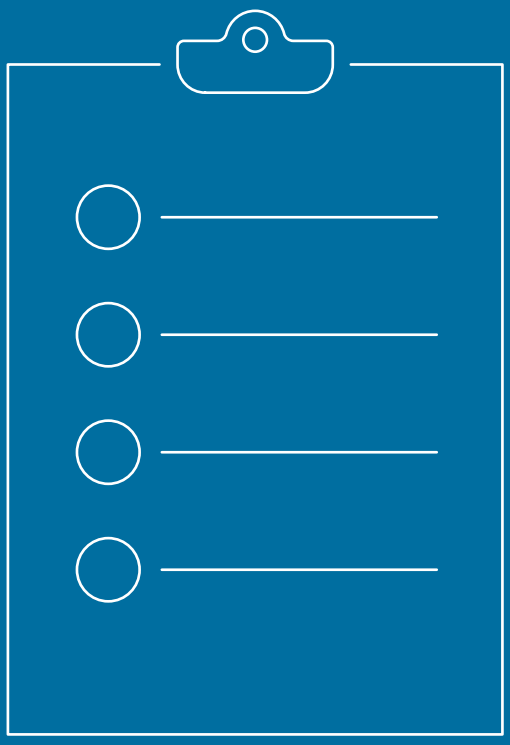
Lastly, we would like to thank the internal reviewers from WRI India including Ms Marie Duraisami, Ms Sumedha Malaviya, Mr Dhilon Subramanian, Ms Azra Khan, Ms Chaitanya Kanuri and Ms Sahana Goswami for providing valuable feedback to strengthen the sectoral strategies in the plan

(Lokendra Thakkar)

Coordinator,
State Knowledge Management
Centre on Climate Change, EPCO

Source: Anshu Vishwakarma

EXECUTIVE SUMMARY



Bhopal and its Vulnerability to Climate Change

Bhopal is the state capital and second largest city of Madhya Pradesh. Bhopal was also rated as the greenest city and the cleanest state capital city in India for three consecutive years – 2017, 2018 and 2019. Bhopal is situated in the Vindhya and Malwa plateau region and has a unique physiography with the Narmada valley in the central-east, Bhoj wetland towards the south-east, Berasia shrub forests in the west, upper and lower lake views, and various hill points. The city – also referred to as the 'city of lakes' – falls under the humid-tropical climatic zone, which contributes to its micro-climatic variabilities to a great extent. However, the city's topography and lack of effective plan implementation have led to Bhopal expanding not as a single city, but as a series of discrete townships which are spreading fast beyond its planning area, and with limited connectivity. This demand for constant infrastructural upgradation to meet the basic needs of a growing population has led to a stress on the micro-climate of the region.

Given the challenges that Bhopal city faces and against the backdrop of the Smart Cities Mission, the Ministry of Housing and Urban Affairs has initiated the "Climate Smart Cities Assessment Framework (CSCAF)" for smart cities in 2019. The framework aims to provide a roadmap for cities to combat climate change, through mitigation and adaptation measures, while planning their city-level development actions and policies. It is made up of 28 indicators across five sectors namely, energy & green buildings, urban planning, green cover & biodiversity, mobility & air quality, water resource management and waste management. By taking appropriate measures, cities can make a significant contribution to mitigating climate change and becoming resilient to its impacts. Bhopal has been amongst the top three performing state capital cities under the CSCAF 2.0, scoring well particularly in the sanitation sector.

In this context, WRI India is supporting EPCO, Department of Environment, and Department of Urban Development and Housing, Government of Madhya Pradesh as a technical partner in planning adaptation and mitigation strategies and building a city climate action plan (CAP) for the seven smart cities in MP. These climate action plans are based on the GHG emissions profile and vulnerability assessment of cities. They identify existing gaps through a review of data submitted by cities under the CSCAF 2.0 to identify key entry points in terms of recommendations to achieve the sectoral priorities of cities through a low-carbon and climate-resilient pathway. The CAP identifies action points based on the current sectoral gaps to address future climate risks across five thematic areas. It also proposes an institutional framework which is necessary to implement the recommendations outlined in the CAP.

Climate Action Planning Process

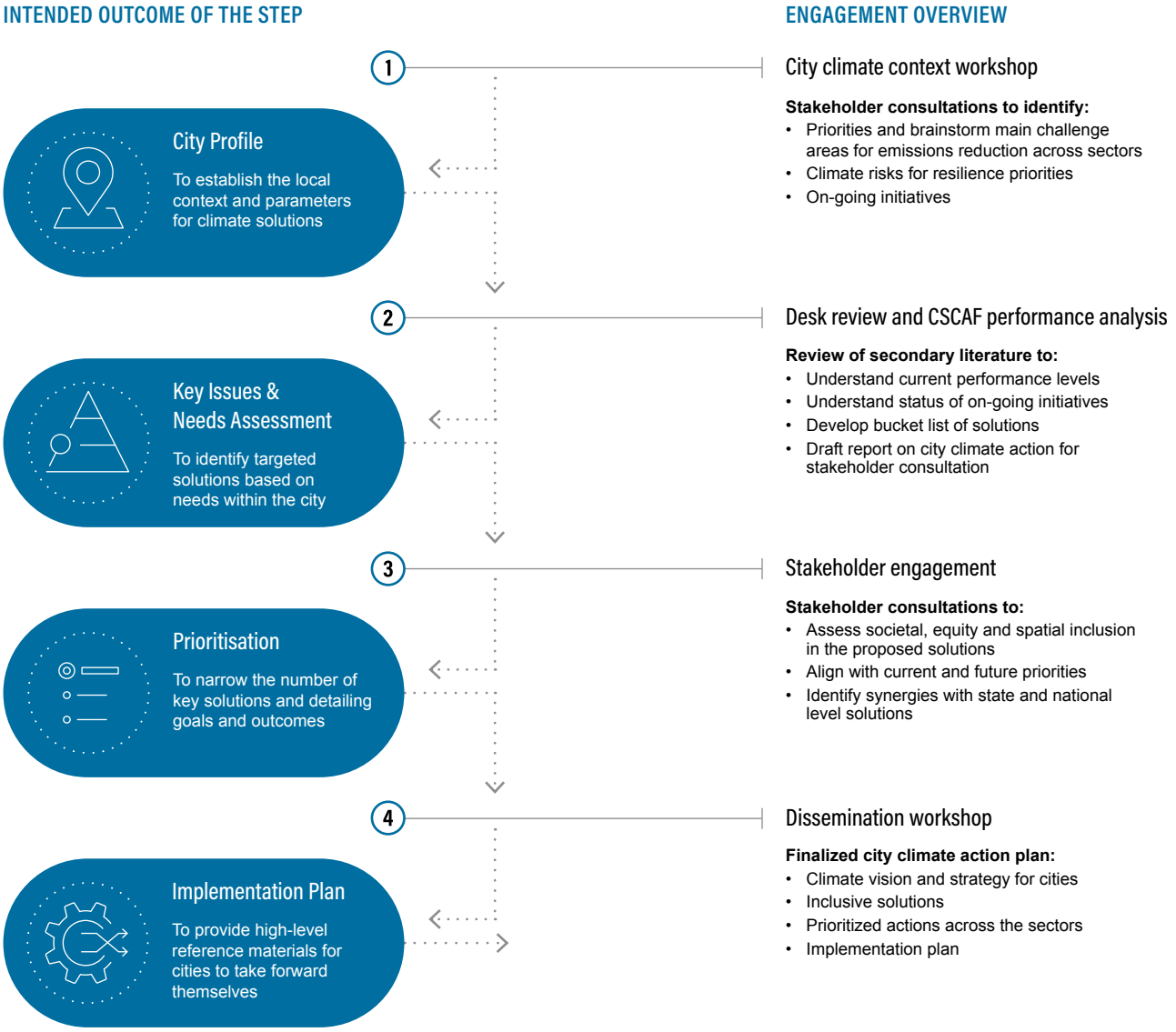
WRI India adopted a 4-pronged approach in the entire process of preparing the Climate Action Plan (CAP) as illustrated in ES Figure 1:

- A planning-cum-launch workshop was organized in Bhopal on 20 February 2020 with participation from state and city officials, academicians, and civil society organizations to apprise participants of the relevance of developing these city-level plans and identify prominent development challenges and key climate risks for urban areas in Madhya Pradesh (MP).

- This was followed by an extensive desk review of the smart city proposal to identify the vision and key sectoral priorities envisaged by Bhopal city. A detailed climate profile of Bhopal city has been developed which includes temperature and rainfall projections, besides baseline and projected GHG inventory. The climate vulnerability assessment carried out by EPCO has been referred, to identify future climate risks. This review and analysis helped in drawing up a list of sectoral goals and actions which are outlined in the climate action plan.

- As the next step, a stakeholder consultation workshop was organized in Bhopal with participation from city officials, sectoral experts, and civil society representatives, to present the preliminary findings and seek inputs on the goals and actions proposed This was used to develop the final CAP, which provides prioritized sectoral actions along with an implementation plan and CAP governance mechanism.

ES Figure 1: CAP development process *(Source: WRI India)*



Baseline Assessment

As highlighted in step 2 of the CAP planning process, a climate profile and baseline assessment for the city were developed using analysis from the CSCAF 2.0 along with an emissions inventory and vulnerability assessment of key urban climate risks.

Climate Smart Cities Assessment Framework

Bhopal has performed above average in the first two rounds under CSCAF. The city has been performing extremely well in the waste management sector. It is reflected in its Swachh Survekshan rankings, being one of the cleanest capitals in the country. However, the city must focus on improving its score and performance for indicators under the other sectors. Some of the current initiatives and possible areas of improvement have been highlighted in the table below.

Greenhouse Gas Inventory

In 2019, Bhopal's GHG emissions were 2.5 mtCO_2e which was 1.1 tCO_2e per person. The emissions inventory was compiled according to the Global Protocol for Communities (GPC) BASIC standards using C40's City Inventory Reporting and Information System (CIRIS) tool. The inventory includes scope 1 emissions (GHG emissions from sources located within the chosen boundary), scope 2 emissions from grid supplied electricity and scope 3 emissions from waste sector alone (GHG emissions that occur outside the city boundary as a result of activities

ES Table 1: CSCAF 2.0 Scores for Bhopal *(Source: CSCAF 2.0 submission by city)*

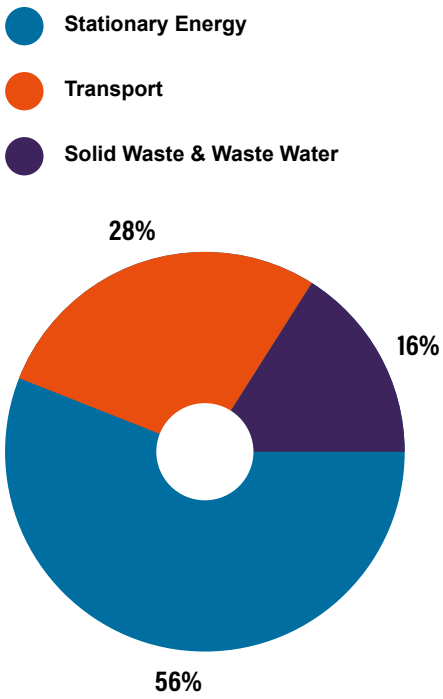
Overall Score as per CSCAF 2.0	Energy and Green Buildings	Urban Planning, Green Cover and Biodiversity	Mobility and Air Quality	Water Management	Waste Management
★★★	★★	★★★	★★★	★★	★★★★★
CSCAF 2.0 Score	205.5	244	201	145	567
Current measures being undertaken in the city	▪ 37.35% of street lighting is LED and energy efficient ▪ City is promoting green buildings. Six Energy Conservation Building Code (ECBC) /Eco Niwas Samhita (ENS) compliant buildings have obtained construction approval through 2019-20. ▪ 5MW solar rooftop energy projects have been set up in the city as part of the city's solar energy project with lake front solar.	▪ >18% of the municipal area is under green cover ▪ Miyawaki plantation in place at various locations like Bhopal Water and Land Management Institute. ▪ Ankur program – where citizens are awarded for tree plantation – has been launched in the state and Pradhan Mantri Awas Yojana (PMAY) has been linked to it. ▪ Bhopal has initiated a city level biodiversity management committee, calculated its city biodiversity index, developed a people's biodiversity register and identified measures within the green and blue master plan to increase biodiversity.	▪ 18% of buses run on CNG. ▪ Metro under construction. ▪ Clean Air Action Plan of the city is in place and under implementation. ▪ Monitoring daily air quality index levels and making it public. ▪ 215 low floor buses are in use, 275 more planned as of 2022. ▪ Plans of electrifying public bike sharing system- 94 stations installed with 480 cycles in operation and currently 30000+ users registered. ▪ Placemaking projects in certain areas such as New Market, Subhash school area, Alkpuri park, etc.	▪ Conducted water resource assessment for future demand & supply for 5 years. ▪ Bhopal has carried out rapid flood/water stagnation risk assessment ▪ City has completed a project on 100% consumer metering through Supervisory control and data acquisition (SCADA).	▪ Bhopal city has authorized and integrated waste pickers. ▪ 100% of segregated domestic waste is collected at doorstep. ▪ 96% of the wet waste is recycled in the city using four composting pits. ▪ Six MRFs (material recovery facilities) for dry waste processing. ▪ 100% C&D waste is being processed in a 100 TPD plant and used in low lying areas and paving blocks.
Areas of improvement	▪ Reducing transmission and distribution losses from 28% in 2019. ▪ Increasing power generation from RE sources (0.05% currently). ▪ Promoting and adopting green buildings. ▪ Increasing energy efficient streetlighting.	▪ City should monitor the impact of the biodiversity strategies. ▪ There is a need to monitor, update & mainstream the disaster management plan within departmental plans.	▪ Increasing the number of buses, only 0.09 buses are available per 1000 population. ▪ Increasing the NMT coverage of road length (15.56% currently). ▪ Increasing uptake of clean fuel vehicles (less than 15% of shared mobility vehicles run on clean fuels)	▪ Reducing NRW (currently between 20-30%). ▪ Increasing the access to drinking water to more than 90% citizens (currently 82%) ▪ Increasing the percentage of wastewater recycled (<5% currently)	▪ Capturing of methane gas from scientific landfill and sewage treatment plants. ▪ Need for more waste transport infrastructure, 41 new vehicles for collecting garden waste and construction and demolition waste are needed. ▪ Need to increase capacity for bio-methanation to treat remaining 4% of organic waste.

Overall Score as per CSCAF 2.0	Energy and Green Buildings	Urban Planning, Green Cover and Biodiversity	Mobility and Air Quality	Water Management	Waste Management
			• City should strengthen the institutional capacity to implement the clean air action plan and conduct an impact assessment of actions.	• Bhopal needs to prepare a water resources management plan with short-, medium- and long-term actions. • City should prepare and implement a flood management plan. • Should conduct an energy audit of the water supply system and wastewater pumping stations and treatment plants.	

taking place within the city boundary). Stationary energy contributes 56% to the city's total emissions, followed by 28% from transportation. Waste and wastewater sector contributes 16% to the total emissions (ES Figure 2).

The business-as-usual projected emissions for Bhopal are presented in ES Figure 3. The emissions are projected to increase by 18.6 % by 2025 and 40% by the end of the decade till 2030 compared to the baseline emissions of 2019. This creates an urgent need for the city to implement measures presented in the report for achieving its vision of low carbon and climate resilient development.

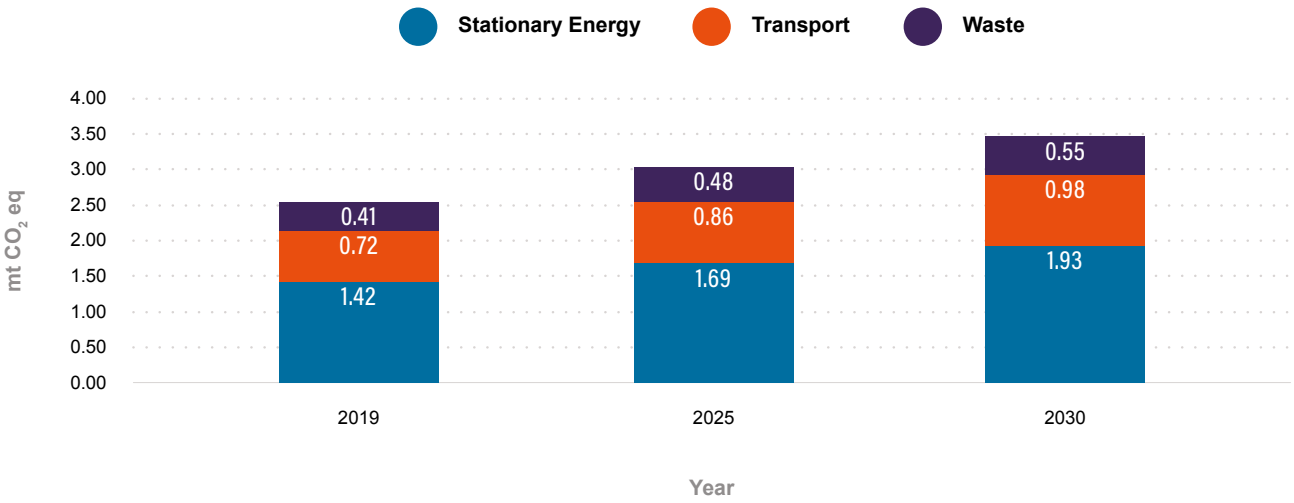
ES Figure 2: Sectoral GHG Emissions Profile *(Source: WRI analysis using primary data)*



Vulnerability analysis

According to this analysis, Bhopal has a low composite vulnerability, driven largely by the socioeconomic indicators. In terms of water resources, Bhopal falls under high vulnerability with a very high risk of decreasing availability of water, increasing crop water stresses and increase in frequency of extreme events like floods and droughts. Bhopal fares well in the forest sector owing to the large green cover. However, the projected changes in temperature and rainfall as well as variability in both are likely to result in increased climate risks.

ES Figure 3: Projected emissions for Bhopal *(Source: WRI India analysis using primary data)*



ES Table 2: Future Climate Risks for Bhopal *(Source: CEEW)*

Projected Climate Changes	Potential Impacts and Risks
Warmer conditions, including more intense and frequent high-temperature extremes and heat wave days.	• Data indicates a clear trend towards higher temperatures and more frequent high temperature extremes, potentially leading to human heat stress and other negative health effects including potential increase in mortality. • Negative impacts on labor productivity, particularly on outdoor workers and increase in cooling demand are also likely.
Higher annual rainfall totals and change in frequencies	• Total rainfall can increase by an average of 8% in 2050 with the number of heavy rainfall days increasing by an average of four days. This can lead to a potential increase in flood risk.

Goals and Sectoral Strategies

The table below summarizes the goals and actions which the city may adopt to become low carbon and climate resilient while also addressing concerns of equity and inclusivity in development.

ES Table 3: Summary of goals and actions for Bhopal *(Source: WRI India)*

Goals	Actions	Outcomes
Goal 1 Transform Bhopal into a solar city	• Promoting energy efficiency improvements and renewable energy use in MSMEs • Piloting solar bus stops • Exploring common solar PV projects for low-income community housing • Installing solar water heaters and solar photovoltaic panels on rooftops of educational institutions • Incentivizing installation of rooftop solar panels and solar water heaters in all new residential constructions • Initiatives towards reduced transmission and distribution losses	• Sensitization of MSMEs and reduced emissions from industrial sector • Long term reduced overall electricity consumption and costs • Benefits for MSMEs due to reduced power bills • Improved air quality • Increased job opportunities • Increased city wide off-grid supply source • 100% RE-powered educational campuses • Green hospitals and hotels

Goals	Actions	Outcomes
		• PPP engagement for efficient infrastructural distribution • Reduction in emissions from the consumption of grid supplied electricity • Improved access to energy • Reduced power cuts • Improved health benefits • Better market for RE technologies • Increased institutional capacity within in-line department
Goal 2 Sustainable & dircular waste management economy in Bhopal	• Innovative models for managing electronic waste in Bhopal • Piloting fuel generation from plastic waste • Connecting all the vegetable and fruit markets in the city with the proposed 200 TPD bio-CNG plant • Upgrading waste collection and transportation infrastructure to electric vehicles • Public-private partnership models for managing construction and demolition waste	• Formalization of informal waste sector • Driveway for skill-development capacities among the marginalized • Creates jobs for self-help groups • Mechanized e-waste recycling and refurbishment • Reduced waste transportation costs • Reduced emissions caused by landfill gas • Reduced daily waste collection trips • Decreased open ground dumping and better landfill management after implementation of the plan
Goal 3 Greening the transport sector in Bhopal	• Improving last mile connectivity of planned metro in Bhopal • Piloting electric buses as part of Mybus (Bhopal BRTS) • NMT focused street design guidelines for Bhopal • Promoting electric two wheelers in Bhopal • Fuel efficiency training and management for public and private bus operators • Increasing the spatial network of Pollution Under Control (PUC) certificate and Ambient Air Quality (AAQ) Monitoring System stations in the city	• Increased NMT infrastructure • Decreased air pollution due to transport • Increased availability and accessibility of public transport • Reduced emissions from transport • Improved access and last mile connectivity
Goal 4 Green & inclusive spaces in Bhopal	• Engaging citizens in urban green cover conservation • Promoting green terraces and kitchen gardens in residential buildings and schools • Bioremediation for conserving the Bhoj wetland (upper and lower lakes) • Institutionalizing a tree cell to prevent illegal logging and implementing policies for scientific transplantation and heritage tree protection • Data, information, and awareness for biodiversity conservation	• Improved flood resilience • Improved carbon sequestration • Better physical health benefits • Decreased air pollution
Goal 5 Water-resilient Bhopal	• Developing and implementing a demand management plan for Bhopal city • Developing and implementing an integrated flood and storm water management plan • Implementing solar-powered sewage treatment plants	• Increased access to potable water • Increased flood resistance • Better sewage management • Reduced water costs and improved equitable access • Reduced emissions from water treatment • Better demand management • Increased ground water table

Goals	Actions	Outcomes
Goal 6 Sustainable & climate-resilient infrastructure in Bhopal	▪ Implementing measures to promote green buildings in Bhopal ▪ Promoting low-carbon, ECBC compliant development in the construction of government housing phase II & III under ABD, heritage development of Sadar Manzil and place making projects ▪ Promotion of green and cool roofs in residential projects/ colonies/apartments to reduce cooling demand	▪ Climate-resilient urban housing ▪ Improved access to housing for all ▪ Better energy demand management ▪ Energy savings ▪ Improved access to energy and water ▪ CSCAF's indicator 5 & 6 under energy & green buildings, indicator 3 under water resource management addressed

The city's authorities can select actions and sectoral strategies provided in this plan to develop a detailed implementation plan for pilot projects that can be rolled out in the short, medium, and long term. The GHG emission profile of the city included in the plan may be used as a guiding analysis to prioritize implementation of actions in different sectors. The plan also provides guidance on mainstreaming actions with existing policies, schemes, and programs to establish convergence of implementation.

Lastly, this plan must be treated as a dynamic document and must be updated regularly with the latest emissions profile of the city. Instituting a climate change cell at the city-level with representation of ULB departments concerned, smart city officials, citizen forums, academic institutions and civil society becomes necessary to lead and coordinate this process. Organizing periodic stake-holder consultations would help in strengthening the plan as per the evolving requirements of the city.

Source: Images of India

State Knowledge Management Centre on Climate Change (SKMCCC)
Environmental Planning and Coordination Organisation (EPCO)
Department of Environment, Government of Madhya Pradesh

Paryavaran Parisar, E-5. Arera Colony, Bhopal – 462016, India
Ph: 0755-2970499, 2970299, 2460255