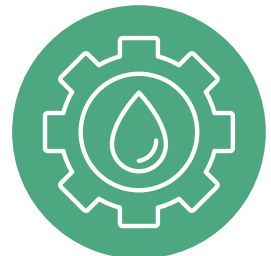




ADVANCING CITY CLIMATE ACTION IN MADHYA PRADESH

Transforming **UJJAIN** into a low-carbon and climate-resilient tourist and pilgrimage capital

Executive Summary



Ujjain City Climate Action Plan

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

Cover image: Ujjain Smart City Development Corporation Ltd.



GULSHAN BAMRA (IAS)
PRINCIPAL SECRETARY



Department of Environment
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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.



(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 Ujjain 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, Ujjain Municipal Corporation and Chief Executive Officer of Ujjain 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 Ujjain 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.

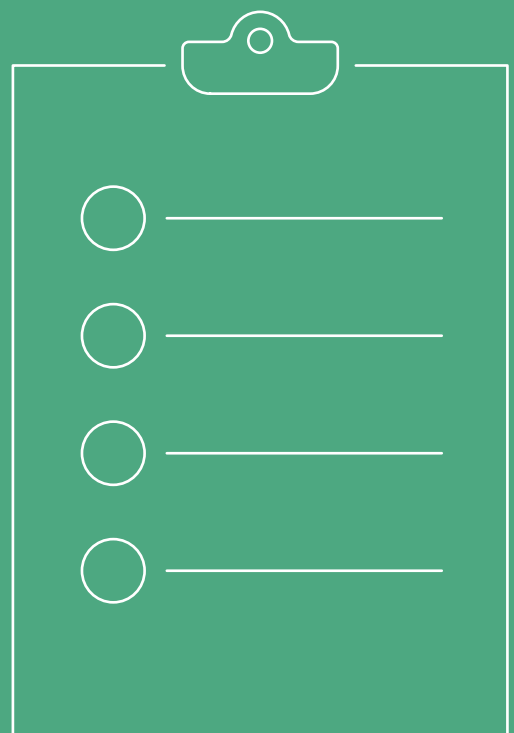
Lastly, we would like to thank the internal reviewers from WRI India including Ms. Marie Duraisami, Ms. Sumedha Malaviya, Mr. Dhilon Subramanian, Ms. Azra Khan, Ms. Chaitanya Kanuri and Ms Sahana Goswami for providing valuable feedback to strengthen the sectoral strategies in the plan.

(Lokendra Thakkar)

Coordinator,
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EXECUTIVE SUMMARY



Ujjain and its Vulnerability to Climate Change

Known as the state's religious capital, Ujjain is a culturally rich ancient city located on the banks of River Kshipra in western Madhya Pradesh. Situated in the Malwa Plateau, Ujjain is a religious tourism hub known for the Kumbh Mela, hosted once in 12 years.

Ujjain is an emerging city based on its socioeconomic growth. The city will see an increase in income growth in future. However, by 2030, the population growth in the city will outpace the income growth. This will create a need to provide essential services with the available limited resources for the rising population. Vulnerability assessment analysis done by Environmental Planning and Coordination Organization (EPCO) shows that Ujjain is very highly vulnerable in the water sector with a very high risk of decreasing availability of water, increasing crop water stresses and increase in frequency of extreme weather events such as floods and droughts.

Given the challenges that Ujjain 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. 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 in these sectors, cities can make a significant contribution to mitigating climate change and becoming resilient to its impacts.

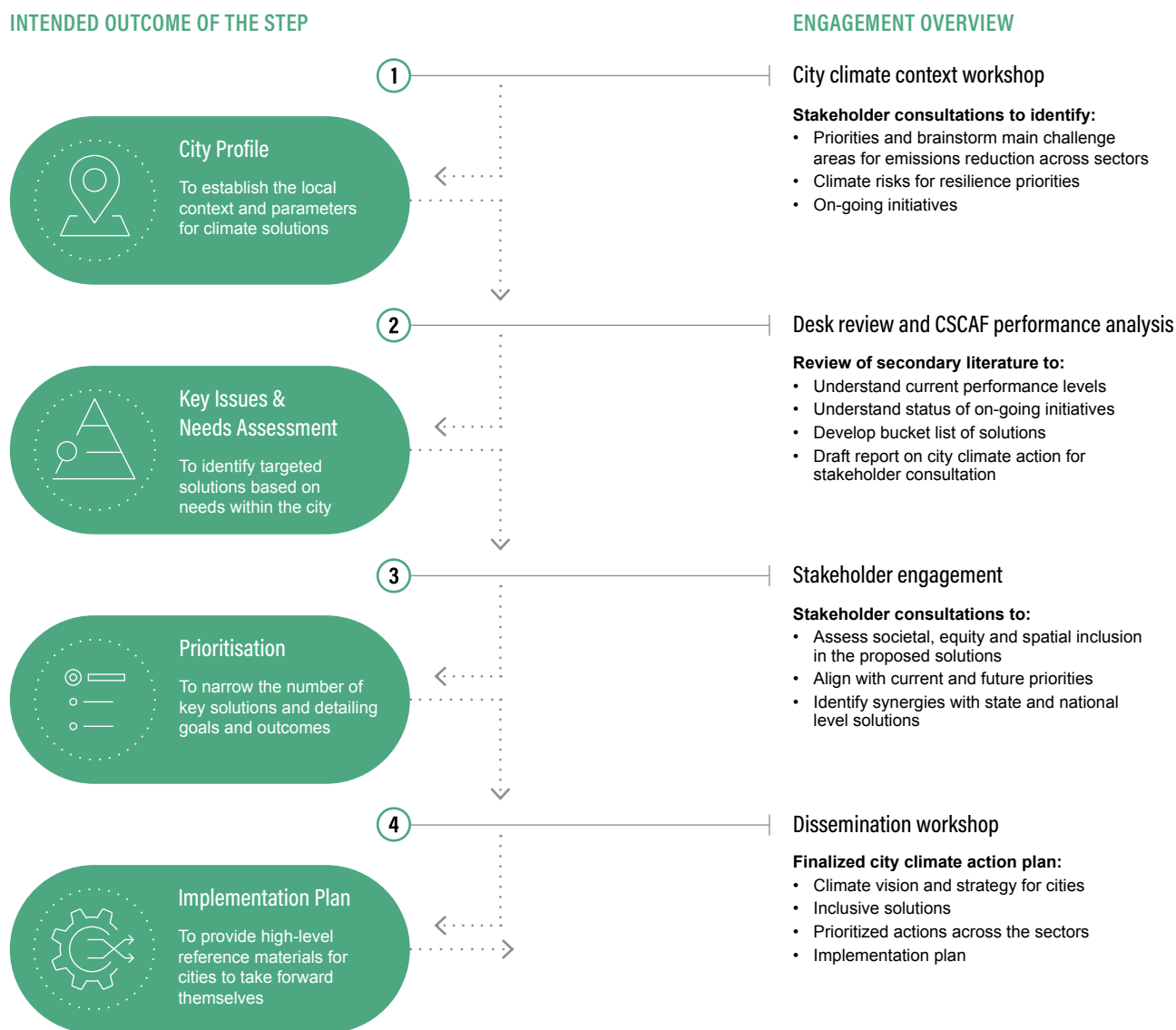
In this context, WRI India is technically supporting EPCO, Department of Environment, and Department of Urban Development and Housing of the Government of Madhya Pradesh, besides the Ujjain administration, in planning adaptation and mitigation strategies and building a city climate action plan (CAP). The climate action plan is based on the GHG emissions profile and vulnerability assessment of the city. It identifies sectoral gaps and proposes key entry points in terms of actions to achieve the sectoral priorities of cities through an inclusive, low-carbon and climate-resilient pathway. The sectoral actions are aligned with inputs received during city-level stakeholders' consultations with participation of officials from district and city authorities, academia, and civil society. The plan prioritizes the actions based on their urgency, importance and convergence with ongoing schemes, programs, and missions of national and state government.

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 Feb 2020, with participation from state and city officials, academicians, and civil society organizations. The idea of the workshop was to apprise the participants and cities about the importance and relevance of developing these city level plans, to brainstorm and identify prominent development challenges and key climate risks in the urban areas of Madhya Pradesh (MP) as well as understand the 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 envisaged by Ujjain city. A thorough review of submissions made by Ujjain as a part of CSCAF 2.0, 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 Ujjain city has been developed which includes temperature and rainfall projections, baseline and projected GHG inventory. The climate vulnerability assessment carried out by EPCO has been referred to identify future climate risks and a scenario modeling exercise was conducted to identify potential areas for reduction of GHG emissions in the short and long term. 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, to narrow the number of sectoral actions and detailing goals and outcomes, a stakeholder consultation workshop was organized in Ujjain in September 2021, 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 for Ujjain to adopt a low-carbon and climate-resilient development pathway.
- The final CAP provides prioritized sectoral actions along with an implementation plan and governance mechanism for effective coordination and monitoring of the CAP's implementation.

ES Figure 1: CAP development process (Source: CSCAF 2.0 data from city)



Baseline Assessment

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

Climate Smart Cities Assessment Framework Analysis for Ujjain

Ujjain needs to prioritize interventions in increasing shared vehicles that use clean fuel and increasing public transport access and availability. Ujjain also needs to prioritize areas such as percentage of renewable energy in the grid (0.07% currently). The city also needs to improve its performance in the green cover and water resources sector. Some of the ongoing measures and sector-wise areas of improvement are given below.

Greenhouse Gas Emissions Inventory

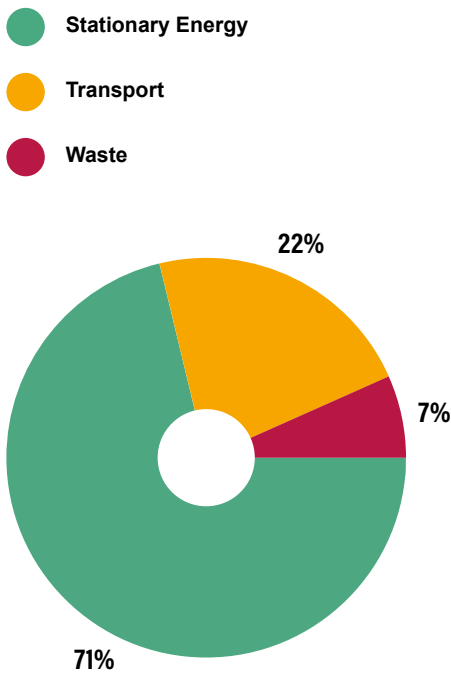
In 2019, Ujjain's GHG emissions were 1.376 mtCO₂e with a per capita emission of 2.3 tCO₂e (Including Manufacturing and Industrial emissions from electricity consumption). Transport constituted 22% and stationary energy constituted 71% while waste accounted for 7% of total city GHG emissions as presented in ES Figure 2.

Majority of these emissions come from manufacturing and construction (49%), followed by residential buildings (36%) and commercial and institutional buildings (15%).

ES Table 1: CSCAF analysis (Source: CSCAF 2.0 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	375	126	143	100	573
Current measures being undertaken in the city	<ul style="list-style-type: none"> 0.07 % of total electricity generation is through renewables. Less than 10% of the buildings are energy efficient or green buildings. 40% of streetlights are LED lights. 	<ul style="list-style-type: none"> 6.87% of the municipal area was under green cover in 2020. Plantation of 12 lakh trees along Rudrasagar lake is underway. Ankur program has been launched in the state and Pradhan Mantri Awaz Yojana (PMAY) has been linked to it. The program rewards citizens for tree plantation. Action plan developed to increase green cover in Ujjain. Established city level biodiversity management committee 	<ul style="list-style-type: none"> 0.08 buses available per 1,000 population. 1888 auto-rickshaws run on clean fuels including 113 electric rickshaws. The city regularly monitors major parameters and city's air quality does comply with NAAQ standards. Clear Air Action Plan of the city is already in place. 	<ul style="list-style-type: none"> In 2018, 52% of the municipal households had in-house water supply connections and 10% of the households below poverty line had in-house water supply connections. As per the data submitted for CSCAF 2.0, 54 MLD of wastewater is treated and is reused for gardening and agriculture purposes. Energy audit conducted for water supply pumping stations and water treatment plants. 41% non-revenue water. 	<ul style="list-style-type: none"> 100% door-to-door collection exists as per the District Environmental Plan. City has proposed construction of a sanitary landfill. Implemented a bio-methanation plant with a capacity of 5 tonnes per day to treat vegetable waste. Bioremediation of legacy waste has been completed. The city has installed a 600 kg capacity organic waste converter plant in the Mahakal temple campus
Areas of improvement	<ul style="list-style-type: none"> Increasing green building adoption. Increasing power generation from RE sources. Increasing percentage of energy efficient streetlighting. Promoting rooftop solar in residential and commercial buildings. Promoting green buildings in at least 85% of ABD area. 	<ul style="list-style-type: none"> Need to integrate the strategy for rejuvenation and conservation of water bodies and open spaces within the City Development Plan/Master Plan Identifying measures to increase urban biodiversity and allocate resources. Need to prepare a disaster management plan with ward level risk assessment and early warning systems. 	<ul style="list-style-type: none"> Increasing the number of clean fuels run vehicles especially buses and taxis. Augmenting the public transport fleet. Increasing the coverage of roads with footpaths and cycle tracks (currently only 1.34%). Improving last mile connectivity. Monitoring and revising the clean air action plan 	<ul style="list-style-type: none"> Increasing the tap water connections to more than 90% households. Introducing metering policy from immediate effect. Increasing wastewater reuse. Carrying out flood/ water stagnation risk assessment of the city. 	<ul style="list-style-type: none"> Reducing waste going to the landfill. Increasing adequate waste transport infrastructure. Monitoring the amount of methane collected from STPs and generating clean energy. Reducing greenhouse gas emissions from waste transport by shifting to alternate fuels.

ES Figure 2: GHG Emissions Profile of Ujjain, 2019
 (Source: WRI India analysis using primary data)



The business-as-usual projected emissions for Ujjain are presented in ES Figure 3. The emissions are projected to increase by 10% by 2025 and 18% 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.

Emissions Scenario Modeling for Ujjain

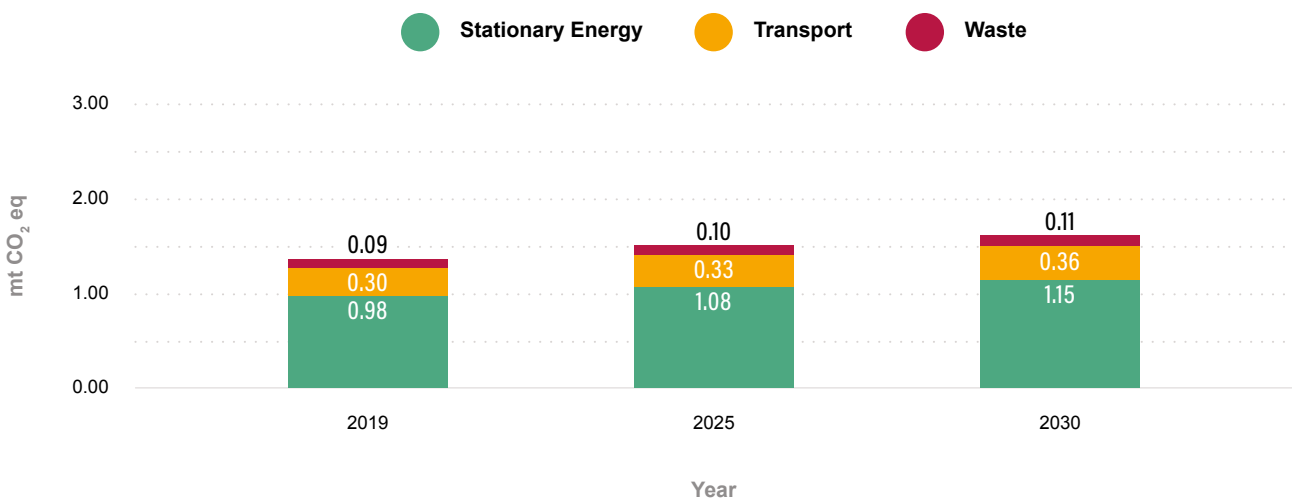
An emissions scenario analysis was developed using the Climate Action for Urban Sustainability (CURB) tool, an interactive spreadsheet-based tool designed by World Bank in partnership with C40 Cities Climate Leadership Group, Global Covenant of Mayors, and AECOM

Consulting. It helps cities develop emissions reduction target for key sectors, assess investments required and prioritize low-carbon interventions based on cost, payback period, feasibility and impact on energy consumption and emissions reduction¹.

This tool was used to develop three main scenarios:

- Business-as-usual scenario:** Predicts the emission reduction if no action is taken for GHG emission mitigation. As per this scenario, emissions are expected to rise 1.5 times from 2019 to 2050 if no action is taken for greenhouse gas mitigation.
- Existing and planned scenario:** This scenario uses existing or planned city, regional and national actions, policies, and programs to demonstrate the emissions reduction trajectory for the city until 2050. It considers current and planned development strategies that would have an indirect co-benefit of emissions reduction. Examples include actions to subsidize photovoltaic solar and solar rooftop installations, electric vehicle policy, etc. The policies studied for Ujjain include Ujjain Development Plan, Climate Informed Environmental Planning for the Smart Cities of Madhya Pradesh for Ujjain prepared by SPA Bhopal, MP EV policy 2019 and the Smart city proposal. As per this scenario, the city has the potential to achieve 10.6% reduction in emissions by 2050 with respect to the BAU scenario.
- Ambitious scenario:** In most cases including in Ujjain, the existing and planned policies leave a significant gap to the 1.5°C Paris Agreement and Deadline 2020 trajectory. This scenario analyzes the emissions reduction due to actions that are ambitious yet achievable. Taking guidance from proposed projects, state-level targets, etc., the city's targets were vetted through stakeholder consultations with city-level experts. As per this scenario, the city has the potential to achieve 55% emissions reduction by 2050, mainly attributed to proliferation of rooftop solar, energy efficient heating and cooling solutions in buildings and decarbonization of the electricity grid.

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



Vulnerability Analysis for Ujjain

The climate of Ujjain is subject to large year-to-year variability, particularly for rainfall. Thus, even in the absence of anthropogenic climate change, the city needs to be resilient to this natural variability. By the 2050s, the city may see its total rainfall increase by 11%, with heavy rainfall days increasing by an average of four days annually.

Observed records for the Ujjain region show emerging trends in temperature over the last few decades – in

particular, a clear trend towards higher temperatures and more frequent high temperature extremes. Mean temperature is set to increase by 2.1°C on an average by the 2050s. The city can see an increase of up to 21 hot days.

If global warming can be constrained to 2°C or less with respect to preindustrial conditions, the impacts of climate change would be substantially reduced for Ujjain, 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 increase in mortality, especially if air quality also decreases. Negative impacts and constraints on labor productivity, particularly on outdoor workers. Potential increased demand for air conditioning – which would increase energy demand. High likelihood of decreasing water availability and increasing crop stresses. Extremely high risk of decrease in biological richness, accelerated forest cover changes based on the disturbance index, changes in canopy cover along with shift in slope and vegetation.
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. Very high risk of decrease in average annual rainfall, increase in intensity of precipitation and rise in heat index

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 inequality and ensuring inclusivity in development.

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

Goals	Actions	Outcomes
Goal 1 Make Ujjain a green pilgrimage and tourist capital	<ul style="list-style-type: none"> Improve energy efficiency in temples Minimize plastic and installing dry waste recovery booths and compost units at major temples Pedestrianize Ramghat and other dense areas in the historic core Towards zero-carbon building projects in the phase I and phase II of MRIDA Develop Ujjain's upcoming 2028 Simhastha Kumbh into a Harit or green Kumbh Promote local tourism through home-stay establishments during tourist season 	<ul style="list-style-type: none"> Reduction in emissions from energy and tourism sectors Improvement in air quality Improvement in health & hygiene, and reduction in water/waste borne diseases Greater awareness among citizens and floating population Increased energy savings from low carbon infrastructure

Goals	Actions	Outcomes
Goal 2 Towards low-carbon and people-friendly transport in Ujjain	<ul style="list-style-type: none"> • Augment the bus fleet in Ujjain • Implement a special Non- Motorized Transport cell within Ujjain Municipal Corporation • Promote electric mobility in Ujjain • NMT focused urban street design guidelines for Ujjain • Implement and upscale the proposed city-wide public bike sharing system 	<ul style="list-style-type: none"> • Increase in NMT infrastructure • Decrease in air pollution due to transport • Increase in availability and accessibility of public transport • Access to NMT options • Access to low-carbon shared mobility options
Goal 3 Powering Ujjain through renewable energy	<ul style="list-style-type: none"> • Mandate installation of solar roof-top panels in all public educational institutions • Promote of green and cool roofs in residential projects/ colonies/apartments to reduce cooling demand • Incentivize installation of rooftop solar panels and solar water heaters in all new residential constructions • Mandate installation of solar water heaters on rooftops of hotels in Ujjain • Explore common solar PV projects for community low-income housing 	<ul style="list-style-type: none"> • Reduced per capita electricity consumption • Better market for RE technologies • Creation of new job opportunities • PPP engagement for efficient infrastructural distribution • Reduction in emissions from the consumption of grid supplied electricity from renewables • Improved access to energy
Goal 4 Greener, inclusive spaces for all in Ujjain	<ul style="list-style-type: none"> • Promote green terraces or kitchen gardens in buildings • Engage citizens in urban green cover conservation • Initiatives to restore, maintain and enhance the city's biodiversity 	<ul style="list-style-type: none"> • Increase in urban green cover • Improved flood resilience • Improved carbon sequestration • Physical health benefits • Improved biodiversity
Goal 5 Sustainable waste management for a clean Ujjain	<ul style="list-style-type: none"> • Explore decentralized composting at the zone level • Public-private partnership models for managing construction and demolition waste • Upgrade collection and transportation infrastructure to electric vehicles 	<ul style="list-style-type: none"> • Reduction in GHG emissions due to improved processing and treatment facilities • Creation of new jobs through expanded waste management infrastructure • Amount of organic waste processed • Reduction in emissions from waste • Reduced operational costs for waste transportation
Goal 6 Water for everyone in Ujjain	<ul style="list-style-type: none"> • Strengthen the implementation of the NRW action plan • Disaster risk reduction by developing and implementing an integrated flood and storm water management plan incorporating nature-based solutions • Implement a demand management plan for optimal usage of water resources • Develop inclusive business models for wastewater treatment and reuse 	<ul style="list-style-type: none"> • Increased access to potable water • Reduced NRW losses • Increased flood resistance • Better sewage management • Reduced water costs and improved equitable access

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 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 from ULB departments concerned, Smart city, citizen forums, academic institutions and civil society becomes necessary to lead and coordinate this process. Organizing periodic stakeholder consultations would help in strengthening the plan as per the evolving requirements of the city.





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