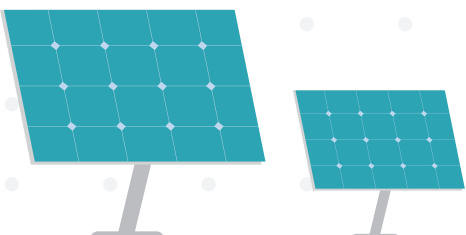
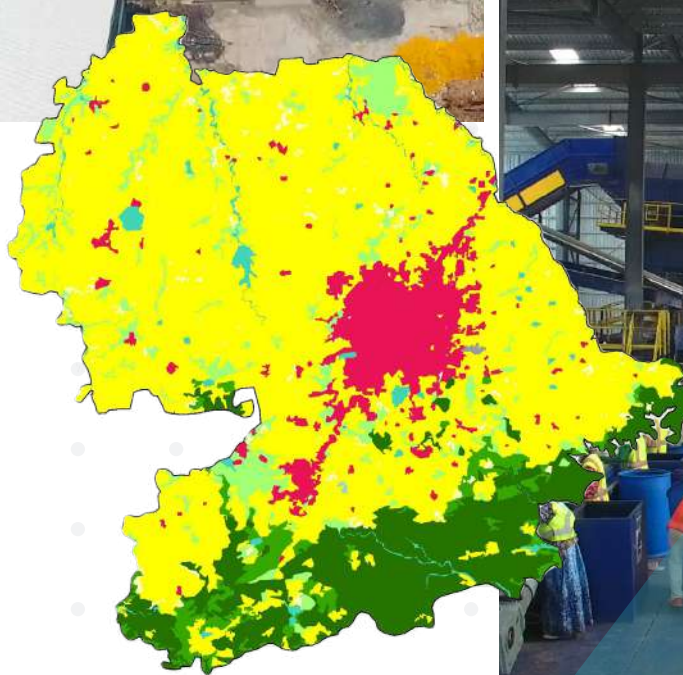




Climate Change and Environment Action Plan of Indore District

Executive summary



Prepared By



In Association with



SKMCCC, EPCO, Department of Environment Government of Madhya Pradesh

Supported By



The Climate Change and Environment Action Plans (CCEAP) have been developed for multiple districts of India by Vasudha Foundation with support from Shakti Sustainable Energy Foundation. For Indore, the plan was developed in collaboration with the State Knowledge Management Centre on Climate Change (SKMCCC), Environmental Planning & Coordination Organisation (EPCO), Department of Housing and Environment, Government of Madhya Pradesh.

The CCEAP aims to complement the State Action Plan on Climate Change (SAPCC) version 2.0 as prescribed by the Ministry of Environment, Forest and Climate Change (MoEF&CC) and align it to India's latest climate change commitments to the United Nations Framework Convention on Climate Change (UNFCCC). The rationale behind this action plan is to follow a bottom-up approach to climate-proof development priorities for the district.

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Indore, Madhya Pradesh

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Cover page images

Top left image:

Bio-methanation facility at Chhoitram Mandi, Indore

Bottom right:

Material recovery facility, Indore (both sourced from Smart City Indore website)

Land use map of Indore district:

Created using data from Landsat 8, secondary data from NRSC/ISRO Bhuvan portal, Google Earth and ORNL-DAAC

 Dense forest	 Mixed forest	 Shrubland	 Cropland	 Fallow Land	 Built-up Land
 Barren Land	 Grassland	 Wasteland	 Waterbodies		



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FOREWORD



D.O. Letter No.

Aniruddhe Mukerjee (I.A.S.)
Principal Secretary

Foreword

The recently concluded 26th convention of the UNFCCC at Glasgow has brought forth the need for tangible actions on emissions. India has made ambitious commitments at CoP26. As the second largest Indian state, with a population of more than 8 million, Madhya Pradesh's efforts in combating climate change would be of significant importance in the national context. The state currently has the largest area under forest cover, and is home to one of the largest solar power projects in India, with a 750 MW solar power plant at Rewa. The state has also been taking initiatives to tackle climate change as highlighted in its State Action Plan for Climate Change (SAPCC).

While national and state level initiatives lead the movement to address climate change, it is important to equip the districts and guide communities for the same at the local level. In this light, I would like to congratulate the State Knowledge Management Centre on Climate Change, Environmental Planning & Coordination Organisation and Vasudha Foundation, New Delhi for formulating this in-depth Action Plan for Indore district. I appreciate that a detailed study was undertaken in consultation with various stakeholders to develop the Climate Change Action Plan of Indore district. I am thankful to Shakti Sustainable Energy Foundation for supporting its preparation.

The action plan is a comprehensive assessment of the sectoral greenhouse gas emissions, current and future climate change scenarios, and climate change drivers in the district. Based on the assessment, the plan identifies various local level interventions, which are in line with the SAPCC, other state and national-level programmes, to tackle climate change at the district level in a sustainable manner.

I would encourage the district administration to adopt this Action Plan and take initiatives for its implementation on the ground.


(Aniruddhe Mukerjee)

PREFACE

Shriman Shukla, IAS
Executive Director
EPCO



Preface

District Climate Action Plan (DCAP) for Indore district has been developed by State Knowledge Management Centre on Climate Change, EPCO in collaboration with Vasudha Foundation, New Delhi with the support of Shakti Sustainable Energy Foundation to assess the transition in terms of both climate & policy, to address the key issues related to climate change in the district.

The Indore DCAP includes district-level baseline studies on climate variability and projections, an emissions profile, a budgetary analysis to estimate climate finance, and analysis of state and national level policies and programmes active in the district. It also incorporates a comprehensive set of recommendations, in alignment with Sustainable Development Goals (SDGs), for various climate-related sectors and environmental issues of Indore district, as well as case studies and estimates of mitigation potential.

I applaud the extensive efforts made towards developing this comprehensive DCAP for Indore district. I am proud to state that the Government of Madhya Pradesh is committed to long-term development. As a result, adopting a district plan that incorporates climate action is a key first step towards attaining state and national climate targets. I am certain that this action plan will serve as a roadmap for district-level planning efforts to integrate climate action and development.

I would like to thank my colleagues at State Knowledge Management Centre on Climate Change, Indore District Administration, Vasudha Foundation & Shakti Sustainable Energy Foundation, and appreciate the efforts of all for undertaking this study for Indore district.

(Shriman Shukla)

ACKNOWLEDGEMENTS

We would like to thank Shriman Shukla, IAS (ED, EPCO), Tanvi Sundriyal, IAS (previous ED, EPCO), Jitendra Singh Raje, IAS (previous ED, EPCO), Lokendra Thakkar (General Manager & Coordinator, EPCO), Prateek Barapatre and other team members from Environmental Planning and Coordination Organisation (EPCO), Government of Madhya Pradesh as their inputs and support have been vital in the development of the Climate Change and Environment Action Plan for Indore district.

We also extend our thanks to Manish Singh, IAS (Collector, Indore) for his inputs and appreciation of the CCEAP for Indore district.

We express our appreciation to V. Subramanian, IAS (Retd.) (former Secretary, MNRE, GoI), for sharing pearls of wisdom during the course of this research.

We extend our gratitude towards Aditi Garg, IAS (CEO, Smart Cities Indore) and her team as their suggestions and inputs have helped shape the action plan for Indore district.

We are grateful to Dr. Ashwini Kulkarni and from IITM, Pune and Dr. Koteswar Rao Kundeti for developing the district climate profile and modelling climate change projections for the district.

We would also like to extend our thanks to participants from various academic institutions, CSOs and line departments who contributed to the development and refinement of CCEAP through their inputs during stakeholder consultations.

We are also grateful to Swati Prasad for proofreading and giving the finishing touches to the manuscript, the team at Aspire Design, New Delhi for designing the final report.

We are thankful to our colleagues from the GIS team and Energy team at Vasudha Foundation for providing their expertise to assist the research and development of the final action plan.

Last but not the least, we extend our gratitude to Shakti Sustainable Energy Foundation (SSEF), New Delhi, for supporting the endeavour and also to Shubhashis Dey and Aishwarya KS from SSEF.

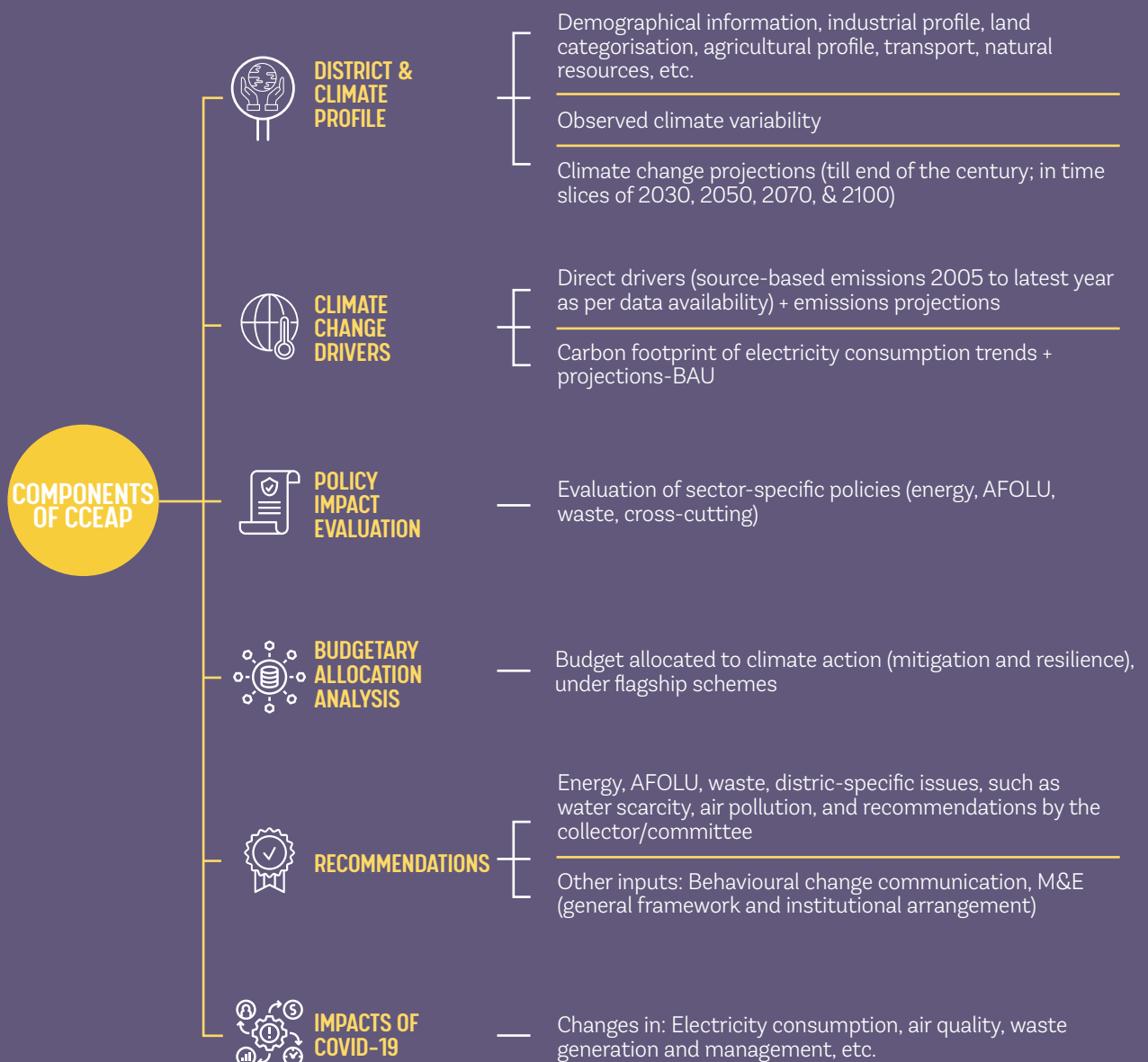
EXECUTIVE SUMMARY

This Climate Change and Environment Action Plan studies the past, present and the future of the district of Indore from both the climate and policy perspective to know where the district stands in terms of meeting India's climate commitments. Based on the findings, it evolves concrete recommendations and the way forward for the district collector and other in-line departments.

The ongoing COVID-19 pandemic, which began with a strict national lockdown, made it abundantly evident that anthropogenic activities have a far-reaching impact on the environment. On the flip side though, climate action has received a setback. A number of mitigation and adaptation-centric sectors have experienced unforeseen shifts. For instance, an overburdened health infrastructure has not been able to accommodate climate-related health issues. Considerable job losses have further diminished the adaptive capacities of the poor and vulnerable. Moreover, there has been a substantial spike in waste sector emissions with the rise in disposals of single use plastic and covid-related waste incineration.

This action plan, therefore, takes a holistic view of the current policies and recommends steps that need to be taken in the short-, medium- and long-term to bring about the necessary changes that are in compliance with India's overall climate goals and commitments.

The key components of this action plan are summarised in the following chart:



CLIMATE PROFILE AND PROJECTIONS

In this section, the historical data and projected changes in rainfall and temperature for Indore district were analysed using IMD and NASA's NEX-GDDP datasets following the multi-modal mean (MMM) approach.

- **Warm days have increased by 9 percent:** The maximum temperatures have shown a significantly increasing trend during summer, with the peak reaching up to 44°C in May. Mean monthly maximum temperature ranges from 35°C to 41°C during the season. The mean percentages of warm days have increased by 9 percent. The maximum temperatures may rise by 1°C to 2.5°C under RCP4.5 and 1.5°C to 4.5°C under RCP8.5. The percentage of warm days are projected to increase in the future by more than 70 percent of the current situation.
- **Cold days are decreasing:** Winter temperatures are also increasing and the number of cold days is showing a decreasing trend. The minimum temperatures project an increasing trend and cold days may decrease drastically in all the epochs under changing climatic conditions.
- **Rainy days are projected to increase:** The monsoon rainfall does not show any significant trend. The mean monsoon seasonal rainfall in the district is around 810 mm. The number of rainy days varies from 9 to 14 in the monsoon months. The variability in rainy days is higher and shows a slight decreasing trend in monsoon months during the period of 1951 to 2018. There may be an increase in precipitation of 7 to 21 percent under RCP4.5 and 16 to 42 percent under RCP8.5 emission scenarios compared to historical data between near-term (2030s) and end-century (2090s). The number of rainy days is projected to increase during the monsoon season.

SECTORAL GREENHOUSE GAS EMISSIONS PROFILE: CLIMATE CHANGE DRIVERS

- **Greenhouse gas have increased nearly three-folds:** Between 2005 and 2019, the total greenhouse gas (GHG) emissions of Indore district increased by 291 percent (from 0.65 million tonnes CO₂e in 2005 to 2.54 million tonnes CO₂e in 2019) with a CAGR of 10.23 percent. These estimates represent GHG emissions from 12 categories covering three major sectors – energy; agriculture, forestry and other land use (AFOLU); and waste.
- **Energy sector is the highest contributor of emissions:** Energy sector (direct fuel combustion in transport, agriculture, residential categories etc.) is the highest contributor of total economy-wide emissions. Although energy emissions of Indore district increased with a CAGR of 5.12 percent, its share has decreased from 88 percent in 2005 to 73 percent in 2019 due to increase in AFOLU emissions. There are no emissions from the industrial product use and processes (IPPU) sector because Indore district does not have any large-scale industries that fall under the IPPU industries as per the IPCC guidelines. However, the energy used in industries and the corresponding emissions are reported in the energy sector.
- **From a net sink in 2011, AFOLU sector is now witnessing high GHG emissions:** Until 2011, AFOLU was a net sink. Emissions from AFOLU peaked in 2015 and then started declining.
- **Share of waste sector emissions has dropped:** Waste sector emissions have grown at a CAGR of 4.52 percent. However, its contribution to total emissions has dropped from 12 percent (in 2005) to 9 percent (in 2019).

ASSESSMENT OF POLICIES THROUGH THE LENS OF CLIMATE CHANGE

Several major national/state level policies and programmes of energy, AFOLU and waste sector were evaluated for their climate mitigation potential.

- **Power and energy:** For this sector 12 policies/programmes were evaluated (UDAY/IPDS/R-APDRP scheme and BRTS are the biggest contributors to GHG emissions mitigation)
 - ◀ Policies related to clean energy generation mitigated 24,326 tCO₂e emissions, annually.
 - ◀ Policies pertaining to energy-efficient buildings and processes helped to avoid 27,73,714 tCO₂e.
 - ◀ Transportation interventions have led to an emission avoidance of 4,04,000 tCO₂e.
- **AFOLU and cross-cutting:** Ten policies were assessed.
 - ◀ Forestry policies alone led to a mitigation of 59,502 tCO₂e.¹
 - ◀ Policies pertaining to livestock proved to be beneficial for climate action by avoiding 5,859 tCO₂e.
 - ◀ GHG impact of agricultural policies could not be computed due to lack of availability of required information/data.

¹ Data for Gair Vanbhoomi Par Vriksharopan of Indore was not available.

- ◀ The crosscutting sector: The National Mission on Micro Irrigation resulted in avoiding 1,407 tonnes of CO₂e emissions (from reduction in use of urea and reduction in energy consumption). The Pradhan Mantri Ujjwala Yojana has helped mitigate 9,39,397 tonnes of CO₂e (scenario 1) and 82,562 tonnes of CO₂e. (scenario 2).
- **Waste:** Sixteen policies were assessed.
 - ◀ Policies pertaining to sanitation added 1,13,009 tCO₂e emissions
 - ◀ Composting as a part of solid waste management practices has mitigated 126,628 tCO₂e.
 - ◀ Domestic wastewater treatment interventions have led to 78,405 tCO₂e. emissions.

BUDGETARY ANALYSIS TO ESTIMATE EXPENDITURE ON CLIMATE ACTION

This section analyses the district expenditure to estimate spending on climate action. However, the district budget for Indore was not available and the following flagship schemes were analysed for the same. A total of 39 flagship schemes were reviewed to identify those with climate resilience and mitigation relevance. Of these, based on availability of information across districts as well as relevance to climate actions, five schemes were selected for further analysis.

Table 1: Summary of flagship schemes budgetary analysis for Indore district

Scheme selected	Climate relevant activities	Year	Total allocation to district under scheme (₹ lakh)	Allocation to climate action (₹ Lakh)	% of total scheme budget for climate action at district level*
MGNREGS	Eleven out of 17 activities identified as climate relevant – drought proofing, fisheries, flood control and protection, land development, micro-irrigation, renovation of traditional water bodies, rural connectivity, drinking water, sanitation, water conservation and water harvesting	2018-19	3,952.64	742.64	19
		2019-20	3,834.24	1,612.20	42
PMKSY	Micro-irrigation activities	2016-17	6900	47.61	69
		2019-20	56000	386.40	
GIM	Enhancing forest cover, ecosystem restoration, agro-forestry, social forestry, wetland restoration, promoting alternative fuels	2018-19	5.37	5.37	100
		2019-20	3067	3067	
AMRUT	Water supply, sewage and septage management, urban transport, drainage, green spaces	2015-16	246.71	129.36	54.5
		2016-17	305.53	160.82	
		2017-20	365.25	191.51	
DDUGJY + Saubhagya	New and upgradation of substations, LT lines, feeder segregation, consumer metering, DTR metering etc	Up to April 2020	9,131.00	4,565.00	50

*Percentage has been attributed by using Climate Public Expenditure and Institutional Review (CPEIR) methodology of UNDP

RECOMMENDATIONS

The action plan provides comprehensive, sector-wise recommendations from a climate perspective. The aim is to align the district with India's climate commitments through this Climate Change and Environment Action Plan (CCEAP).

The recommendations factor-in state/district vision documents and development plans. They also list the current policies, programmes and schemes and identify concerned departments that can help streamline the actions. This section also provides information on SDGs and other co-benefits that will be addressed through these recommendations.

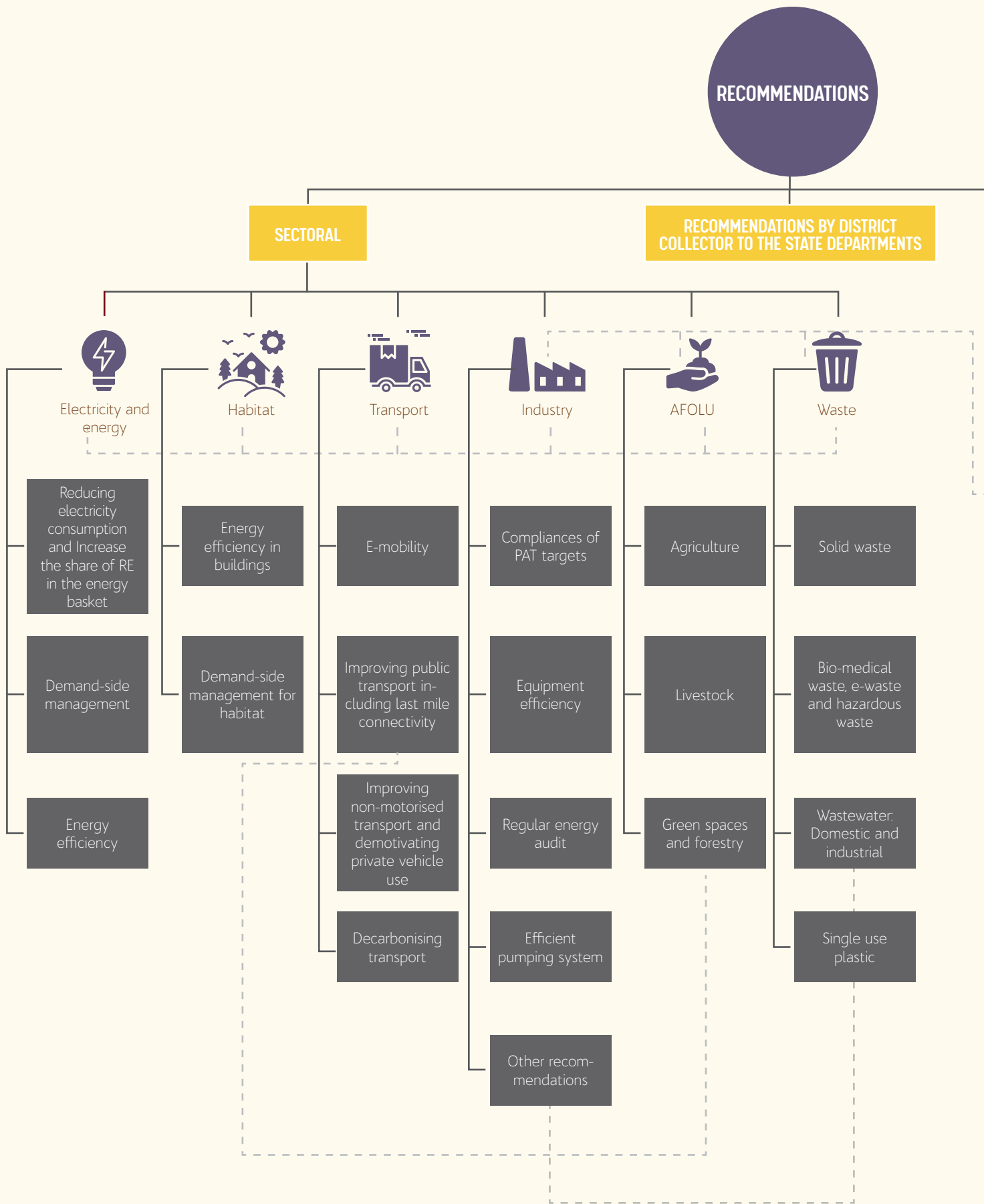


Figure 1 Recommendations for CCEAP Indore

DISTRICT ENVIRONMENTAL ISSUES



Water scarcity & water pollution



Air pollution

PROMOTING VOLUNTARY ACTIONS



Lighting



Transport



Housing



Kitchen



Daily use appliance



Waste management



Other recommendations

BEHAVIOURAL CHANGE COMMUNICATION



Grassroots-communicators as energy ambassadors



Ward/village level Urja Samiti



IEC products



Reward residential societies on environmental performance



Issue specific campaigns using all forms of media



Encourage lifestyle changes

----- : Interlinkages across sectors and sub-sectors (cross-cutting aspects)

Overall, the mitigation actions suggested in the recommendations can help mitigate 6.45 Mt CO₂e per annum. The sectoral breakdown of the same is as following:

GHG mitigation potential of CCEAP recommendations (tCO₂e)

 **Energy**
51,23,069

 **AFOLU**
12,31,468

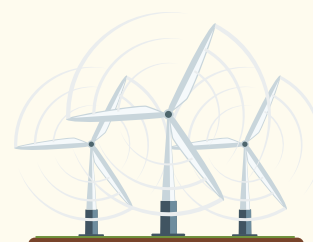
 **Waste**
99,613

Here are some in-brief, sector-wise recommendations:

Power and energy

Though the energy sector is crucial to achieving India's growth ambitions, it is also responsible for around 70 percent of the country's annual GHG emissions. This calls for a paradigm shift in the energy sector.

Therefore, the action plan recommends (a) increasing the share of RE generation in the district by advancing on-grid and off-grid solar rooftop, ground-mounted installations and other RE installations; (b) encouraging faster penetration of energy-efficient and star-labelled fixtures and upgrading existing power-grid infrastructure to advanced metering infrastructure (in public, institutional and commercial setups); (c) promoting energy efficiency in the residential sector by encouraging the incorporation of ECBC in the building bye-laws, implementation of India Cooling Action Plan, 2018, etc.; and (d) promoting energy conservation in the industrial sector by introducing measures such as a "cap and trade" system for MSMEs at the district level.



Transport

Being one of the fastest growing sectors in India, transport contributes 12 percent of India's total GHG emissions. The action plan recommends (a) promoting e-mobility through awareness, increase of e-vehicles' modal share, transition of public transport (PT) and intermediate public transport (IPT) to electric-powered or hybrid vehicles, developing widespread charging infrastructure, incentivising e-vehicle owners, etc.; (b) ensuring last-mile connectivity and promoting increased use of PT and IPT; (c) augmenting non-motorised transport through dedicated cycle lanes; and (d) improving traffic flow.



AFOLU

For agriculture, forestry and other land use (AFOLU) sector, it's important to promote climate-conscious practices that do not have an adverse impact on the ecosystem, biodiversity and natural resource dependent communities. Our recommendations include: (a) promoting the use of organic fertilisers, solar pumps and practices such as micro-irrigation and alternative ways to manage crop-residue under agriculture; (b) having a good mix of high-yield cross-breed cattle and indigenous cattle, and encouraging the use of good quality fodder to bring down enteric fermentation emissions; and (c) maintaining the forest area and the tree cover of the Indore district through strict M&E, afforestation in fallow and wasteland, use of alternative funding like CSR, adoption of Miyawaki urban forestry and study on suitability of plantation sites/species, etc. The action plan also recommends involvement of regional agriculture universities to initiate research on high yielding, drought- and temperature-resilient genotypes for various crops, among other measures.



Waste

With the waste sector being one of the biggest contributor of methane emissions globally, major recommendations revolve around reducing landfill disposal of waste and managing wastewater to reduce GHG emissions from them through measures such as: (a) reducing waste at source; (b) proper segregation, collection and channelisation of different categories of waste (including bio-medical waste and e-waste) for recycling and treatment; (c) 100 percent conversion of organic waste to compost and gas management of composting units; (d) recycling, recovery and reuse of 100 percent inert waste (plastic, construction waste, etc); and (e) setting up of centralised aerobic wastewater treatment plants with closed sewer networks and sludge removal facility.



Given the unique environmental issues of the district, the action plan also recommends:

1. Adopting a holistic approach to water conservation and wastewater management, including conservation techniques such as rainwater harvesting, net zero water infrastructure, minimising losses in water supply, installing water-efficient fittings, water metering and adoption of inclusive and sustainable water governance.
2. Developing extensive infrastructure to monitor air pollution and suggestions on interventions for preventive measures.

COVID-19 IMPACT

This section presents an assessment of how the COVID-19 pandemic has impacted various sectors and the developmental measures. During the national lockdown in 2020, the total energy demand in India went down considerably. However, in Madhya Pradesh, power demand went up by 6.4 percent due to increase in consumption by the agricultural sector.

The pandemic has only underscored the need to increase focus on renewable energy and strengthen its integration into the grid. Indore district needs to increase implementation of RE generation through solar rooftops, biogas, solar pumps for agriculture and water supply.

Overall, the pandemic resulted in significant reduction in air pollution due to reduced transport and industrial activities during the lockdown and unlock periods. However, the most impacted sector was waste management with single-use plastic waste and bio-medical waste from both households and healthcare sector increasing manifold, leading to increased incineration, landfilling and single-use product consumption.





Shakti Sustainable Energy Foundation (SSEF) seeks to facilitate India's transition to a sustainable energy future by aiding the design and implementation of policies in the following sectors: clean power, energy efficiency, sustainable urban transport, climate policy and clean energy finance.



Vasudha Foundation is a not for profit organization set up in April 2010 with the belief in conservation of Vasudha, which in Sanskrit means the Earth, the giver of wealth and with the objective of promoting sustainable consumption of its bounties.

The core mission is to promote environment -friendly, socially just and sustainable models of energy by focusing on renewable energy and energy efficient technologies and lifestyle solutions. Climate change mitigation is one of the key verticals of the organization. The focus is to bring about reduction in greenhouse gas emissions in the environment and ensure energy efficiency, energy security, energy independence, and sustainable development as well as simultaneously, promoting the concept of "Low Carbon Solutions" and "Green Economies".



SKMCCC, EPCO, Department of Environment
Government of Madhya Pradesh

The Environmental Planning & Coordination Organisation (EPCO), state's premier organisation in the field of environmental matters, was established by the Housing and Environment Department of the Government of Madhya Pradesh in 1981 and is presently under the Urban Development and Environment Department of the Government of Madhya Pradesh. It works closely with the State Government, despite having established its own identity as an autonomous organisation.



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