



ADVANCING CITY CLIMATE ACTION IN MADHYA PRADESH

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

Executive Summary



Indore City Climate Action Plan

© State Knowledge Management Centre on Climate Change (SKMCCC), EPCO,
Department of Environment, Government of Madhya Pradesh, 2023

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 Indore city in developing its Climate Action Plan. The data and information used for preparing this report have been sourced from Indore 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

Image credits: Office of Hon'ble Mayor, Indore



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 CO₂ 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.

A handwritten signature in blue ink, appearing to be 'Gulshan Bamra', with a stylized flourish at the end.

(Gulshan Bamra)



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 impending 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 Indore 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, Indore Municipal Corporation and Chief Executive Officer of Indore 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 Indore 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 Baipai, Mr. Prateek Barapatre, Ms. Ramya MA, Ms. Faiza Solanki and Ms. Avni Agarwal for providing their expertise to assist in the research and development of the climate action plan.

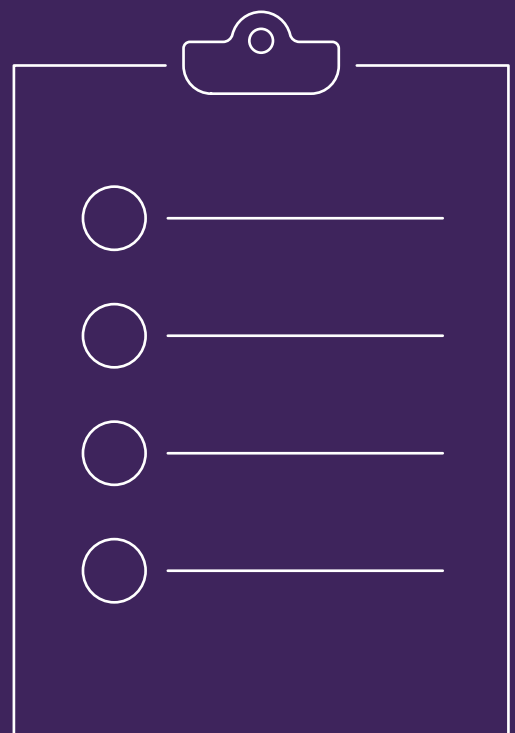
Lastly, we would like to thank the internal reviewers from WRI India including Ms. Marie Duraisami, Ms. Sumedha Malaviya, Mr. Dhilon Subramanian, Ms. Azra Khan, Ms. Chaitanya Kanuri and Ms Sahana Goswami for providing valuable feedback to strengthen the sectoral strategies in the plan.

(Lokendra Thakkar)

Coordinator,
State Knowledge Management
Centre on Climate Change, EPCO



EXECUTIVE SUMMARY



Indore and its Vulnerability to Climate Change

Indore is the largest city and commercial hub of Madhya Pradesh, prominent for sectors such as engineering, pharmaceuticals, food processing and textiles. Situated on the Malwa Plateau, Indore is a water-stressed city, facing frequent drought, heatwaves, and floods. Indore faces high vulnerability in terms of water resources, estimated using indicators such as water availability, crop water stress, and extreme events of flooding and drought. It has a higher base-line vulnerability value for drought. A study highlighted Indore as one of India's cities that would face acute water risk due to water stress and population growth, and called for urgent measures to enhance its resilience to climate-related risks. According to the climate change vulnerability assessment of Madhya Pradesh done by EPCO, the variability of rainy days in Indore is greater in July and August, and these two monsoon months show a decreasing trend during the period 1951-2018. The maximum temperature in April and May shows a significant increasing trend with sharp heat waves.

Given the challenges faced by Indore city and the backdrop of the Smart Cities Mission, the Ministry of Housing and Urban Affairs (MoHUA) has initiated the Climate Smart Cities Assessment Framework (CSCAF) for smart cities. The framework aims to provide a roadmap for cities to combat climate change through mitigation and adaptation

measures, while planning their development actions and policies. It is made up of 28 indicators across five sectors, viz. Energy and Green Buildings, Urban Planning, Green Cover and Biodiversity, Mobility and Air Quality, Water Resource Management, and Waste Management. By taking appropriate measures, cities can make a significant contribution to mitigating climate change and become resilient to its impacts. Indore has been amongst the top nine performing cities under the CSCAF, scoring particularly well on sanitation.

In this context, WRI India is providing technical support to EPCO, and the Madhya Pradesh State Government Departments of Environment and Urban Development & Housing. This includes planning adaptation and mitigation strategies and building city climate action plans (CAP) for Indore and other cities. These climate action plans are informed by the GHG emissions profile and vulnerability assessment of each city. They identify gaps through a review of data submitted by cities under the CSCAF and identify key entry points in terms of recommendations to achieve the cities' sectoral priorities through a low-carbon and climate-resilient pathway. The CAP action points address future climate risks across five thematic areas. The CAP also proposes an institutional framework which is necessary to implement the recommendations outlined in the plan.

Climate Action Planning Process

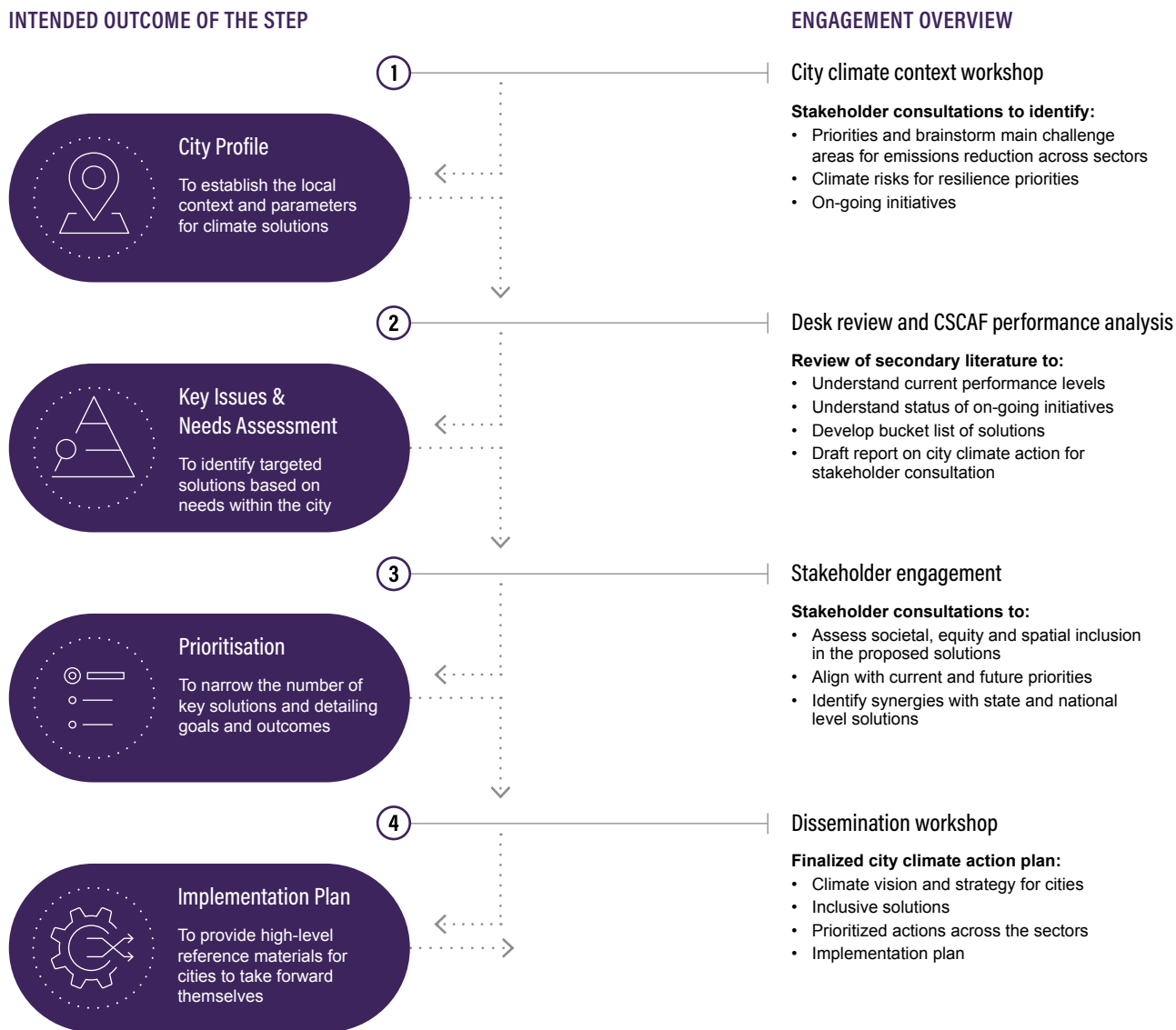
WRI India adopted a four-pronged approach in the entire process of preparing the CAP as illustrated in the figure below.

- 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. The idea of the workshop was to apprise participants of the importance and relevance of developing city-level plans, to brainstorm and identify prominent development challenges and key climate risks in urban areas in MP, and to understand ongoing initiatives in order to establish a local context for climate solutions.
- This was followed by an extensive desk review of the smart city proposal to identify the vision and key sectoral priorities for Indore city. A thorough review of submissions made by Indore Smart City Development Corporation Limited as a part of CSCAF, sectoral plans, government reports and other documents was done to identify key issues and gaps in achieving the sectoral priorities. A detailed climate profile of Indore

city was developed, including temperature and rainfall projections, baseline and projected GHG inventory, and a climate vulnerability assessment. This helped identify future climate risks and potential areas for reduction of GHG emissions. The review and analysis led to the development of a list of sectoral goals and actions, which are enumerated in the climate action plan.

- As the next step, in order to facilitate holistic brainstorming on key priorities and sectoral actions, a stakeholders' consultation workshop was organized in Indore in September 2021. City officials, sectoral experts and civil society representatives participated, and provided feedback on the preliminary sectoral findings on key priority areas, as well as inputs on the goals and actions proposed for Indore to adopt a low-carbon and climate-resilient development pathway.
- The final CAP provides prioritized sectoral actions along with an implementation plan and CAP governance mechanism for effective coordination and monitoring of implementation.

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



Baseline Assessment

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

Climate Smart Cities Assessment Framework Analysis for Indore

Indore has been performing well under the CSCAF 2.0, particularly in waste management and urban planning. It ranked as the cleanest city in India for five consecutive years. However, there is scope for improvement in sectors such as energy and green buildings, and water management.

Greenhouse Gas Emissions Inventory

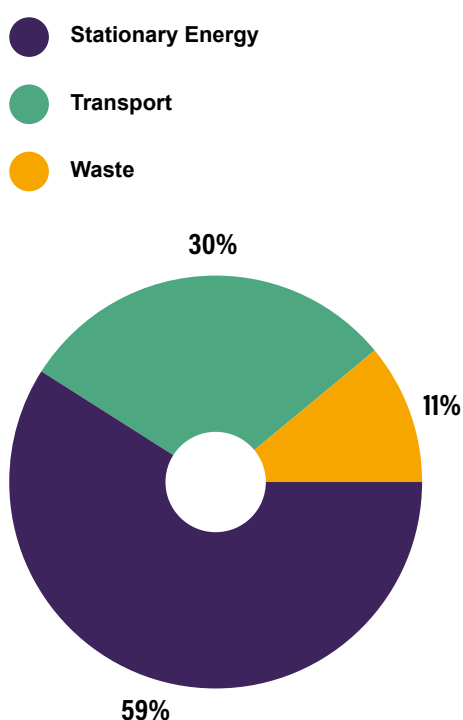
As per the 2019 greenhouse gas emissions inventory prepared for Indore using the CIRIS tool, as per GPC standards, total emissions for Indore were 3.6 million tons of CO₂e. Of these, 59% came from stationary energy, 30% from transportation, and 11% from waste management. Per capita emissions were 1.6 tCO₂e (including manufacturing and industrial emissions).

The majority of these emissions comes from energy and electricity use in commercial and institutional buildings, followed by residential buildings. Emissions from electricity consumption account for 57% of total emissions.

ES Table 1: CSCAF analysis (Source: CSCAF data from the 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	330.5	404	362	350	581
Current measures being undertaken in the city	<ul style="list-style-type: none"> 98% LED streetlights. The city is promoting adaptive reuse of older buildings. 65% of terraces of redeveloped buildings to have solar PV. Pioneering a floating solar funding model 	<ul style="list-style-type: none"> 20% of the municipal area is under green cover. Vertical gardens on the rivers/nullah bridges, Miyawaki plantations being implemented. 	<ul style="list-style-type: none"> 10% of public buses run on low-carbon fuel. Metro is proposed. Clear Air Action Plan is in place. Shared scooter service in the city. 	<ul style="list-style-type: none"> 629 traditional water supply sources along with wetlands being restored. City has a water resources management plant and has identified future water demand. 	<ul style="list-style-type: none"> 100% of door-to-door collection. 92% of dry waste is recycled Bioremediation already in practice in Devguradia trenching ground, 550 TPD plant inaugurated in February 2022
Areas of improvement	<ul style="list-style-type: none"> Reducing high Transmission and Distribution losses which is currently 24%. Increasing power generation from RE sources, which is currently 0.8%. 	<ul style="list-style-type: none"> Inequitable green and open spaces. Need to integrate green infrastructure within lake redevelopment. 	<ul style="list-style-type: none"> Augmenting bus fleet and NMT coverage Improving last-mile connectivity Increasing uptake of EVs particularly for shared mobility and public transport (10% of buses run on clean fuels) 	<ul style="list-style-type: none"> Reducing NRW (currently 30%). Poor access of tap water, 46% as of 2019. Increasing use of treated water (currently 11% wastewater is recycled) 	<ul style="list-style-type: none"> Biomedical waste treatment to be made scientific. Capturing of methane gas from STPs.

ES Figure 2: GHG emissions profile for Indore, 2019 (Source: WRI India analysis using primary data)

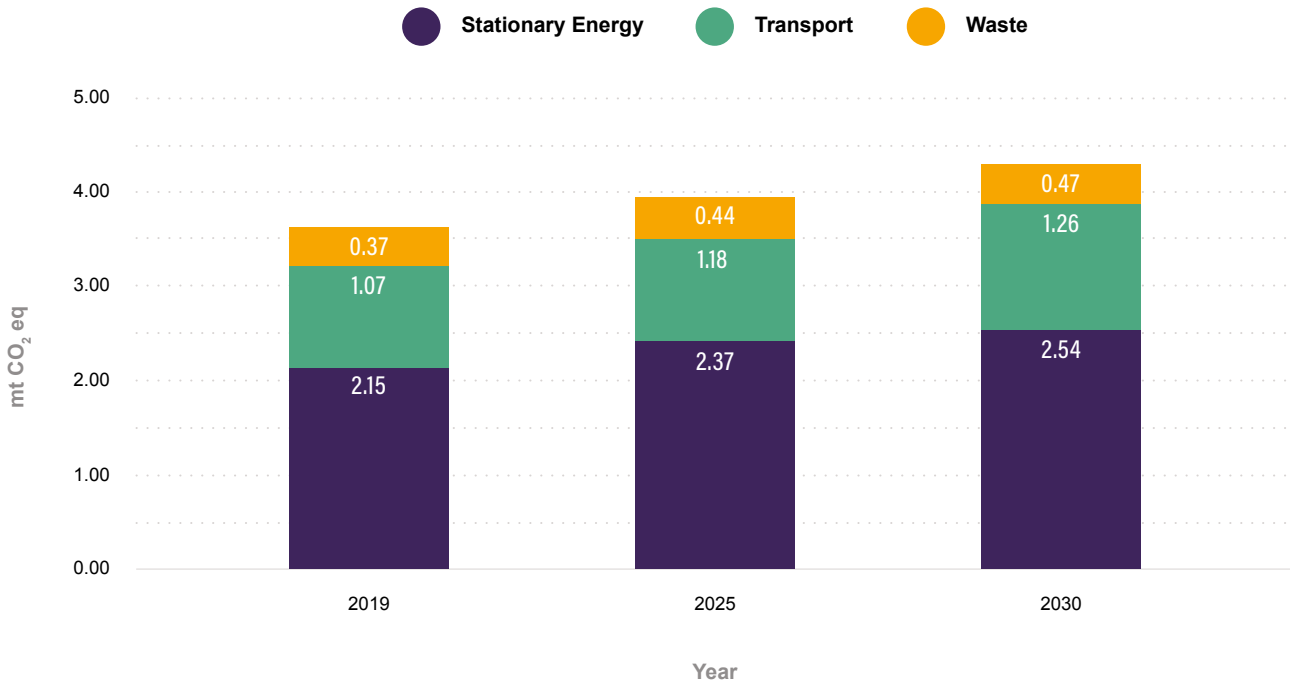


The business-as-usual emissions for Indore are projected to increase by 10% by 2025 and 18% by 2030, as compared with baseline emissions in 2019 (see ES Figure 3). Thus, the city urgently needs to implement the measures presented in the report in order to achieve its vision of low carbon and climate-resilient development.

Emissions Scenario Modeling for Indore

An emissions scenario analysis was developed using the Climate Action for Urban Sustainability (CURB) tool, an interactive Excel-based tool designed by the World Bank in partnership with C40 Cities Climate Leadership Group, Global Covenant of Mayors, and AECOM Consulting. It helps cities develop emissions reduction targets for key sectors, assess the investments required, and prioritize low-carbon interventions based on cost, payback period, feasibility and impact on energy consumption and emissions reduction.

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



This tool was used to develop three main scenarios:

- Business-as-usual scenario:** This predicts the GHG emissions reduction if no action is taken for mitigation. In this scenario, emissions are expected to rise 1.5 times from 2019 to 2050.
- Existing and planned scenario:** This scenario uses existing or planned city, regional and national actions, policies, and programs to demonstrate the emissions reductions trajectory for the city until 2050. As per this scenario, the city has the potential to achieve a 44% reduction in emissions by 2050 as compared to the BAU scenario. Key targets include 35% electricity from renewables from 2050, electrifying 40% of 4-wheelers and 2-wheelers and 70% of buses, and achieving a 38% mode share for public transport by 2050.
- Ambitious scenario:** In most cases, existing and planned policies leave a significant gap in relation to the 1.5°C Paris Agreement and Deadline 2020 trajectory. This scenario analyzes emissions reduction due to actions that are ambitious yet achievable. It can take guidance from proposed projects, state-level targets, etc. The targets were then vetted through stakeholder consultations with city-level experts. In this scenario, the city has a potential to achieve 78% emissions reduction by 2050, mainly due to the increased adoption of rooftop solar, energy-efficient heating and cooling solutions in buildings, and decarbonizing of the electricity grid.

Vulnerability Analysis for Indore

As per the vulnerability analysis for the city, if current trends continue, the mean temperature is expected to increase by 1.3°C by the 2030s and to go up to 2.6°C by 2050. If this trendline continues, the city may see 32 more warm days by 2050, up to 45 more warm nights and an increase in total rainfall up to 22% by 2050.

- Indore's climate varies considerably from year to year, particularly rainfall. Thus, even in the absence of anthropogenic climate change, this Smart City needs to be resilient to this natural variability.
- Records for the Indore region over the last few decades show a clear trend towards higher temperatures and more frequent high temperature extremes.
- Climate projections show a strengthening of the observed temperature trends, particularly with higher GHG emissions, as well as a tendency towards more frequent intense rainfall.

If global warming is restricted to 2°C or less above preindustrial levels, the impacts of climate change would be substantially reduced for Indore, particularly in the second half of the century.

ES Table 2: Climate change and potential risks (Source: CEEW)

Projected Climate Changes	Potential Impacts and Risks
Warmer conditions, including more intense and frequent hot extremes and heat wave days	<ul style="list-style-type: none"> • Human heat stress and other negative health effects, including potential increases in mortality, particularly if air quality also declines. • Increase in water stress and drought-like events. • Negative impacts on labor productivity, particularly on outdoor workers. • Potential increase in demand for air conditioning, which would increase energy consumption. • Increased water stress and high groundwater exploitation.
Higher annual rainfall totals and more frequent heavy rainfall events	<ul style="list-style-type: none"> • Potential increase in flood risk. • Possible implications for water balance, and the quantity and quality of water resources (also taking into consideration the likely persistence of long dry spells and increased evaporation with warmer conditions).

Goals and Sectoral Strategies

ES Table 3 on the next page summarizes the goals and actions which can help the city become low carbon

and climate-resilient while also addressing concerns of inequality and inclusivity in development.

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

Goals	Actions	Outcomes
Goal 1 From water-stressed to water-resilient Indore	<ul style="list-style-type: none"> • Mandate to use treated wastewater to cool thermal power plants and for other industrial uses • Integrated flood and storm water management plan • Mandate to reuse treated water for urban gardens, parks, and rooftop gardens • Installing smart water meters and implementing a demand management plan for optimal usage of resources • Developing a contingency plan for municipal water supply • Instituting a non-revenue water cell • Implementing green walls in buildings for grey water reuse • Reviving local lakes and ponds, and rejuvenating polluted river stretches through desilting, aquifer recharging and river rejuvenation projects 	<ul style="list-style-type: none"> • Increased access to potable water • Reduced NRW losses, increased flood resistance • Better sewage management • Reduced water distribution costs and more equitable access • Rejuvenation of natural water supply sources
Goal 2 Promoting low-carbon transport and reducing private vehicle usage	<ul style="list-style-type: none"> • Improving last-mile connectivity of planned metro • Converting i-ride service into electric scooters • Increasing the public transport fleet and incorporating passenger communication initiatives • Initiatives to increase the share of e-vehicles and charging infrastructure for passenger transport • Initiatives to increase the share of e-vehicles and charging infrastructure for freight transport 	<ul style="list-style-type: none"> • Reduced congestion and private vehicle use • Improved public transport infrastructure
Goal 3 People-friendly Indore	<ul style="list-style-type: none"> • Creating a city-level NMT cell • NMT-focused urban street design guidelines • Reviving Indore's Public Bicycle System, i-bike 	<ul style="list-style-type: none"> • Reduction in GHG emissions from transport • Improved road safety • Improved air quality and access to mobility infrastructure

Goals	Actions	Outcomes
Goal 4 Transforming Indore into a green city	<ul style="list-style-type: none"> Action plan for increasing green cover Incorporating green infrastructure within lake redevelopment projects 	<ul style="list-style-type: none"> Improved air quality Increased carbon sequestration Lowered flood risk, reduction in urban heat island effect Increased proportion of green cover Conservation of biodiversity species
Goal 5 Powering Indore through renewables	<ul style="list-style-type: none"> Developing a local RE procurement plan Mandating installation of solar water heaters in new buildings under the municipal area Increasing the use of solar and CNG in slums Conversion of municipal buildings into net zero energy buildings Retrofitting buildings under the Pradhan Mantri Awas Yojana scheme with climate sensitive components Institutional measures to promote green buildings 	<ul style="list-style-type: none"> Reduced GHG emissions from buildings Reduced energy costs and improved access for slum dwellers Improved air quality and reduced negative health effects Reduced conventional energy demand and use in buildings Increased share of RE in buildings
Goal 6 Sustainable waste management in Indore	<ul style="list-style-type: none"> Power generation from wastewater Community compost pits in each zone based on land availability Introducing incentive-based take back programs for dry waste Eco-bricks from plastic waste 	<ul style="list-style-type: none"> Reduced energy costs for sewage treatment Reduced contamination of water bodies Improved green cover Increased participation for waste management

The city authorities can select actions and recommendations 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 city's GHG emission profile included in the plan may be used as a guide to prioritize the implementation of actions in different sectors. The plan also provides guidance on mainstreaming actions in existing policies, schemes, and programs to facilitate the convergence of implementation.

Lastly, this plan must be treated as a dynamic document, and must be updated periodically with the latest emissions profile of the city. Instituting a climate change cell at the city level with representation from relevant ULB departments, Smart City, citizen forums, academic institutions, and civil society is necessary to lead and coordinate this process. Organizing periodic stakeholder consultations would help strengthen the plan as the city's requirements evolve.





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