



ADVANCING CITY CLIMATE ACTION IN MADHYA PRADESH

Towards a low-carbon and
climate-resilient **SAGAR**

Executive Summary



Sagar 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 Sagar city in developing its Climate Action Plan. The data and information used for preparing this report have been sourced from Sagar 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: Sagar Smart City 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 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', written over a light blue grid background.

(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 Sagar 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, Sagar Municipal Corporation and Chief Executive Officer of Sagar Smart City 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 Sagar 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.

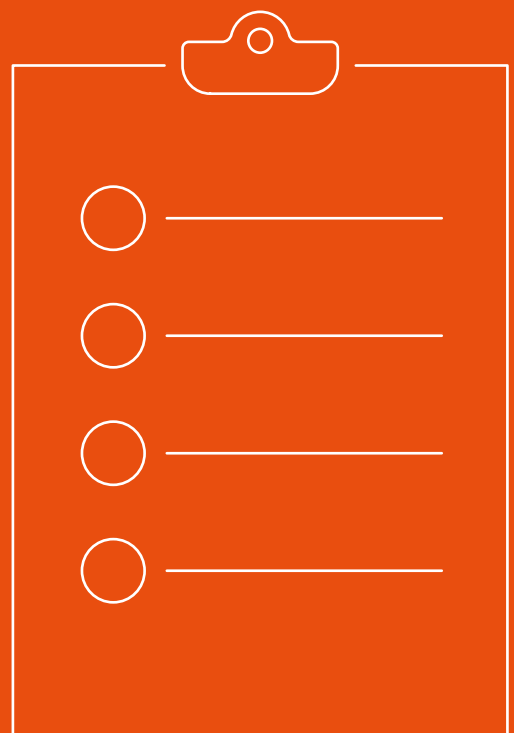
Lastly, we would like to thank the internal reviewers from WRI India including Ms Marie Duraisami, Ms Sumedha Malaviya, Mr Dhilon Subramanian, Ms Azra Khan, Ms Chaitanya Kanuri and Ms Sahana Goswami for providing valuable feedback to strengthen the sectoral strategies in the plan

(Lokendra Thakkar)

Coordinator,
State Knowledge Management
Centre on Climate Change, EPCO



EXECUTIVE SUMMARY



Sagar and its Vulnerability to Climate Change

Sagar is in the Bundelkhand region of Madhya Pradesh, Central India and is one among the hundred cities to be developed as a smart city under the smart cities mission. A centre of higher education, the city was also recognized as the safest city in India as per the 2018 Ease of Living index and ranked 23rd in sanitation as per the Swachh Survekshan Survey of 2017. Often referred to as the 'Switzerland of Madhya Pradesh,' Sagar lies at an average elevation of 427m above mean sea level and has a unique physiography surrounded by the Vindhya Ranges, located around the Lakha Banjara Lake. This contributes to the humid subtropical climate of the city. The Rajghat Dam and Lakha Banjara lake remain the city's major water sources. However, the lake currently faces issues of pollution and growth of squatter settlements around it.

Projections based on socio-economic growth show that while economic strength is low today, the city's projected economic growth is greater than projected population growth, indicating an increase in economic productivity. Sagar is also more likely to have the capacity to overcome current resource constraints and strengthen its position as a commercial and touristic centre. The city is one of the non-attainment cities in the state with regards to air quality.

According to the Vulnerability Assessment by Environmental Planning and Coordination Organization (EPCO), the advisory wing for the Department of Environment, Government of Madhya Pradesh, Sagar has a high composite vulnerability, which indicates it is likely to face higher climate change impacts in different sectors. The city faces a high risk of decreased availability of water, increasing crop water stresses and increase in frequency of extreme events like floods and droughts. Forest vulnerability is moderate, but moves to highly vulnerable in mid-century, with a risk of decrease in biological richness, accelerated forest cover changes (based on the

disturbance index), changes in canopy cover, and shift in slope and vegetation. Climate vulnerability goes from moderate to high in mid-century, with a very high risk of decrease in average annual rainfall, increase in intensity of precipitation and rise in the heat index.

Against the backdrop of the Smart Cities Mission, the Ministry of Housing and Urban Affairs initiated the Climate Smart Cities Assessment Framework (CSCAF), which provides a roadmap to combat climate change, through mitigation and adaptation, while planning city-level development actions and policies. CSCAF is made up of 28 indicators across five sectors: Energy and Green Buildings; Urban Planning, Green Cover and Biodiversity; Mobility and Air Quality; Water Resource Management; and Waste Management. With appropriate measures, cities can make a significant contribution to mitigating climate change and becoming resilient to its impacts.

WRI India is supporting EPCO, Department of Environment and Department of Urban Development and Housing, Government of Madhya Pradesh, as a technical partner, in developing a city level climate action plan (CAP) with adaptation and mitigation strategies, for the seven smart cities of MP, including Sagar. The CAP is informed by the GHG emissions profile and a 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 low-carbon and climate-resilient pathways. Sectoral actions are aligned with inputs received during city-level stakeholders' consultations with district and city authorities, academia and civil society. The plan prioritizes actions based on their urgency, importance and convergence with on-going schemes, programmes and missions of the national and state governments.

Climate Action Planning Process

WRI India adopted a four-pronged approach to preparing the CAP.

- In February 2020, in Bhopal, WRI organized a planning -cum-launch workshop with state and city officials, academicians and civil society organizations. The idea was to apprise participants and cities about the importance and relevance of developing these city level plans and identify prominent development challenges and key climate risks in urban areas.
- This was followed by an extensive desk review of Sagar's smart city proposal, CSCAF 2.0, sectoral plans and government reports to identify key issues and gaps in achieving sectoral priorities. A detailed climate profile was 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. This review and analysis helped in drawing up a list of sectoral goals and actions which are outlined in the climate action plan.

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

INTENDED OUTCOME OF THE STEP

ENGAGEMENT OVERVIEW



Baseline Assessment

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

| CSCAF 2.0 analysis

Based on the analysis, Sagar has significant scope to improve its rating especially in Energy and Green Buildings, Mobility and Air Quality; and Water Resource Management, where it scored 1/5 stars, standing at level 1. ES table 1 provides an assessment of current measures in each of the five sectors and scope for improvement.

| Greenhouse Gas Inventory

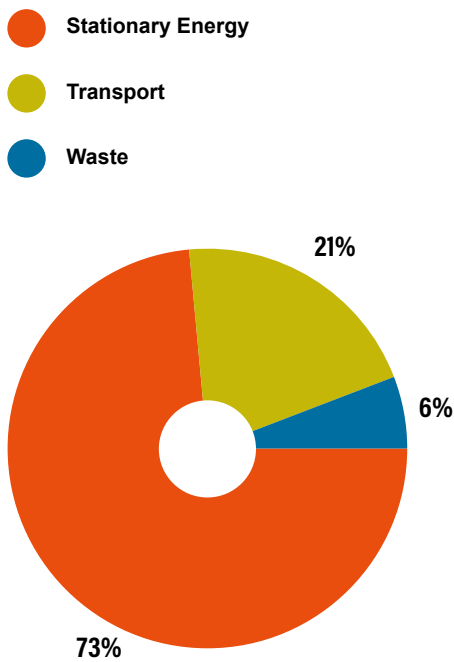
In 2019, Sagar’s GHG emissions were 0.86 mtCO₂e. This amounted to 2.7 tCO₂e per person. The emissions inventory was compiled as per the Global Protocol for Communities (GPC) BASIC standards using C40’s City Inventory Reporting and Information System (CIRIS) tool. Stationary energy contributes 73% to total city emissions followed by transportation (21%) and waste (6%) as seen in ES Figure 2.

The business-as-usual projected emissions for Sagar are presented in ES Figure 3. The emissions are projected to increase by 7.1% by 2025 and 13.5% by the end of the

ES Table 1: CSCAF 2.0 Scores for Sagar (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	104	114	100	50	434
Current measures being undertaken in the city	<ul style="list-style-type: none"> • Demand side energy management measures resulting in 40% savings. • 24X7 SCADA-enabled power supply with smart metering being considered. • Detailed Project Report (DPR) prepared for proposed solar power plant. • Smart pole project underway. 	<ul style="list-style-type: none"> • City has mapped open spaces and water bodies. • 10 acres of city forestry at southern edge of lake with cycling and jogging tracks proposed. • Redeveloped three parks with special focus on being child-and elderly-friendly. • 40 Sqm High density living Green Wall installed in the city. • Landscaping work ongoing at New collectorate premises. 	<ul style="list-style-type: none"> • Old diesel public transport vehicles discontinue. • 50 e-rickshaws proposed. • Clean Air Action Plan for the city in place. • 28% of shared mobility in the city run on clean fuels. • 01 Continuous Ambient Air Quality Monitoring Station is installed. • Aim to deviate 40% demand from private to public transport by 2027. Katra pedestrianization pilot with no vehicle zone planned. 	<ul style="list-style-type: none"> • City has 35% non-revenue water and has prepared a plan to reduce it. • 57% of households were connected to water supply as of 2017. Sagar also aims to increase water treatment capacity to 92.4 MLD. • Aim to improve rainwater harvesting and re-use in public buildings. 	<ul style="list-style-type: none"> • 100% of door-to-door waste collection of solid waste. • 350 TPD cluster based integrated waste management facility constructed. • Awareness programs for waste segregation is underway. • Segregation at source initiated on pilot basis in 7 wards. • 30 TPD C&D waste processing & reuse facility.
Areas of improvement	<ul style="list-style-type: none"> • Increase in energy-efficient streetlighting on high priority (currently 0%). • Increase power generation from RE sources (currently 0.07%). • Promote rooftop solar PV installation in all types of buildings and open spaces. • Promote and adopt green buildings. 	<ul style="list-style-type: none"> • City has more than 18% green cover as per the CSCAF 2.0 city performance report. However stronger policy and financial frameworks are needed to further increase green cover. • Taking steps to conserve biodiversity and set up a city level biodiversity committee. • Should institutionalize a disaster management cell and prepare a city disaster management plan. 	<ul style="list-style-type: none"> • Needs to develop a planned citywide public transport system. • Increase coverage of roads with footpaths and cycle tracks (currently 4.93%) • Ensuring last mile connectivity and TOD principles to promote pedestrianization. • Strengthening institutional capacity to implement actions in the clean air action plan. 	<ul style="list-style-type: none"> • Need to assess current water resources and future availability and prepare a demand management plan. • 01 STP is installed in Sagar but not functional. • Need to reuse and recycle wastewater. • Need to prepare a flood risk management plan. • Conduct energy audits for water supply and treatment plants 	<ul style="list-style-type: none"> • Need to increase awareness on source segregation. • Setting up of a bio-methanation plant. • Setting up plastic waste collection centers

ES Figure 2: Sectoral contribution to Sagar's GHG inventory, 2019 (Source: WRI India analysis using primary data)

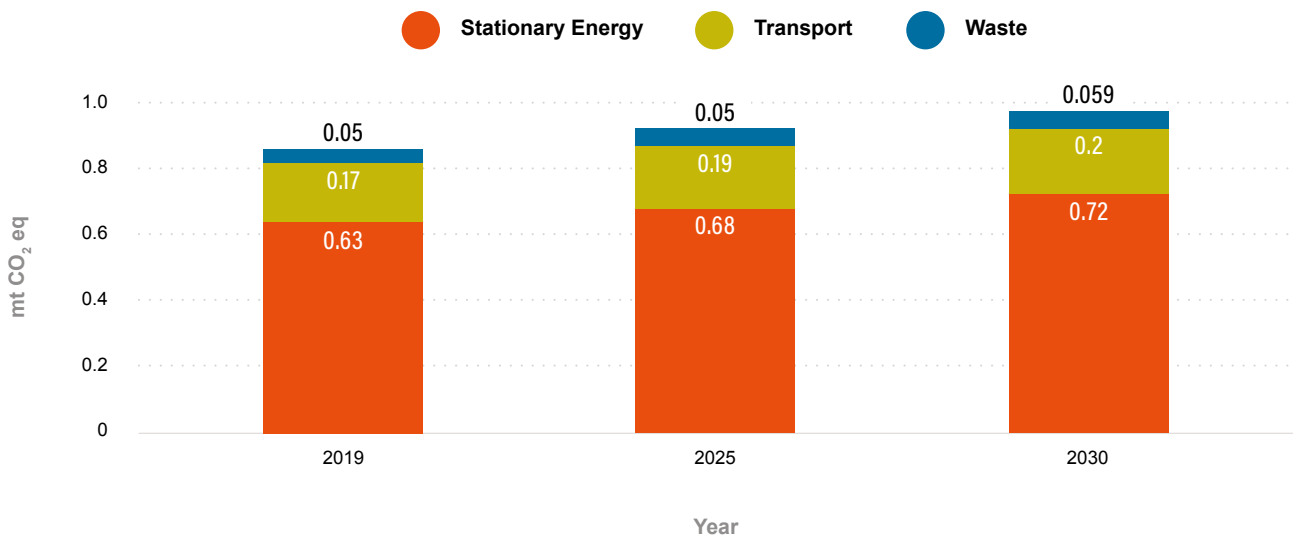


decade till 2030 compared to the baseline emissions of 2019. This creates an urgent need for the city to implement measures presented in the report for achieving its vision of low carbon and climate resilient development.

Vulnerability analysis

Sagar has a humid subtropical climate with hot summers, a cooler monsoon with very heavy rainfall, and cool winters. The analysis of temperature shows that Sagar is likely to witness extreme warm days with high incidences of heat waves leading to human and animal stress, negative impacts on labor productivity and higher stress on resources like energy and water.

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



ES Table 2: Climate change and potential impacts for Sagar

Projected Climate Changes	Potential Impacts and Risks
Warmer conditions, including more intense and frequent high-temperature extremes and heat wave days.	<ul style="list-style-type: none"> Temperature analysis shows a likelihood of extreme warm days with high incidences of heat waves leading to human and animal stress, negative impacts on labor productivity and higher stress on resources like energy and water. Potential increased energy demand for air conditioning.
Higher annual rainfall and more frequent/heavy rainfall events.	<ul style="list-style-type: none"> In terms of water resources, Sagar goes from a moderately vulnerable current baseline to highly vulnerable in mid- and end-century, with a high risk of decreasing availability of water, increasing crop water stresses and increase in frequency of extreme events like floods and droughts.

Strategic Goals and Sectoral Actions

Through these goals and actions, Sagar can become low carbon, climate-resilient, and inclusive in its development.

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

Goals	Actions	Outcomes
Goal 1 Enabling low carbon infrastructure powered by renewables	<ul style="list-style-type: none"> • Piloting solar streetlights in Sagar • Incentivizing installation of rooftop solar panels and solar water heaters in all existing and new residential buildings • Installing solar water heaters and solar photovoltaic panels on rooftops of educational institutions • Integrating low carbon building projects into heritage conservation efforts • Energy efficient retrofits and common solar PV projects for low-income housing under PMAY scheme • Implementing institutional measures to increase the adoption of green buildings in Sagar 	<ul style="list-style-type: none"> • Long-term reduced overall electricity consumption and costs. • Increased job opportunities. • 100% RE source operational educational campuses. • Reduction in emissions from the consumption of grid supplied electricity. • Improved access to energy. • Increased green buildings in the city
Goal 2 Moving towards sustainable transport	<ul style="list-style-type: none"> • Implementing the planned public transport fleet in Sagar • Piloting solar charging for existing and proposed e-rickshaws • Strengthening Non-Motorized Transport (NMT) infrastructure through an NMT cell, policy and street design guideline • Leveraging private sector to promote electric vehicles in the city • Implementing a Public Bicycle Sharing (PBS) system 	<ul style="list-style-type: none"> • Increase in NMT infrastructure • Decrease in air pollution and GHG emissions due to transport. • Increase in low-carbon and non-motorized transport modal share. • Availability of a robust public transport system.
Goal 3 Water-resilient Sagar	<ul style="list-style-type: none"> • Conduct a water resources assessment and implement a demand management plan • Developing and implementing an integrated flood and storm water management plan • Reusing treated water to maintain the city's parks and gardens • Implementing energy efficient water supply and treatment systems 	<ul style="list-style-type: none"> • Increased access to potable water. • Increased flood resistance. • Better sewage management. • Reduced water costs and improved equitable access. • Reduced emissions from water treatment. • Efficient demand management. • Increase in ground water table.
Goal 4 Create inclusive blue and green spaces	<ul style="list-style-type: none"> • Participatory model for maintaining green spaces in Sagar • Revitalizing the Lakha Banjara lake through bioremediation and green infrastructure elements • Disaster management cell and plan for Sagar • Setting up a biodiversity committee and developing Local Biodiversity Strategies and Action Plans (LBSAP) 	<ul style="list-style-type: none"> • Improved water security. • Reduced flood risk. • Improved air quality and climate resilience due to city green cover. • Inclusive access to green and open spaces • Biodiversity conservation
Goal 5 Climate – smart waste management	<ul style="list-style-type: none"> • Steps towards achieving 'Zero-waste communities' in Sagar: learning from best case examples • Installing plastic collection centres and reverse vending machines • Upgrading waste collection and transportation infrastructure to electric vehicles 	<ul style="list-style-type: none"> • Formalisation of informal e-sector. • Create jobs by self-help groups. • Reduced waste-transportation costs. • Improved public awareness

City authorities can select actions and sectoral strategies 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 can be used to guide analysis and prioritize implementation of actions in different sectors. The plan also provides guidance on mainstreaming actions with existing policies, schemes and programmes to establish convergence of implementation.

This plan must be treated as a dynamic document and must be updated regularly with the latest emissions profile. Instituting a climate change cell at city-level — with representation from concerned ULB departments, smart city, citizen forums, academic institutions and civil society — becomes necessary to lead and coordinate this process. Organizing periodic stakeholder consultations will help strengthen the plan as per Sagar's evolving requirement.





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