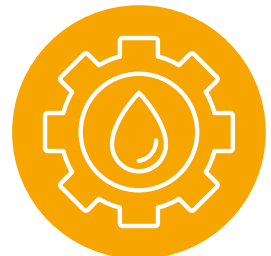
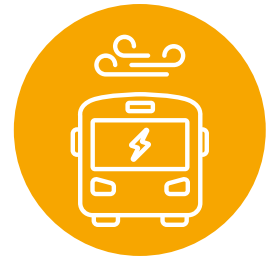




ADVANCING CITY CLIMATE ACTION IN MADHYA PRADESH

Transforming **SATNA** into a low-carbon
and climate-resilient city

Executive Summary



Satna 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 Satna city in developing its Climate Action Plan. The data and information used for preparing this report have been sourced from Satna 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: Satna 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 Satna 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, Satna Municipal Corporation and Chief Executive Officer of Satna 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 Satna 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.

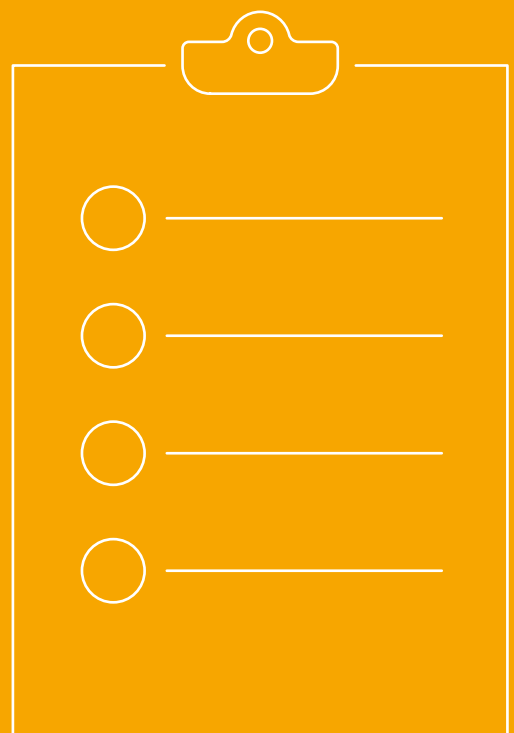
Lastly, we would like to thank the internal reviewers from WRI India including Ms. Marie Duraisami, Ms. Sumedha Malaviya, Mr. Dhilon Subramanian, Ms. Azra Khan, Ms. Chaitanya Kanuri and Ms Sahana Goswami for providing valuable feedback to strengthen the sectoral strategies in the plan.

(Lokendra Thakkar)

Coordinator,
State Knowledge Management
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EXECUTIVE SUMMARY



Satna and its Vulnerability to Climate Change

Satna, “the cement capital of India”, lies in the Baghelkhand region of the Vindhya Mountain ranges, in the state of Madhya Pradesh. It was selected as a smart city in 2017, among the hundred cities to be developed as a smart city under the Smart Cities Mission. Satna has also been recognized as an open defecation free (ODF) city under the Swachh Bharat Mission Urban¹. As a rich reservoir of chemical grade limestone, the city is also known as the “commercial and industrial capital of Baghelkhand”² and contributes to 9% of India’s cement production.

Satna 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 high stress on resources like energy and water. According to the climate change vulnerability assessment of Madhya Pradesh carried out by Environmental Planning and Coordination Organization (EPCO), Satna has a high composite vulnerability, determined by social indicators, economic indicators, water indicators, agriculture indicators and forest indicators, which indicates that Satna is likely to face higher impacts of climate change for different sectors. In terms of water resources, Satna faces high vulnerability, showing a high risk of decreasing availability of water, increasing crop water stresses and increase in frequency of extreme events such as floods and droughts. In terms of climate, the city goes from being highly vulnerable in baseline scenario to very highly vulnerable in mid-century projections, with a very high risk of decrease in average annual rainfall, increase in precipitation intensity and rise in heat index.

Given the challenges that Satna 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 the smart cities in India. 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 resources management and waste management. By taking appropriate measures, cities can make a significant contribution to mitigating climate change and becoming resilient to its impacts.

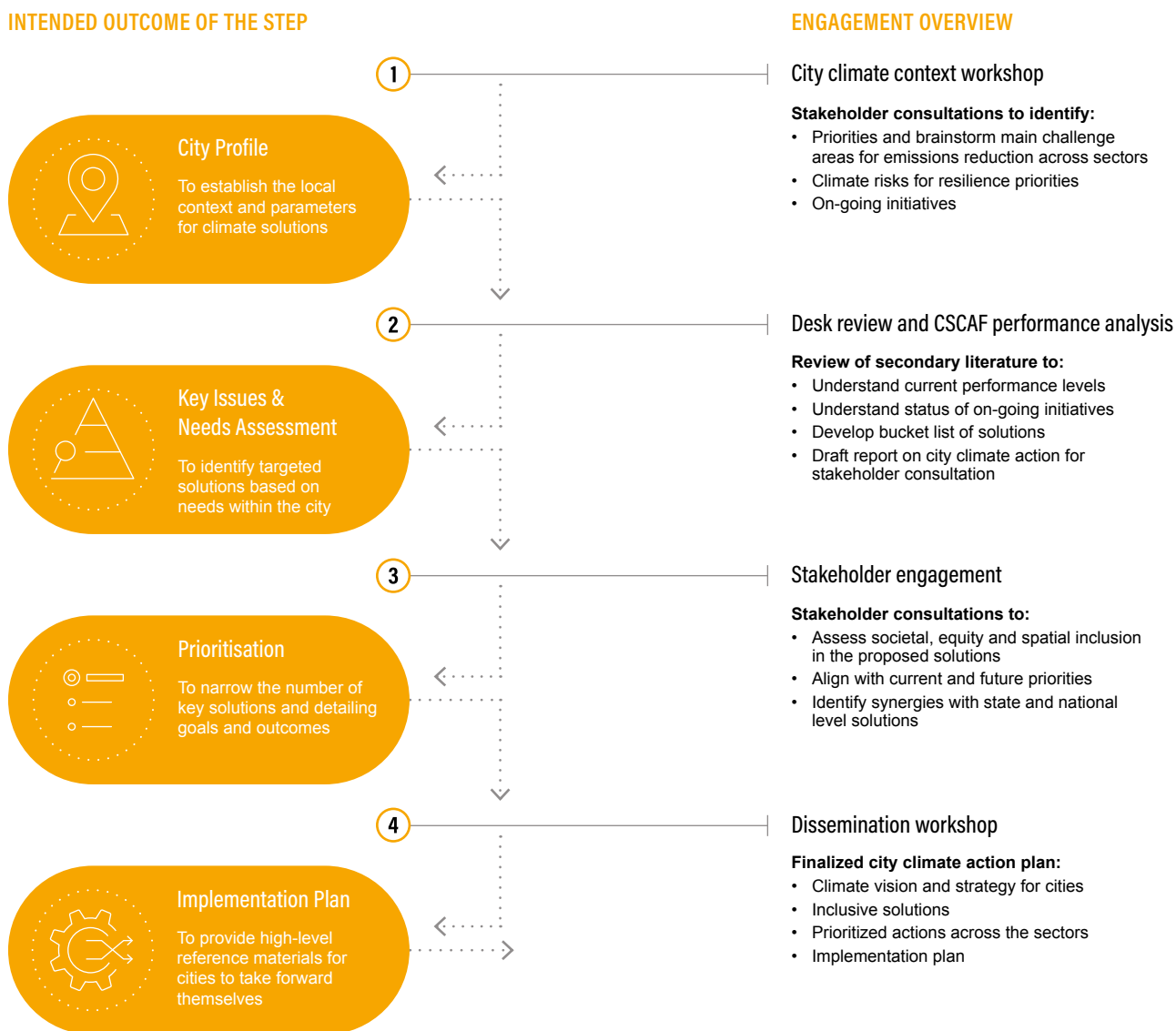
In this context, WRI India is supporting EPCO, Environmental Planning and Coordination Organization, and the Madhya Pradesh State Government Departments of Environment and Urban Development and Housing, as a technical partner, in planning adaptation and mitigation strategies and developing a city-level 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 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 that 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 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 the participants and cities about the importance and relevance of developing these city-level plans 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 Satna city. A thorough review of submissions made by Satna as part of CSCAF 2.0, sectoral plans and government reports and other documents was done to identify key issues and gaps in achieving the sectoral priorities. A detailed climate profile of Satna city has been developed including temperature and rainfall projections and a GHG inventory. 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 to present the preliminary findings and seek inputs on the goals and actions proposed for a low-carbon and climate-resilient development pathway for Satna.
- The final CAP provides prioritized sectoral actions along with an implementation plan and CAP governance mechanism for effective coordination and monitoring of the CAP’s implementation.

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



Baseline Assessment

As highlighted in step 2 of the CAP planning process, a climate profile and baseline assessment 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.

Climate Smart Cities Assessment

Satna has been a moderate performer in the first two rounds under CSCAF 2.0. The city has fared well under the waste management sector. However, the city has performed below average for indicators under other sectors. Some of the current initiatives and possible areas of improvement have been highlighted in the table below.

Greenhouse Gas Emissions Inventory

In 2019, Satna's GHG emissions were 6,57,688 tCO₂e with per capita emissions of 2.0 tCO₂e (including emissions from manufacturing and industrial electricity consumption). Of the total emissions attributed to the three sectors, stationary energy accounts for 67%, transport for 23% and waste accounts for 10% as presented in ES Figure 2.

Under stationary energy sector, majority of the emissions come from electricity and fuel consumption use in manufacturing industries and construction (49%) followed by residential buildings (34%) and commercial and institutional buildings (17%).

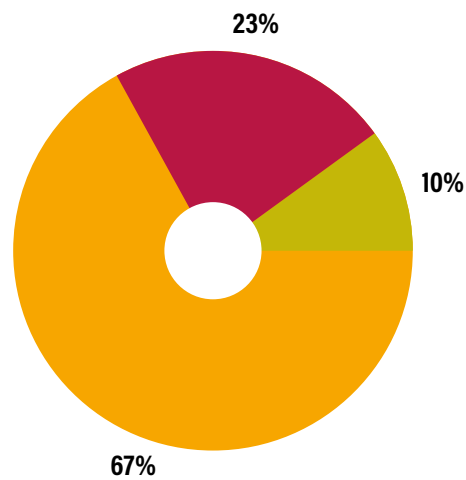
ES Table 1: CSCAF analysis (Source: CSCAF 2.0 data from the city)

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	175	90	124	50	475
Current measures being undertaken in the city	<ul style="list-style-type: none"> Satna has 100% energy efficient LED streetlights. 	<ul style="list-style-type: none"> Ankur program - which rewards citizens for free plantation - has been launched in the state and PMAY has been linked to it. 1.39 % of the municipal area has green cover. Implementing a "Save the seeds" campaign to increase greenery and citizen awareness. The city has a disaster management plan and a disaster management cell. 	<ul style="list-style-type: none"> City has 130 e-rickshaws which constitute 1.69% of total shared vehicles in the city.. 0.03 buses are available per 1,000 population. Satna is monitoring air pollution and publishing daily air quality index levels on the public domain. Completed development of a 5.5 km cycle track in Rewa Road and Nagaud Panna Marg. 	<ul style="list-style-type: none"> <5% of wastewater is recycled. The city has conducted an energy audit for water supply system. The city is also undertaking a project for intelligent water management with SCADA data. 	<ul style="list-style-type: none"> 100% door to door collection of solid waste and segregation of waste at source. The city has a Cluster based Integrated Solid Waste Management (ISWM) facility operated by Satna MSW Energy Solutions Ltd (Ramky) where windrow composting is done.
Areas of improvement	<ul style="list-style-type: none"> Increasing power generation from RE sources in the city. Satna currently does not generate power from renewable sources. Promoting rooftop solar in residential, commercial and government buildings. Increasing the green building adoption and compliance of NBC/ ECBC codes in the city. The city does not have a green building cell and has not implemented any measures to promote green buildings 	<ul style="list-style-type: none"> Increasing green cover within the municipal limits (1.39% currently). Needs to set up a biodiversity committee and identify measures to increase urban biodiversity and allocate resources. Increasing green cover within the municipal limits (1.39% currently). Needs to set up a biodiversity committee and identify measures to increase urban biodiversity and allocate resources. 	<ul style="list-style-type: none"> Non-Motorized Transport (NMT) supported by Non-Motorized Vehicle (NMV)-oriented design of roads and intersections. Increasing the coverage of roads with cycle lanes and footpaths (currently 0.75% of roads are covered). Augmenting the public transport fleet. Increasing the share of clean fuels run vehicles especially buses and taxis. 	<ul style="list-style-type: none"> Increased recycling and reuse of the wastewater Introducing metering policy and installation of smart water meters. City needs to conduct a flood and water stagnation risk assessment. City needs to conduct a water resources assessment to assess status of existing water resources, its uses, along with projected future demand and availability. 	<ul style="list-style-type: none"> Awareness is required for better response of residents along segregation at source. Authorization of waste pickers is to be completed. Setting up a bio methanation plant for managing the wet waste. Strengthening the Extended Producer Responsibility (EPR) of producers. Implementing measures for re-use of construction and demolition waste in building and road construction.

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
				<ul style="list-style-type: none"> City should then develop a water resources management plan with short-, medium- and long-term actions. City needs to conduct an energy audit of its wastewater treatment system. 	<ul style="list-style-type: none"> Reducing greenhouse gas emissions from waste transport by shifting to alternate fuels.

The business-as-usual projected emissions for Satna are presented in ES Figure 3. The emissions are projected to increase by 10.1% by 2025 and 17.7% 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: GHG Emissions Profile for Satna
(Source: WRI India analysis using primary data)

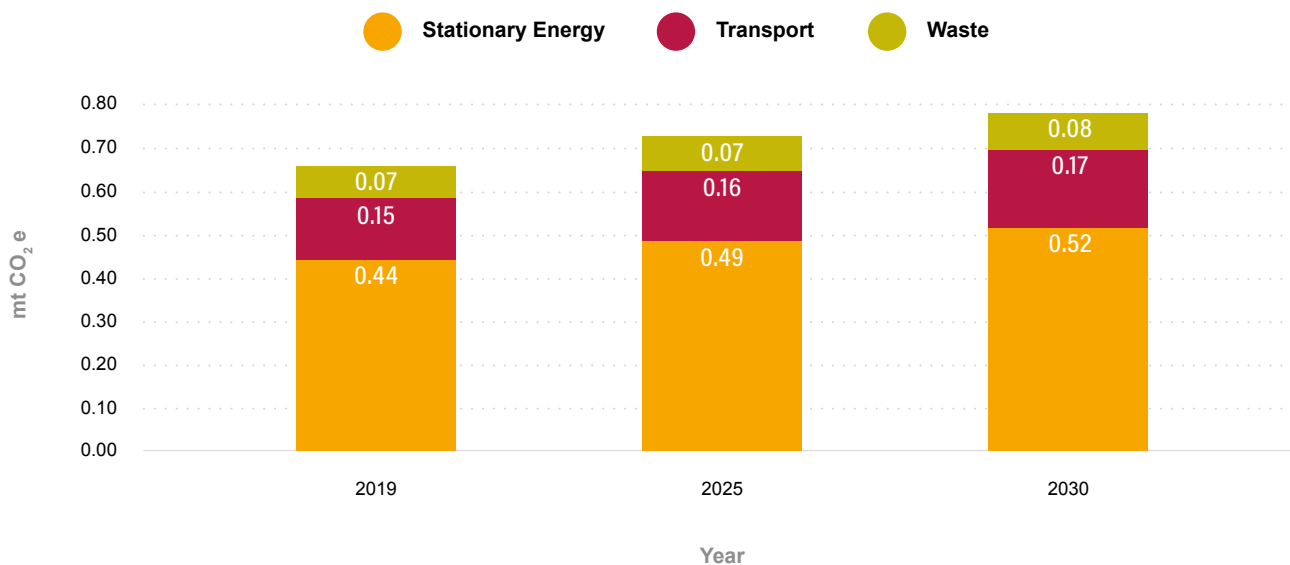


Vulnerability Assessment

The climate projections for Satna show that the annual maximum temperature is likely to increase by 2.1°C in moderate emissions scenario and by 4.4°C in high emissions scenario towards the end of the century. Similarly, annual minimum temperature is likely to increase by 2.5°C in moderate emissions scenario and by 5.2°C in high emissions scenario towards the end of the century. In a moderate emissions scenario, mean annual rainfall is projected to decrease by about 9% by mid-century.

According to the vulnerability assessment analysis done by EPCO, Satna is under high composite vulnerability, which indicates that the city is likely to face higher impacts of climate change in different sectors. In terms of water resources, Satna faces high vulnerability, showing a high risk of decrease in availability of water, increase in crop water stresses and increase in frequency of extreme events like floods and droughts. In terms of climate, the city goes from high vulnerability in baseline scenario to very high vulnerability in mid-century projections, with a very high risk of decrease in average annual rainfall, increase in intensity of precipitation and rise in heat index.

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



Goals and Sectoral Strategies

The table below summarizes the goals and actions which the city may adopt to develop into a low-carbon and

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

ES Table 2: Summary of goals and actions for Satna (Source: WRI India)

Goals	Actions	Outcomes
Goal 1 Satna's transition to a clean energy economy & climate resilient infrastructure	<ul style="list-style-type: none"> • Incentivize installation of rooftop solar panels and solar water heaters in all new residential constructions • Piloting zero-carbon building components in upcoming municipal development projects • Piloting solar-powered streetlighting in the city • Implementing institutional measures to increase adoption of green buildings in the city • Promotion of green and cool roofs in residential projects/ colonies/apartments to reduce cooling demand. • Piloting solar bus stops • Upgrading to solar-powered sewage treatment plants 	<ul style="list-style-type: none"> • Long term reduced overall electricity consumption and costs. • Improved air quality • Increased job opportunities • 100% RE-powered public educational campuses • PPP engagement for efficient RE distribution • Reduction in emissions from the consumption of grid supplied electricity. • Improved access to clean energy for low-income households and affordable housing units • Improved health benefits • Better market for RE technologies
Goal 2 Low-carbon transport in Satna	<ul style="list-style-type: none"> • Conduct a water resources assessment and implement a demand management plan • Capacity building for smart water governance • Implementing an integrated flood and storm water management plan incorporating nature-based solutions • Initiatives to promote wastewater recycle and reuse in Satna 	<ul style="list-style-type: none"> • Increased flood resistance • Better sewage management • Reduced water costs and improved equitable access • Reduced emissions from energy consumption for water treatment • Better demand management • Increased usage of recycled and treated wastewater, reduction in demand for fresh water – lesser stress on existing water sources • Increase in groundwater table

Goals	Actions	Outcomes
Goal 3 Water-resilient Satna	<ul style="list-style-type: none"> Conduct a water resources assessment and implement a demand management plan Capacity building for smart water governance Implementing an integrated flood and storm water management plan incorporating nature-based solutions Initiatives to promote wastewater recycle and reuse in Satna 	<ul style="list-style-type: none"> Increased flood resistance Better sewage management Reduced water costs and improved equitable access Reduced emissions from energy consumption for water treatment Better demand management Increased usage of recycled and treated wastewater, reduction in demand for fresh water – lesser stress on existing water sources Increase in groundwater table
Goal 4 Satna as the sustainable cement capital	<ul style="list-style-type: none"> Develop a low-carbon roadmap for Satna's cement industries. Business models to use alternative fuels and raw materials (AFR) in cement production. Promoting use of fly ash in all new constructions, cement roads and flyover embankments 	<ul style="list-style-type: none"> Economic growth and job creation Reduction in emissions from cement industry – especially due to electricity usage Decoupling growth from cement sector emissions Improved air quality
Goal 5 Rejuvenate green & blue spaces in Satna	<ul style="list-style-type: none"> Engaging citizens in the conservation and management of the green and blue spaces in the city Developing local biodiversity strategies and action plans for Satna (LBSAP) Implementing green walls and terrace gardens 	<ul style="list-style-type: none"> Improved air quality and climate resilience due to green cover in the city Will help the city achieve higher progress under water management and urban green cover indicators within the CSCAF Foster citizen engagement in management of green and blue spaces in the city
Goal 6 Towards a climate-smart & circular waste economy in Satna	<ul style="list-style-type: none"> Increasing collection of e-waste in the city by including the marginalized/ informal sector Upgrading waste collection and transportation infrastructure to electric vehicles Planning for efficient recycling of construction and demolition waste 	<ul style="list-style-type: none"> Economic growth and job creation Reduction in emissions from cement industry – especially due to electricity usage Decoupling growth from cement sector emissions Improved air quality

The city's 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 of concerning ULB departments, 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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