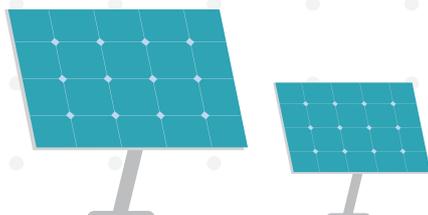


Climate Change
and Environment
Action Plan of
Bhopal District
Recommendations



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 Bhopal, 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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January, 2022

Bhopal, Madhya Pradesh

The material in this report is based on data points and information that we believe to be reliable and adequately comprehensive. However, we do not guarantee that such information is in all respects accurate or complete. Vasudha Foundation does not accept any liability for any losses resulting from the use of this report.

Cover page images

Top left image:

Rice cultivation in Bhopal (sourced from freepik website)

Bottom right:

Waste to energy plant, Bhopal (sourced from Swachh Bhopal webpage).

Land use map of Bhopal 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

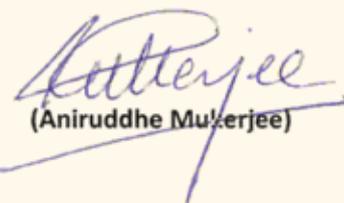
Foreword

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 Bhopal district. I appreciate that a detailed study was undertaken in consultation with various stakeholders to develop the Climate Change Action Plan of Bhopal 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 Bhopal 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 Bhopal 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 Bhopal district, as well as case studies and estimates of mitigation potential.

I applaud the extensive efforts made towards developing this comprehensive DCAP for Bhopal 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, Bhopal District Administration, Vasudha Foundation & Shakti Sustainable Energy Foundation, and appreciate the efforts of all for undertaking this study for Bhopal 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 Bhopal district.

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

We are grateful to Dr. Ashwini Kulkarni 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.



RECOMMENDATIONS



Electric bicycle sharing spot in Bhopal

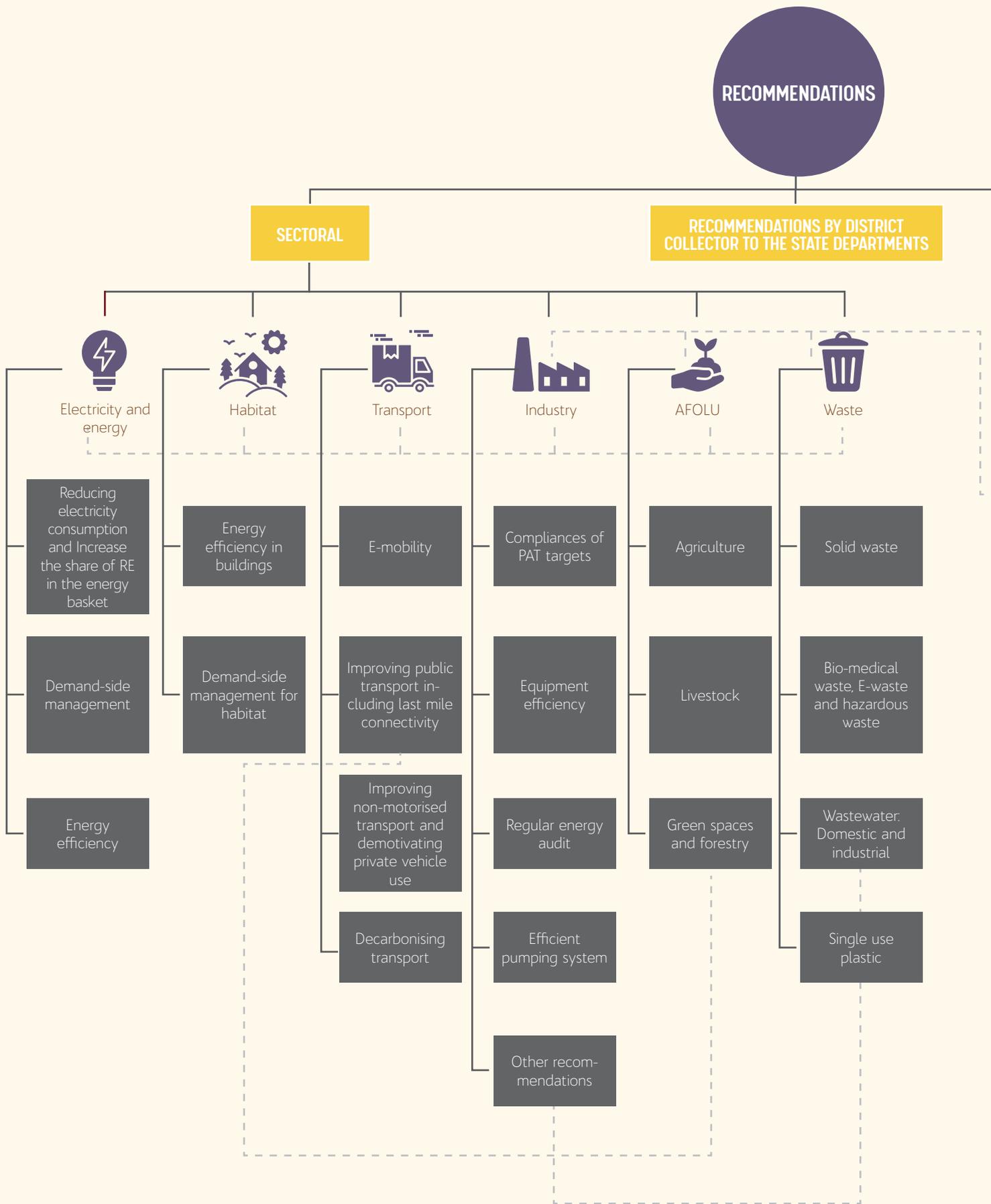


Figure 1 Recommendations for CCEAP Bhopal

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)

RECOMMENDATIONS

This section provides a comprehensive basket of sector-wise recommendations from a climate perspective, with an aim to complement India's 2030 NDC commitments through a district-level alignment in the form of this District Climate Change and Environment Plan. The salient features of these recommendations are as follows:

- Recommendations are grouped under four broad categories – energy, agriculture, forestry and other land use (AFOLU), waste, and district-specific environmental issues.
- Actions under each category on which recommendations can be made by the district collector/committee to the relevant state departments as well as inputs on innovative financing have been identified.
- These are based on district specific ground realities and situations.
- The state and district vision documents were factored in while developing the recommendations.
- Information provided on timeframe and framework for implementation would enable the district authorities and concerned departments to prioritise actions.
- List of existing policies, programmes and schemes that can help streamline the actions is provided along with the concerned primary and supporting departments in separate table following each sectoral recommendation matrix.
- Additionally, this section provides information on SDGs and other co-benefits that can be addressed through the mentioned recommendations in this action plan.
- Further, the cross-sectoral benefits of each recommendation have been identified and indicated using the icons as listed in the following table:

| | | | |
|---|--------------------------------------|---|---|
|  | Energy and electricity |  | Green space, forestry and allied activities and bio-diversity |
|  | Habitat (residential) |  | Water resources and water conservation |
|  | Commercial and public infrastructure |  | Solid waste |
|  | Transport |  | Wastewater |
|  | Industry |  | Air pollution |
|  | Agriculture and allied activities |  | Awareness, communication and capacity building |

6.1. Sector-specific recommendations

6.1.1. Electricity and energy: Recommendations, cross-cutting sectors, qualifying priority and district scenario

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|--|--|--|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Increasing RE share in the electricity generation basket | | | | |
| <p>Increase the share of renewable energy (RE) generation by advancing rooftop and ground mounted installations, and other RE installations.</p> |   | <p>Short to medium-term (govt buildings)</p> <p>Medium-term (commercial buildings)</p> <p>Medium to long-term (residential and others)</p> | <p>Policy framework and RE targets exist (See section 6.1.1.1)</p> <p>Need to create awareness</p> | <p>India has a target of 40 GW for solar rooftop (2022). As of February 28, 2021, only 4.32GW has been achieved.</p> <p>Madhya Pradesh has only 76.91 MW solar rooftop capacity.</p> <p>Case example calculation:</p> <ol style="list-style-type: none"> If equipped with solar rooftops, just the government schools in the district can generate 95.81 MUs electricity, thereby avoiding 0.08 MtCO₂e annually. If the commercial/institutional buildings are also factored in, solar rooftop potential for such buildings would be 1,209 MW, which would help mitigate 1.2MtCO₂e annually. Further, if 50% households in the district are equipped with solar rooftops, total installed capacity will be 1,772 MW, which can help avoid 1.86 Mt CO₂e annually. <p>Adoption of solar energy can be accelerated by making it mandatory for hospitality industry/new construction (having a built-up area greater than 20,000 sq ft) / private healthcare infrastructure (above a certain bed-capacity) to have solar rooftops.</p> <p>Ground mounted solar: The current installed capacity of ground mounted solar in Madhya Pradesh stands at 2.38GW (as of February 2021).</p> <p>Bhopal district has a huge potential for solar power generation (rooftop and ground mounted). In Bhopal city, solar rooftop installation can be promoted. For the remaining district, ground-mounted solar installations can be a more viable option.</p> |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|---|---|--|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Aggressively promote battery storage for RE |    | Short to medium-term | Additional financial support can be created | Case example: Maharashtra Energy Development Agency has installed 650 Ah batteries for a few solar projects and has proposed hybrid inverters for RE projects across Maharashtra. Hybrid inverters take power from battery/RE installation up to a particular load, and on increased demand, they switch to the grid supply. Similar initiatives can be taken up in the district. |
| Encourage captive use of renewable energy, particularly in rural areas for small industries and local entrepreneurs. |   | Short to medium-term | <p>Policy framework exists</p> <p>Need to create awareness</p> | <p>By 2030, electricity demand is expected to be approximately 5,000 MUs, annually. If this demand is entirely met from coal, around 4.3 MtCO₂e would be caused, annually.</p> <p>Decentralised renewable energy (DRE) setups can power small/cottage industries, which in turn can play an important role in providing livelihoods in rural areas as well as support reverse-migration (that was recently witnessed during the COVID-19 pandemic). Such setups would also create new jobs, and empower rural entrepreneurs.</p> <p>The cold storage network across the district can be powered through DRE. Such set-ups can be especially useful for reliable storage of vaccines, farm produce, and rural non-farm productive use appliances.</p> |
| Energy demand side management (DSM) and energy efficiency | | | | |
| Encourage faster penetration of Street Lighting National Programme (SLNP). This would ensure that all street and public lighting fixtures are replaced with energy-efficient LED bulbs, prioritising premises and recreational areas of all government / public institutions. |  | Short-term | Policy framework and schemes exist | <p>Smart streetlighting can reduce electricity use by up to 80%. Around 320 million streetlighting poles are in use globally, but fewer than 3% of these are Smart enabled. SLNP had a national target of replacing 1.34 crore conventional street lamps with LED lamps by March 2020. But till date only 1.18 crore LED lamps have been installed.¹</p> <p>In Bhopal district, under the SLNP, if 36,222 existing conventional lamps are replaced by LED lamps, about 19,077 tCO₂e can be avoided, annually.</p> |

1 International Energy Agency. 2021. Empowering Cities for a Net Zero Future: Unlocking resilient, smart, sustainable urban energy systems. Available at <https://iea.blob.core.windows.net/assets/4d5c939d-9c37-490b-bb53-2c0d23f2cf3d/G20EmpoweringCitiesforaNetZeroFuture.pdf>

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|--|---|---|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| <p>Expedite installation of smart meters in collaboration with MPPMCL (Madhya Pradesh Power Management Company Limited) in an effort to develop advanced metering infrastructure (AMI).</p> <p>Installing smart meters, along with its associated IT infrastructure would allow the DISCOM to obtain real time energy consumption data of each consumer for subsequent analysis and will pave the way for initiating various smart measures like</p> <p>(a) Time of day (TOD)/Time of use (TOU) billing, (b) Prediction and management of peak demand, (c) Providing real time energy consumption data to consumer, (d) Prepaid billing facility, (e) Remote connection and disconnection of load, (f) Development and adoption of a differential pricing model to demotivate energy consumption during peak hour, etc.</p> |    | Short to medium-term | <p>Policy framework and targets exist (section 6.1.1.1)</p> <p>Create awareness for consumer segment</p> | <p>Implemented by EESL (BEE), Smart Meter National Programme aims to replace 25 crore conventional metres across the country with smart meters.</p> <p>MPMKVVCL is planning to install around 3.7 lakh smart meters across Bhopal, covering around 80% of the city. If implemented, this would be a major step towards smartening of the grid, and reducing carbon footprint of the district.</p> |
| <p>Replace/upgrade existing inefficient pumping infrastructure with energy efficient pumps/solar pumps for supply of piped drinking water in both rural and urban pockets of Bhopal district.</p> |   | Short to medium-term | <p>Relevant schemes and programmes can help achieve this (section 6.1.1.1)</p> <p>Inter-departmental collaboration required</p> | <p>MPUVNL has been designated as the nodal agency for the Municipal Energy Efficiency Programme(MEEP) in Madhya Pradesh. This programme aims to save 120 MW through energy-efficiency project in 134 ULBs, which will result in avoidance of fresh generation capacity.</p> |
| <p>In agriculture, promote energy-efficient water pumps (provided by EESL), and solar pumps (through PM-KUSUM and SKY)</p> |   | Short to medium-term | <p>Policy framework exists (section 6.1.1.1)</p> | <p>According to BEE, 30-40% energy savings is possible in agriculture by adoption of energy-efficient star-labelled pump sets.</p> <p>If 50% of tube-wells in the district are converted to solar, 0.133 MtCO₂e emissions can be saved annually.</p> |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|---|---|---|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| <p>Increase community awareness on and access to energy-efficient appliances and fixtures.</p> <p>Provide additional incentives (over and above existing schemes) on energy-efficient appliances.</p> <p>(Other recommendations pertaining to energy efficiency are listed under sections: Habitat, Industry and other recommendations that can be made by the Collector's office to the state departments)</p> |  | Medium term | <p>Additional financial support could be created</p> <p>Create awareness through dedicated IEC and long running campaigns</p> | <p>BSES Yamuna Power Ltd (BYPL) launched an AC replacement scheme in Delhi NCR with the objective of promoting energy efficiency among households. Under the programme, upfront rebate per air conditioner (BEE 5-star rated/ inverter) was offered by BYPL to the consumer in exchange of their old non-star rated air conditioner.</p> <p>MPMKVVCL can implement a similar scheme in its area of supply, with a pilot in Bhopal district.</p> |

6.1.1.1 Electricity and energy: Policy framework and concerned departments/agencies

| Sub-sectors | Policies and programmes ² that can push forward the recommendation | Primary departments/agencies | Supporting departments/agencies |
|---|--|--|---|
| Increase RE share in the electricity generation basket | <ol style="list-style-type: none"> 1) MP Solar Policy, 2012 2) MP Policy for Decentralised Renewable Energy Systems, 2016 3) Waste to Energy Policy, 2016 4) National Solar Mission 5) SMART Project 6) PM KUSUM | <ol style="list-style-type: none"> 1) MPUVNL, GoMP 2) Energy Department, GoMP | <ol style="list-style-type: none"> 1) ALL ULBs 2) Madhya Pradesh Electricity Regulatory Commission (MPERC) 3) Rural Development Department, GoMP (reporting and monitoring) 4) Urban Development and Housing Department, GoMP 5) State Knowledge Management Centre on Climate Change (SKMCC) - EPCO 6) Department of Cottage and Rural Industries, GoMP 7) MPPMCL-MPMKVVCL, GoMP 8) Department of Agriculture, GoMP 9) Proposed District level Committee on Climate Change and Environment |
| Energy demand-side management (DSM) and energy efficiency | <ol style="list-style-type: none"> 1) Smart Meter National Programme (SMNP) 2) National Smart Grid Mission 3) Streetlight National Programme (SLNP), 2015 4) UJALA Scheme, 2015 5) Standards and Labelling Programme 6) Sustainable Habitat Mission 7) Smart Cities Mission 8) National Mission for Enhanced Energy Efficiency 9) Municipal Energy Efficiency Programme (MEEP) 10) PM KUSUM 11) MP Solar Policy, 2012 12) MP Policy for Decentralised Renewable Energy Systems, 2016 | <ol style="list-style-type: none"> 1) BEE (EESL) 2) MPUVNL, GoMP 3) All ULBs 4) Panchayati Raj Institutions (PRIs) 5) Energy Department, GoMP | <ol style="list-style-type: none"> 1) State Knowledge Management Centre on Climate Change (SKMCC)- EPCO 2) Department of Agriculture, GoMP 3) Urban Development and Housing Department, GoMP 4) Bhopal Smart City Development Corporation Limited (BSDCL) 5) Proposed District level Committee on Climate Change and Environment |

² This column enlists information on policies, programmes, rules, schemes and other regulatory provisions pertaining to the sector

6.1.2. Habitat (urban and rural development): Recommendations, cross-cutting sectors, qualifying priority and district scenario

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|---|---|---|--|
| | | Timeframe for the action to be accomplished | Framework for Implementation | |
| Energy efficiency in buildings | | | | |
| <p>Energy Conservation Building Code (ECBC) to be incorporated in the building by-laws for all ULBs, as a pathway to buildings having net zero energy consumption.</p> |  | <p>Medium to long-term</p> | <p>Policy framework exists (section 6.1.2.1)</p> <p>Inter-departmental collaboration required</p> <p>Capital incentives/ relevant exemptions over and above the existing provisions from the district administration required</p> | <p>Residential and commercial sectors in Bhopal make up for around 17% of the total electricity consumed in the district.</p> <p>MPUVNL is working to incorporate ECBC into building compliance systems in MP.</p> <p>For example: By 2025, if 23% of the existing residential area becomes ECBC compliant, 2.07 MtCO₂e can be avoided.</p> |
| <p>District administration, in collaboration with the ULBs, can implement the India Cooling Action Plan (ICAP) and achieve its objectives.</p> <p>District administration can also explore the possibilities of piloting solar-passive architecture/ other renewable energy technologies in a few of its iconic buildings.</p> <p>Implementing this at the district level could help avoid significant GHG emissions.</p> |  | <p>Medium-term</p> | <p>Policy framework exists (section 6.1.2.1)</p> <p>Needs inter-departmental collaboration</p> <p>Capital incentives/ relevant exemptions from the district administration required.</p> | <p>In September 2018, India became the first country in the world to have a Cooling Action Plan, which seeks to:</p> <ol style="list-style-type: none"> Reduce cooling demand across sectors by 20% to 25% by 2037-38 Reduce refrigerant demand by 25% to 30% by 2037-38 Reduce cooling energy requirements by 25% to 40% by 2037-38 Recognise "cooling and related areas" as a thrust area of research under national S&T Programme Training and certification of 1,00,000 servicing sector technicians by 2022-23, synergizing with Skill India Mission. <p>The plan aims to provide the following benefits (i) Thermal comfort for all – provision for cooling EWS and LIG housing, (ii) Sustainable cooling – low GHG emissions related to cooling, (iii) Doubling farmers' income – better cold chain infrastructure (iv) Skilled workforce for better livelihoods and environmental protection, (v) Make in India – domestic manufacturing of air-conditioning and related cooling equipment, and other benefits.</p> <p>The district cooling system in the Gujarat International Finance Tec-City (GiFT City) in Gandhinagar provides reliable cooling to residential, commercial and industrial buildings. The system, regulated by advanced metering and supervisory control and data acquisition (SCADA) systems, is expected to consume only 60% to 85% of the energy used in conventional air conditioning.</p> |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|--|---|---|
| | | Timeframe for the action to be accomplished | Framework for Implementation | |
| <p>Replace diesel powered backup in a phased manner with solar-powered or other RE-powered backup. This can essentially be promoted in government / commercial / institutional buildings with built-up area >20,000 sq ft.</p> |  | <p>Short to medium term (government buildings)</p> <p>Medium to long-term (privately owned, commercial, institutional, and others)</p> | <p>Policy intervention is required</p> <p>Proper policy backup can mitigate GHG emissions and align India with Paris targets</p> <p>Needs inter-departmental collaboration</p> | <p>A DG set of 200kW, (used in industries/ huge commercial buildings) operating at full-load consumes approximately 45 litres of diesel/hour. This results in around 117 KgCO₂e/hour.</p> <p>Replacing DG sets with solar-powered backup could help avoid these emissions.</p> |
| <p>Upgrade public transport infrastructure to include RE and ECBC compliance. Roadside hoardings near such infrastructure can also be powered through RE.</p> |   | <p>Short to medium-term</p> | <p>Can be pushed forward by aligning with existing policy framework for solar rooftop (section 6.1.2.1)</p> <p>ECBC compliance of public transport infrastructure to be mandated by building bye-laws</p> | <p>Bhopal district can adopt and implement initiatives, similar to the one in Lucknow, where the municipal corporation has said it would set up 200 solar-powered bus stops.</p> |
| <p>Promoting formulation of energy communities in existing RWAs/other residential committees where residents have ownership over their energy supply. Energy communities can host wind and solar generation installations, or a self-sufficient system functioning as a microgrid/ undergrid-minigrid.</p> <p>These committees can make agreements between the community, the private developer and the utility company. Digitalisation can create innovative billing mechanisms and generate data that will provide important investment information to the energy market.</p> <p>Deploying public funding schemes like feed-in tariffs, leverage national and international funds, and providing digital upskilling opportunities to citizens can help promoting the initiative.</p> |  | <p>Medium-term</p> | <p>Can be pushed forward by aligning with existing policy framework</p> | |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|---|---|---|---|
| | | Timeframe for the action to be accomplished | Framework for Implementation | |
| Encourage fast penetration of UJALA scheme in every household of Bhopal district. |  | Short to medium-term | Schemes and programmes are available (section 6.1.2.1) | The UJALA scheme provides an LED bulb at a nominal price for replacement of incandescent lamps /conventional bulbs. By 2030, the UJALA scheme can potentially avoid emissions of 0.20 MtCO ₂ e annually. |
| Energy-efficient vertical urban development should be promoted (instead of horizontal development) to conserve green cover. |   | Short-term and continuous | Needs collaborations and awareness | |
| Energy-efficient vertical urban development should be promoted to conserve green cover. |    | Medium to long-term | Policy intervention required | Vertical urban growth not only facilitates settlement of more people per sq m, but also contributes towards the environment. It averts the loss of agricultural land and makes the transport system much more efficient. India has high-rise buildings in Mumbai, Delhi NCR and Bengaluru. Other cities like Kolkata, Chennai, Hyderabad and Ahmedabad are also catching up. |
| Demand-side management for habitat | | | | |
| Promote and subsidise good practices for all ULBs, such as installing rainwater harvesting setups in buildings that can considerably reduce energy dependence on submersible motors for groundwater pumping. |    | Short-term | Schemes and programmes exist (section 6.1.2.1) Need to raise awareness | The government of Madhya Pradesh is planning to make rainwater harvesting (RWH) a part of permission-related clauses for multi-storey buildings, thereby making it mandatory. The government aims to follow the Indore model in RWH setups. Indore Municipal Corporation (IMC) has mandated RWH in all new buildings in Indore, with an area of 250 sq m or more. Moreover, a rebate of 6% on property tax is provided as an incentive to install RWH system. Bhopal district can follow a similar model. |
| Implement individual water metering in residential sector to reduce water wastage, and introduce other energy efficient measures for drinking water and wastewater plants thereby bringing down the energy consumption. |    | Medium-term | Policy intervention is required Need to create awareness | In many cities, drinking water and wastewater plants are municipally owned and are among the largest municipal energy consumers, often accounting for 30% to 40% of total municipal energy consumption. By incorporating energy efficiency measures into their water and wastewater plants, municipalities can save 15% to 30% of their municipal budgets. Sixteen apartments in Mantri Residency, Bengaluru, installed with water meters, are consuming 25% to 30% less water every year. |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|--|---|--|--|
| | | Timeframe for the action to be accomplished | Framework for Implementation | |
| Encourage residential societies to adopt solar-thermal water heaters. |   | Short-term and continuous | Schemes and programmes exist (section 6.1.2.1) Inter-departmental collaboration required Scheme to be implemented as a part of green buildings | Multi-storey (up to 12 storeys) residential buildings can meet around 70% of the annual electricity requirement for water heating (BEE) through community solar water heating systems on the roof (assuming utilisation of 60% of roof area) |
| Promote installation of automatic/smart water pumps to control overflowing of tanks. |  | Short term | Need to create awareness | |
| Water cess/pricing by Municipal Corporation to be revised and gradually increased. | | Medium term | Policy framework to be revised | |
| Digital tools, such as GIS, remote sensing can be used to identify opportunities to reduce energy demand and implement energy efficiency interventions where it holds most value, and identify where and how to set up mixed-use zones to flatten demand curves. Energy demands (for cooling) of the district can be mapped, combining weather data with demand data, to identify where efficiency interventions are needed. |   | Medium to long-term | Needs policy intervention and infrastructural development. | By identifying optimal locations for water features or vegetation, Bhopal can counteract on heat islands through tree plantations that provide shade and reduce the power demand for cooling in buildings. |

6.1.2.1 Habitat: Policy framework and concerned departments/agencies

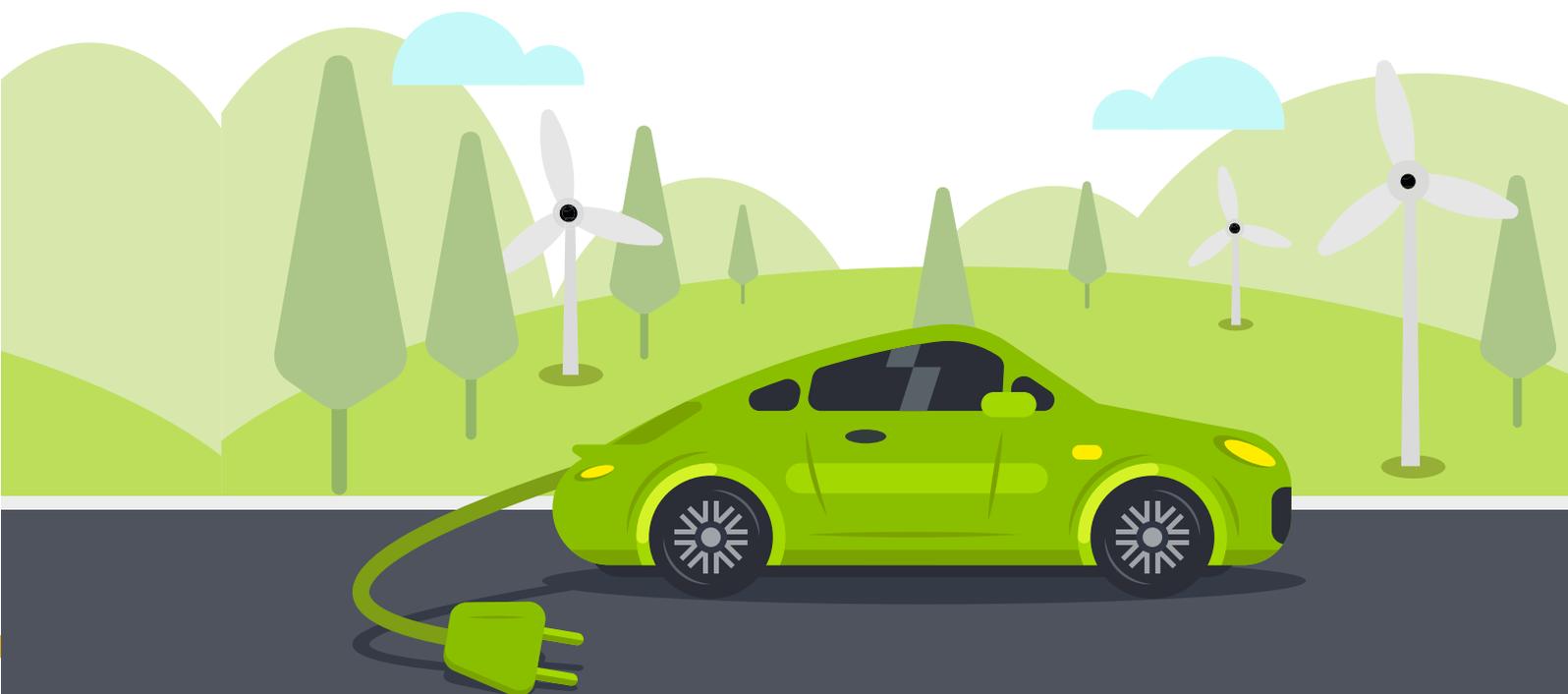
| Sub-sectors | Policies and programmes that can push forward the recommendation | Primary departments/agencies | Supporting departments/agencies |
|--------------------------------|---|--|---|
| Energy efficiency in buildings | <ol style="list-style-type: none"> 1) ECBC 2017 2) India Cooling Action Plan, 2018 3) UJALA Scheme, 2015 4) MP Solar Power Policy, 2012 5) MP Policy for Decentralised Renewable Energy Systems, 2016 6) Smart Cities Mission 7) Sustainable Habitat Mission | <ol style="list-style-type: none"> 1) Urban Development and Housing Department, GoMP 2) All ULBs 3) Bhopal Smart City Development Corporation (BSDCL). 4) Panchayati Raj Institutions (PRIs) | <ol style="list-style-type: none"> 1) MPUVNL, GoMP 2) State Knowledge Management Centre on Climate Change (SKMCC)- EPCO 3) BEE (EESL) 4) Rural Development Department, GoMP 5) MP Road Development Corporation Limited (MPDCL) 6) MP Transport Department 7) Proposed district-level committee on climate change and environment |

| Sub-sectors | Policies and programmes that can push forward the recommendation | Primary departments/agencies | Supporting departments/agencies |
|------------------------|--|--|---|
| Demand-side management | 1) MP Jal Viniyaman Adhinyam, 2013 2) ECBC 3) Building bye-laws 4) Comprehensive General Development Control Regulations- Urban Development and Housing Development | 1) Urban Development Housing Department, GoMP 2) All ULBs 3) Rural Development Department 4) Panchayati Raj Institutions (PRIs) | 1) MP Jal Nigam. 2) Bhopal Smart City Development Corporation Limited (BSDCL) 3) MPPCB 4) Proposed district-level committee on climate change and environment 5) State Knowledge Management Centre on Climate Change (SKMCC) - EPCO |

6.1.3 Transport: Recommendations, cross-cutting sectors, qualifying priority and district scenario

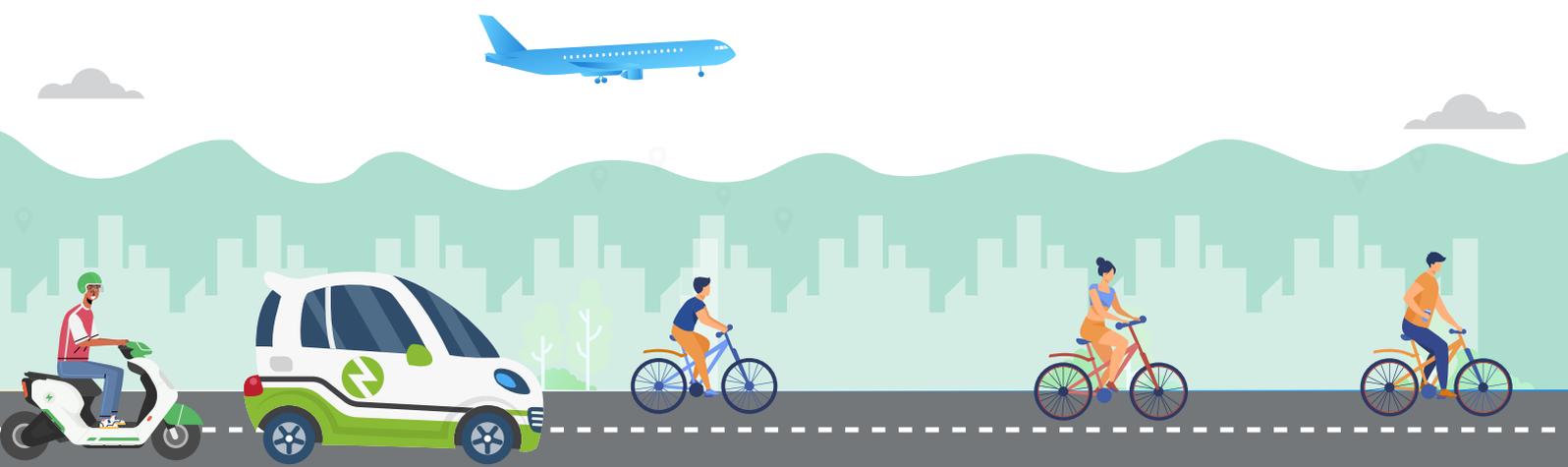
| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|---|--|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Promote e-mobility | | | | |
| Generate awareness and information dissipation to encourage adoption of electric vehicles. |  | Short-term and continuous | Inter-departmental collaboration and dedicated long-running campaigns required | Madhya Pradesh EV Policy, 2019 plans to declare Bhopal as model electric mobility (EM) city. Planned awareness campaigns can encourage widespread acceptance of EVs in the district. |
| Increase the modal share of e-vehicles to achieve the target of National Electric Mobility Mission Plan (NEMMP) and FAME II. |  | Short-term and continuous | Policy framework exists (section 6.1.3.1) and budgetary provisions can be made available through various schemes | In January 2021, Bhopal Smart City Development Corporation Limited announced it will be installing 100 electric vehicle charging stations through an MoU with EESL. The MP Electric Vehicle Policy, 2019 aims to increase the modal share of electric vehicles in major cities of Madhya Pradesh through introduction of electric buses, two wheelers, three-wheelers and cars in the cities. |
| Make all public transport (PT) modes low carbon intensive, such as shifting current fossil fuel-based vehicles to electric powered or hybrid vehicles. |  | Medium to long-term | Policy framework (section 6.1.3.1) and budgetary provisions exist | In November 2019, NTPC announced plans to procure and operate 250 electric buses for three cities in MP – Jabalpur, Bhopal, and Indore. Around the same time, Bhopal Municipal Corporation also announced its plans to operate 100 electric buses on the city roads. The MP EV Policy, 2019 aims to achieve 25% new EV registration in public transport by 2026. It also targets 100% conversion of current public transport bus fleet into electric buses by 2028. Further, the policy also states that electric buses procured in the first five years will be charged 1% motor tax and will be exempted from vehicle registration fees. |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|--|---|---|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| <p>Similarly, initiate transition of intermediate public transport (IPT) vehicles to electric by incentivising IPT operators through:</p> <p>a) subsidies b) separate lanes c) dedicated parking spaces d) replacement of lead acid battery-powered electric IPT vehicles with more sustainable Li-ion battery e-vehicles in a phased manner.</p> |     | Medium-term | Policy framework exists (section 6.1.3.1) | <p>MP is providing subsidies for electric auto-rickshaws and other IPT vehicles as per FAME II.</p> <p>The MP EV Policy states that for the first five years of the policy, e-rickshaws and e-autos will be charged only 1% motor tax and vehicle registration fee will be exempt. Further, these vehicles will also not be charged parking fee at ULB-run parking facilities for the first five years.</p> <p>Converting Vikram auto (popular large auto in Bhopal) alone to electric auto will save 7 tonnes of CO₂e/auto/day, while a scenario in which passengers of Vikram auto shift to electric bus will save 20 tonnes of CO₂e/bus/day.</p> <p>In addition to the above, the district can provide dedicated parking spaces, plan for separate lanes for electric IPT vehicles.</p> |
| <p>District administration, ULBs (for office use and solid waste transport activities) and all district level government offices can adopt e-vehicle fleets. Additionally, all these offices need to install charging infrastructure at the earliest.</p> |    | Short to medium-term | Policy framework exists (section 6.1.3.1) | <p>The MP EV Policy 2019 has recommended all government office buildings to install charging infrastructure. Being the administrative capital, Bhopal can lead by example, taking advantage of this provision and build on the same to encourage government departments to transition their fleets to EV-based vehicles.</p> |



| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|--|---|---|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| <p>Develop robust and widespread charging infrastructure:</p> <p>a) Charging infrastructure to be at strategic locations – commercial hubs, public parking, airports and railway stations etc., preferably RE powered.</p> <p>b) Adoption of relevant policies.</p> <p>c) Prioritise land acquisition for setting up charging infrastructure.</p> <p>d) Dedicated parking spaces for EV rickshaws should be introduced with charging facilities.</p> <p>e) Restaurants and commercial spaces in highways can be incentivised to install charging infrastructure for e-vehicles to make long journeys with e-vehicles hassle-free.</p> <p>f) As a cost effective solution to reduce street clutter and to open access (particularly for those without garages), integrated EV charging points into lampposts can be evaluated on a trial basis to ascertain further implementation possibilities.</p> |    | Medium-term | <p>Policy framework exists (section 6.1.3.1)</p> <p>Inter-departmental collaboration required</p> | <p>Energy Efficiency Services Limited (EESL) and Bhopal Municipal Corporation (BMC) have partnered to establish infrastructure for electric vehicles (EVs) in Bhopal city.</p> <p>District authorities can promote EV charging infrastructure installation at key locations, such as local markets and recreational areas near lakes where they can collaborate with/incentivise business owners to set up charging points.</p> |
| <p>The district administration, in collaboration with the ULBs and state officials, may explore options to provide incentives to e-vehicle owners over and above existing programmes through:</p> <p>a) exemptions on road tax,</p> <p>b) exclusive parking for e-vehicles,</p> <p>c) additional subsidy schemes for women and students,</p> |   | Short-term | Policy framework towards holistic integration of EVs needs to be enhanced | The MP EV Policy, 2019 has a target of increasing the modal share of EV and has suggested means to promote EVs. Bhopal can lead by example by easing transition to EV through additional incentives as suggested. |
| Promote fast registration of EVs at RTOs. |  | Short-term | Existing policy framework can be enhanced | MP EV Policy, 2019 has provisions to incentivise adoption of EVs including exemption of vehicle registration charges. |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|---|---|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Encourage development of local network of rental e-vehicles across the district including cars and bikes as well as a battery rental network, for faster adoption of EVs. Further, this can be integrated with smart cards. |  | Medium-term | Needs policy backing | The successful rental model of Yulu bikes in Bengaluru can be emulated to develop hour-based electric bike rentals for key routes. These bikes can be a part of an integrated ticketing system that utilise smart cards for payments. |
| Encourage and promote adoption of EVs for all delivery operations within the district. |  | Short to medium-term | Policy framework is required | Currently, most delivery partners for food, courier, and other services rely on self-owned fossil fuel-based two or four-wheelers. In some cities, certain companies are working towards developing an EV fleet. The district can recommend a transition to EVs for such delivery persons. |
| Range anxiety is a key barrier to EV adoption. Mobile applications (local app, google map, etc) with real-time data availability of charging points and the cost of charging at various locations will be critical to ensure the popularity of EV by allowing the EV users to plan routes that have charging points. |  | Medium to long-term | Needs support for digitalisation | |
| Smart lampposts can radically improve electrical efficiency and enable a number of new services, like being equipped with PV modules to harvest and store solar energy during the day to power lighting at night. They could also be equipped with sensors and communication technologies that can adjust their output according to ambient light levels, monitor traffic, noise and air pollution, seismic activity and increase coverage of cellular and Wi-Fi networks. |    | Medium to long-term | Needs technological, infrastructural and policy interventions | |



| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|--|---|--|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Public transport (PT) and intermediate public transport (IPT) | | | | |
| <p>Increase reliability, accessibility and enhance last mile connectivity of public transport (PT) and intermediate public transport (IPT) through:</p> <p>a) Integrated ticketing and smart cards that works across all transport modes (IPT, cycle hire, etc),</p> <p>b) Integrating smart mobility applications with real-time service updates across modes, including car hire, public transit and shared micromobility schemes,</p> <p>c) Increasing fleet strength,</p> <p>d) Increasing frequency,</p> <p>e) Adding more stops,</p> <p>f) Enhancing reach to low/non-serviced areas, peri-urban and rural areas</p> <p>g) Developing dedicated parking spaces for IPT.</p> |     | Medium to long-term | <p>Existing policy framework can be enhanced</p> <p>Interdepartmental collaboration required</p> | <p>Bhopal has multiple public transport services including city bus service by Bhopal City Link Limited (BCLL), star bus and red bus along with the BRTS called MyBus.</p> <p>BRTS: Route length 22 km, 1 route, fleet strength 50 buses, ridership 40,453 (2019)</p> <p>City bus: 11 routes, fleet strength 150 buses, ridership 95,369 (2019)</p> <p>The option of smart card for MyBus payments is available. However, it hasn't been popularised.</p> <p>Some examples of effective smart cards include: Janmitra Card in Ahmedabad, and Smart Cards in Delhi.</p> <p>Peri-urban areas are currently connected only through MPRTC services.</p> <p>The share of IPT by ridership in Bhopal city is just 2% (excluding mini buses) with majority of the population opting for private vehicles for commuting. Currently, the IPT sector is not completely formalised and the connectivity is limited to certain routes in and around popular commercial and residential areas. The informal IPT modes operating in the peri-urban areas of the district include mini buses, shared autos, omni vans and jeeps. Residents in city outskirts/ peri-urban areas still rely on private vehicles or walking.</p> <p>Mini buses in Bhopal city have a modal share of 35%. Majority of these are privately owned and operated.</p> |
| <p>District administration can collaborate with ULBs to discourage the use of personal vehicles by developing fiscal measures such as variable parking charges for peak hours.</p> |    | Short-term and continuous | Requires policy framework based on research and interdepartmental cooperation | <p>Bhopal can adopt recommendations from Delhi Master Plan 2021, which provides a Parking District Management Plan. The action plan suggests that the transport department, municipal corporations, traffic police and other agencies need to collaborate to develop and maintain parking areas. The plan also suggests that variable and time-based parking prices should be introduced.</p> |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|--|---|---|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Implement policy measures to discourage use of private vehicles: a) parking policy for vehicle ownership, b) no car days on certain roads, c) parking allowed only in dedicated areas. |   | Short to medium-term | Requires proper policy backing based on research and inter-departmental cooperation. | Sikkim Parking Policy, 2010 mandates that only houses with parking slots can procure vehicles. |
| Improve enforcement of vehicular pollution control norms to minimise emissions from fossil fuel-based PT and IPT vehicles. |  | Short-term and continuous | Policy framework exists (section 6.1.3.1); needs stricter implementation | |
| Awareness campaigns to popularise PT and IPT modes. |  | Short-term and continuous | Dedicated awareness campaigns required | |
| Augment non-motorised transport (NMT) | | | | |
| Improve infrastructure to enhance modal share of NMT transport options in urban areas, by introducing measures such as segregated cycle lanes. |   | Medium-term | Policy based on research and inter-departmental cooperation is required | Current modal split in Bhopal indicates that the share of NMT is approximately 48%. However, over the years, it has been decreasing. Efforts are needed to make NMT a preferred and viable option. |
| Regular O&M of NMT infrastructure by: a) developing and maintaining well-lit, clean and safe pathways for pedestrians and cyclists, b) consulting and engaging local experts and community for development and maintenance, c) removing encroachments. |     | Short-term and continuous | Policy framework exists Requires inter-departmental cooperation | |
| Promote cycle hire service in key locations across the district. |   | Short-term | Needs proper policy backing and strategic awareness drives Further, PPP models can be explored for successful implementation | Bhopal Smart Bike Sharing Service: Bhopal was the first city to introduce a bike sharing scheme in Madhya Pradesh in 2017. In the first phase, 50 locations were chosen to set up rental stations in the city. In the second phase, the network is being expanded. Users can register for using the bikes through the website or app. Strategic placement of cycle hire stations, ease of use and reasonable pricing schemes can help popularise the programme. |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|---|--|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Improving traffic flow | | | | |
| Promote staggered and flexible work timings to limit traffic movement at peak hours to and from key busy routes across the district. |    | Short-term | Needs policy based on research, along with multi-stakeholder and inter-departmental cooperation | <p>Bhopal district could emulate the following best practices to minimise congestion during peak hours.</p> <p>Delhi government in 2019 decided to stagger working hours of its offices during the implementation of the 12-day odd-even scheme, a move aimed at reducing traffic congestion and pollution in the city.</p> <p>Similar shift in work timing is also being planned in Bengaluru.</p> |
| <p>a) Create additional dedicated parking zones for vehicles in order to deter encroachment of road space and pavements.</p> <p>b) Direct business/corporate centres to have mandatory private parking with sufficient parking slots so as to avoid parking on roads, service lanes and other public spaces.</p> |   | <p>a) Medium-term</p> <p>b) Short-term and continuous</p> | <p>Policy framework exists</p> <p>Multi stakeholder and inter-departmental cooperation is required</p> | Bhopal has multiple parking spaces available. However, since awareness is low and maintenance is poor, utilisation is low. The municipal corporation and district authorities need to work towards building awareness and encouraging use of parking facilities. |
| Develop dedicated areas for street vendors to free up the pavements, so that traffic congestion on the roadsides can be minimized. |   | Short to medium-term | <p>While the policy framework exists, implementation is irregular and for short timeframes</p> <p>Multi-stakeholder and inter-departmental cooperation is required</p> | A town vending committee can be set-up in the district to identify all street vendors and be of aid in formulating an effective plan of action for their rehabilitation. |
| Regular maintenance of roads to ensure smooth flow of traffic can help reduce GHG emissions, while extending the life of the road. |   | Short to medium-term and continuous | <p>While the policy framework exists, implementation is lacking in some areas</p> <p>Multi-stakeholder and inter-departmental cooperation is required</p> | |

6.1.3.1 Transport: Policy framework and concerned departments/agencies

| Sub-sectors | Policies and programmes that can push forward the recommendation | Primary departments/agencies | Supporting departments/agencies |
|--|---|---|---|
| Promoting e-mobility | <ol style="list-style-type: none"> 1) FAME II 2) Madhya Pradesh EV Policy, 2019 3) JNNURM 4) National Electric Mobility Mission Plan 5) Smart Cities Mission 6) AMRUT 7) Proposed e-vehicle Policy (as per 2021-22 Union budget) 8) National Urban Transport Policy, 2006 | <ol style="list-style-type: none"> 1) All ULBs 2) RTOs 3) EESL | <ol style="list-style-type: none"> 1) Urban Development and Housing Department, GoMP 2) MPUVNL 3) Madhya Pradesh Transport Department, GoMP 4) Madhya Pradesh Road Development Corporation Limited (MPRDCL), GoMP 5) State Knowledge Management Centre on Climate Change (SKMCC)- EPCO 6) Rural Development Department, GoMP 7) Bhopal Smart City Development Corporation Limited 8) PRIs 9) Airport Authority of India 10) Central Railways - Bhopal Division 11) Proposed District level Committee on Climate Change and Environment |
| Public transport and intermediate public transport | <ol style="list-style-type: none"> 1) BRTS 2) JNNURM 3) ECBC 4) Smart Cities Mission 5) AMRUT 6) National Urban Transport Policy, 2006 | <ol style="list-style-type: none"> 1) All ULBs 2) Bhopal Smart City Development Corporation Limited (BSCDCL) 3) MPSRTC | <ol style="list-style-type: none"> 1) Urban Development and Housing Department, GoMP 2) Madhya Pradesh Transport Department, GoMP 3) RTOs 4) Madhya Pradesh Road Development Corporation Limited (MPRDCL), GoMP 5) State Knowledge Management Centre on Climate Change (SKMCC)- EPCO 6) Rural Development Department, GoMP 7) MPUVNL 8) Proposed District level Committee on Climate Change and Environment |
| Augment non-motorised transport | <ol style="list-style-type: none"> 1) Smart Cities Mission 2) AMRUT 3) National Urban Transport Policy, 2006 | <ol style="list-style-type: none"> 1) All ULBs 2) Bhopal Smart City Development Corporation Limited (BSCDCL) | <ol style="list-style-type: none"> 1) Urban Development and Housing Department, GoMP 2) Madhya Pradesh Road Development Corporation Limited (MPRDCL), GoMP 3) State Knowledge Management Centre on Climate Change (SKMCC)- EPCO 4) Rural Development Department, GoMP 5) PRIs 6) MPUVNL 7) Police Department, GoMP 8) Proposed District level Committee on Climate Change and Environment |

| Sub-sectors | Policies and programmes that can push forward the recommendation | Primary departments/agencies | Supporting departments/agencies |
|------------------------|--|---|--|
| Improving traffic flow | <ol style="list-style-type: none"> 1) BRTS 2) JNNURM 3) ECBC 4) Smart Cities Mission 5) AMRUT 6) National Urban Transport Policy, 2006 | <ol style="list-style-type: none"> 1) All ULBs 2) Bhopal Smart City Development Corporation Limited (BSCDCL) 3) RTOs | <ol style="list-style-type: none"> 1) Urban Development and Housing Department, GoMP 2) Madhya Pradesh Road Development Corporation Limited (MPRDCL), GoMP 3) Madhya Pradesh Housing and Infrastructure Development Board (MPHIDB) 4) State Knowledge Management Centre on Climate Change (SKMCC)- EPCO (for policy support and reporting) 5) Rural Development Department, GoMP 6) Police Department, GoMP 7) Department of Industries, GoMP 8) PRIs 9) MPIDC, GoMP 10) Proposed District level Committee on Climate Change and Environment |

6.1.4 Industry: Recommendations, cross-cutting sectors, qualifying priority and district scenario

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|---|---|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| The district can develop an incentive system, similar to a "cap and trade" system, for enhancing energy efficiency of MSMEs, in coordination with the state energy department. |  | Medium-term | Requires policy framework based on research and inter-departmental cooperation | |
| Promote combined heat and power (CHP)/ co-generation for running captive power plants. |  | Medium-term | <p>Policy framework exists</p> <p>Inter-departmental collaboration required</p> <p>Awareness is needed to popularise the initiative</p> | CHP systems can achieve system efficiencies close to 80%, as compared to around 60% by conventional technologies |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|--|---|---|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Optimise equipment efficiency. Equipment that are not usually turned off during downtime, such as heating or cooling equipment, pumps, alarm systems, etc., need to be energy-efficient and strategies must be developed to switch them off whenever possible. |   | Medium-term | Policy framework exists (section 6.1.4.1) | MP Industrial Promotion Policy, 2014 undertakes the following measures: a) Creates a level-playing field for all investors that helps them conduct their businesses with ease b) Strengthens the single-window system to make it more effective under the provisions of the Madhya Pradesh Investment Facilitation Act, 2008 c) Provides competitive fiscal incentives and exemptions to attract investment d) Provides support to the investors in making government and private land available for industrial projects across different scales of investments |
| Invest in green projects such as plantation drives and afforestation activities within and around industrial areas. |   | Short-term | Policy framework exists. Improved monitoring and evaluation will give recommendation a further push | e) Upgrades industrial infrastructure in existing industrial growth centres f) Promotes the creation of ancillaries to strengthen local vendors g) Enhances the employability of youth by focused skill development efforts |
| Target better M&E of energy audits to improve accountability. |  | Short to medium-term | Policy framework exists Inter-departmental collaboration is required for successful implementation | h) Strengthens MSMEs through an attractive package of incentives and concessions i) Ensures harmony between private sector investors and local citizens through an enhanced dispute settlement mechanism j) Promotes thrust sectors through sector-specific promotion policies k) Establishes a 'land bank' keeping in mind future requirements of land for industries |
| Encourage industries to use recycled water from their plants rather than freshwater. |   | Short-term | Policy framework exists. However, it needs to be upgraded in collaboration with the responsible agencies and departments. | l) Develops world-class infrastructural facilities for industries with active participation of the private sector m) Provisions for the protection of the environment and encourages water conservation measures in the industry through go-green strategies n) Promotes industrial parks for cluster development of similar micro and small-scale industries in regions that are rich in the raw material being used by that particular industry |

6.1.4.1 Industry: Policy framework and concerned departments/agencies

| Sectors | Policies and programmes that can push forward the recommendation | Primary departments/agencies | Supporting departments/agencies |
|----------|--|---|--|
| Industry | 1) MP Industrial Promotion Policy, 2014 2) MP Solar Policy, 2021 3) National Mission on Enhanced Energy Efficiency | 1) Department of Industry Policy and Investment Promotion, GoMP | 1) MP Audyogik Vikas Nigam (MPIDC) 2) Energy Department, GoMP 3) District Industries Centre 4) BEE 5) MPUVNL, GoMP 6) MPPMCL-MPMKVVCL 7) Proposed District level Committee on Climate Change and Environment |

6.1.5 AFOLU: Recommendations, cross-cutting sectors, qualifying priority and district scenario

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|---|--|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| AFOLU: Agriculture | | | | |
| <p>Promotion of sustainable farming practices and programmes, like use of non-chemical fertilisers and zero budget natural farming in the district.</p> |  | Short to medium-term | <p>Policy framework exists (section 6.1.5.1)</p> <p>Budgetary provisions are available</p> | <p>In 2017-18, Bhopal used approximately 41,430 tonnes of urea in agriculture. Replacing just 10% of this with non-chemical fertilisers will help avoid 3,038.2 tonnes of CO₂e emissions/annum in Bhopal.</p> <p>This initiative would also contribute towards: a) cutting down of compostable solid waste from landfilling/dumping and converting it into organic waste which can be used to make organic fertilisers (thereby, reducing emission from waste sector); b) reduction of harmful agricultural run-off (thereby reducing water pollution and eutrophication).</p> |
| <p>Promote adoption of alternative ways to manage crop residue, other than burning.</p> <p>Promoting adoption of improved harvesting practices, such as land leveller, direct seeding, nutrition management, etc. through agricultural extension programme and financial assistance/formation of cooperatives, etc.</p> <p>Stubble can be used as feedstock for different industries to make products including paper, cardboard, furniture, organic fertiliser and animal feed, which will also act as an alternative source of income for farmers.</p> |  | Short to medium-term | <p>Policy framework required</p> <p>Collaboration required</p> <p>Farmers to have easy access to markets/industries that would take crop residue/stubble</p> <p>Helps meet the following targets:</p> <ul style="list-style-type: none"> -- SDG#8 (Decent Work and Economic Growth): 8.2 -- SDG#12 (Responsible Consumption and Production): 12.5, 12. a | <p>Improved harvesting practices, such as the use of happy seeder, which has the capacity to eliminate 78% of GHG emissions (from crop residue burning). It also has the potential to add to farmers' profits by at least 10%. Feasibility studies for a cost-benefit analysis of such improved harvesting machines and practices need to be undertaken. Direct sowing of rice reduces soil disturbance, enabling it to retain more nutrients, moisture and organic content. It also, removes the need for stubble-burning, thereby reducing air pollution.</p> <p>Other feasibility studies or projects can be initiated, such as the development of biofuel pellets from crop residue.</p> |
| <p>Farmers should be encouraged to follow the recommendation given in soil health cards.</p> |  | Short to medium-term | <p>Can be implemented by raising awareness</p> | <p>According to Soil Health Card Portal, 23,15,844 samples have been collected and tested in cycle-II in Madhya Pradesh. In Bhopal, of all the samples tested, 60%, 6% and 7% of the samples had very low nitrogen, phosphorus and potassium, respectively. However, micronutrient status was found to be sufficient.</p> |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|--|---|---|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| <p>Promotion of micro-irrigation (MI) to improve water use efficiency. It saves water, energy and fertiliser consumption.</p> |    | Short to medium-term | <p>Policy framework is available (section 6.1.5.1)</p> <p>Enable swift procedures and subsidy disbursement for adoption of micro-irrigation</p> <p>District may consider providing additional subsidies</p> | <p>Currently, Madhya Pradesh holds 4.99% of the total area under micro-irrigation in India.³ Under the prevailing subsidy regime of Madhya Pradesh, the extent of subsidy varies between 70% and 80% of the cost of the drip system. While the central government provides 50% of the equipment cost as subsidy to small and marginal farmers (belonging to both general category as well as SC/ST category), the extent of subsidy is 40% in the case of other farmers. Additionally, the state government provides between 20% and 30% of the cost as subsidy. The total subsidy varies between 70% and 80% for different category of farmers.⁴</p> <p>MI helps in attaining greater water-use efficiency, thereby reducing the pressure on groundwater sources and reducing GHG emissions. Drip systems have 95% water use efficiency.</p> <p>According to PMKSY Achievement Report, 2,615.74 ha of land was covered under MI in Bhopal during 2019-20, which should have led to avoidance of approximately 2,211.32 tonnes of CO₂ emissions. (w.r.t to conventional irrigation through groundwater).</p> |
| <p>Encourage adoption of latest technologies, such as:</p> <ol style="list-style-type: none"> Solar pumps (under PM KUSUM Yojana), Star-rated Energy Efficient Pump System (EEPS), Smart Control Panels and Internet of Things (IoT) based systems for optimum resource utilisation (water, energy). |     | Short to medium-term | <p>Policy framework is available (section 6.1.5.1)</p> <p>Support in capital investment over and above the existing policy can be considered</p> | <p>According to MNRE, Madhya Pradesh has achieved 92.4% of the target of installing solar pumps under PM-Garib Kalyan Rojgar Abhiyan (as of January 21, 2021, MP has installed 3,224 solar pumps, against the target of 3,490 pumps, in 24 districts of the state).</p> <p>Replacement of 1 lakh diesel pumps with solar pumps, over a period of five years, would result in diesel use mitigation of 900 million litres over the life cycle of solar pumps, which translates into diesel subsidy saving of ₹ 840 crore and CO₂ emission abatement of 2.53 million tonnes.</p> <p>Under PM KUSUM Yojana and CM Solar Pumps Yojana, government provides 83% to 65% subsidy for various pumps and about 50% subsidy for cowsheds (gaushalas). Such initiatives by the state will increase farmers' income, provide reliable source for irrigation and reduce dependence on diesel in the farm sector.</p> |

³ Suresh A. and Samuel M. P., 2020, Micro-irrigation development in India: Challenges and strategies

⁴ Towards Accelerating Adoption of Drip Irrigation in Madhya Pradesh, International Water Management Institute Centre for Environment and Development Studies, Jaipur

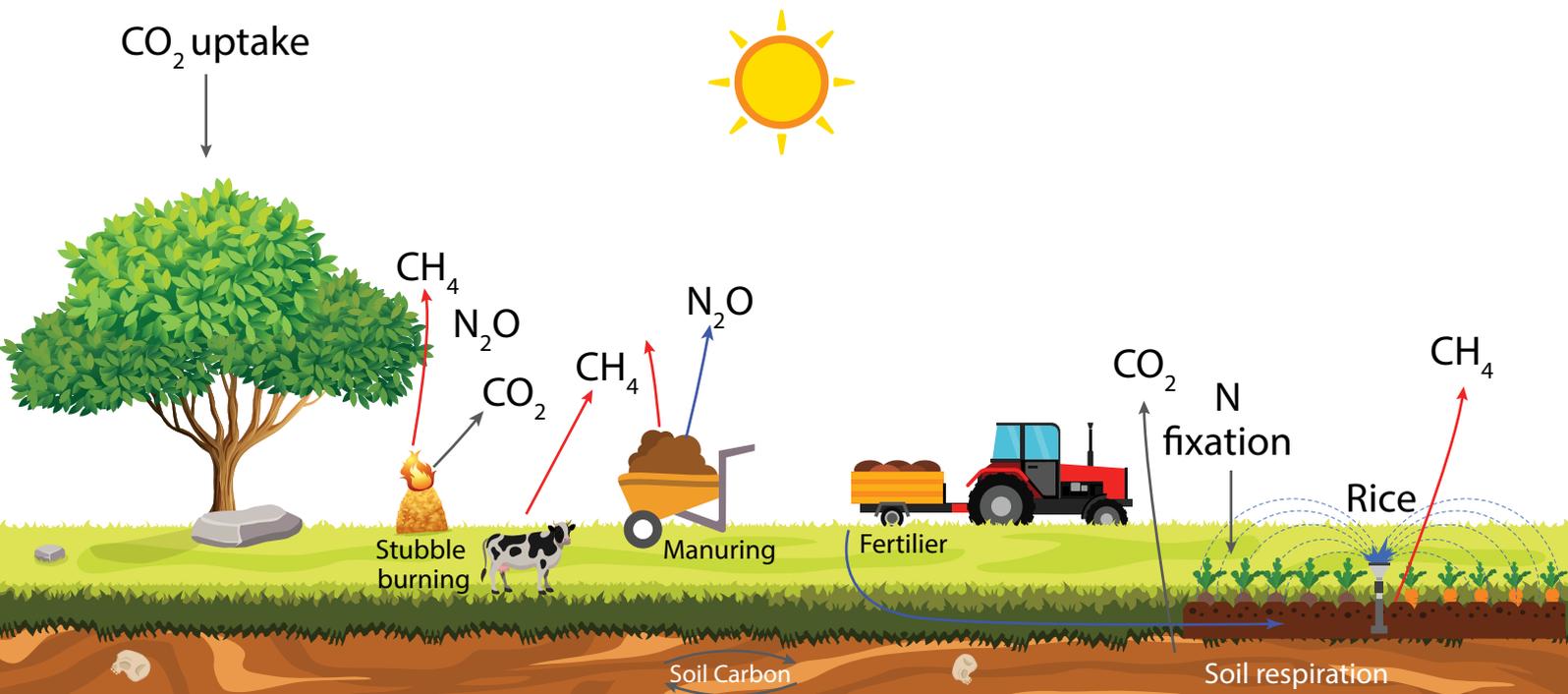
| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|--|---|--|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Enhance the efficiency/network of cold storage systems and wherever possible, power them with renewable energy. |   | Medium to long-term | Policy framework exists and can be enhanced (section 6.1.5.1) Capital investment required Align with solar rooftop policies and ECBC | |
| AFOLU: Livestock | | | | |
| Promote grasslands and cultivation of cattle feedstock for good quality forage and to manage fodder scarcity. |    | Short to medium-term | Policy framework exists (section 6.1.5.1) Research inputs required Collaboration between different communities (farming and pastoral) is needed | Intensive cultivation of <i>Sesbania grandiflora</i> which produces about 7.8 kg/tree/year or 936 MT/year/ha when fed to lactating crossbred cows leads to an increase in milk yield by 11.97%. ⁵ Straws from millets, corn and maize have better feeding quality than straws from rice, barley and wheat. This change in quality of forage species leads to better productivity and an estimated reduction of 30% in emissions. ICAR-NIANP has recently developed a feed supplement - Harit Dhara and Tamarin Plus, for cattle, buffalo and sheep. It is found effective in cutting down methane emissions by 20%. Use of this feed supplement can be encouraged by Bhopal at the district level. ⁶ |
| Promote cattle breeds with higher productivity. Moreover, productivity of indigenous cattle should also be improved (for instance, through the provision of Nand Ghars) However, it's essential to maintain the balance between resilience and productivity. Currently, in most areas flock sizes are negatively impacting the climate and ecology. |  | Medium to long-term | Policy framework exists (section 6.1.5.1) Research collaboration required (to ensure biodiversity of the region is not impacted) Raise awareness Provide monetary support to the pastoral community | These initiatives will help meet growing demand of milk, while keeping the livestock headcount low. In Bhopal, if there is a 10% decrease in the number of indigenous cattle over a period of five years, the loss in milk production will be 12 lakh litres and 78,449.54 tonnes of CO ₂ e emission will be avoided. To compensate for this loss in milk production, a total of 7,91,912 new crossbred cattle are required, resulting in 71,524.78 tonnes CO ₂ e emissions. The net emissions avoided per year will be 1,380 tonnes CO ₂ e. |
| Promote the use of waste from livestock and poultry as an important source of organic manure for crops. Poultry manure, which is rich in nitrogen, can be used for various crops like sugarcane, potato etc. for enhancing crop production. |   | Short to medium-term | Collaboration between different communities (farming and pastoral) is needed Policy framework is available (section 6.1.5.1) | Poultry manure fertiliser is rich in nitrogen and contains all 13 essential nutrients required for crop production. In comparison to cow manure, it is two to three times richer in inorganic fertiliser content. |

5 Earagariyanna M.Y. et. al., 2017, Fodder Resource Management in India-Critical Analysis

6 <http://nianp.res.in/harit-dhara-tamarin-plus>

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|---|---|---|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| AFOLU: Forestry and green spaces | | | | |
| <p>Ensure minimum diversion of forest land for any activity or project and promote compensatory afforestation (of the same species) from the funds given by the user agency.</p> <p>Funds for continuous tree improvement and tree breeding programmes can be ensured through the Compensatory Afforestation Fund Management and Planning Authority (CAMPA).</p> |  | Short to medium-term | <p>Policy framework and budget provisions exist (section 6.1.5.1)</p> <p>Policy implementation required</p> <p>Stringent monitoring and evaluation needed</p> | <p>As per India State of Forest Report, 2019, during the period January 2015 to February 2019, a total of 12,785 hectares of forest land was diverted for non-forestry purposes under the Forest Conservation Act, 1980.</p> <p>According to Environmental Clearance Report, 2019, 298.06 ha of total forest area in Bhopal had been diverted since 1980.</p> <p>In 2019, Madhya Pradesh received Rs 5,196.69 crore from the CAMPA, which aims to promote afforestation and regeneration activities as a way of compensating for forest land diverted to non-forest uses.</p> |
| <p>Measures to increase trees outside forest (TOF) area and green spaces in Bhopal:</p> <ol style="list-style-type: none"> Setting up of urban parks, Adopting Miyawaki Urban Forestry method, Transplanting trees with the help of tree transplanter machines, Setting up of floating gardens, butterfly gardens etc, Initiate afforestation activities on wastelands and fallow lands, Plantation along village roads can be taken up under MGNREGS, Development of green belt along the major terrain roads, and surrounding the industrial areas, Tree census should be conducted periodically. |    | Medium to long-term | <p>Policy framework is available (section 6.1.5.1)</p> <p>Capital investment, research collaboration, and inter-departmental cooperation required</p> | <p>According to 2019 FSI assessment report, the extent of TOF for Madhya Pradesh is 21,069 sq km. Dominant tree species in TOF are Babul (<i>Acacia arabica</i>), Neem (<i>Azadirachta indica</i>), Ber (<i>Zizyphus jujuba</i>), sacred tree (<i>Butea frondose</i>) and many more.</p> <p>Currently, the forest area in Bhopal district is only 11.86%. If 25% of geographical area of Bhopal (equivalent to state average forest cover) is converted to forest and tree cover, 8.79 million tonnes of CO₂ emissions can be avoided over a period of 10 years.</p> <p>Miyawaki Urban Forestry method has reported 15% faster growth rate per year compared to other reforestation methods. AIIMS Bhopal has developed the state's first Miyawaki forest on 24,000 sq ft of land.</p> <p>Green belts help in mitigating air pollution, increasing urban green cover, thereby leading to carbon sequestration.</p> |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|---|--|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| <p>Enhance forest cover by promoting agro-forestry and social forestry to increase forest biomass and soil moisture. Here are some more measures that are needed in forestry:</p> <p>a) Control illegal timber trade,</p> <p>b) Carry out mapping of agroforestry area to monitor the coverage,</p> <p>c) Create provisions of financial instruments/relaxation in other taxes (over and above the existing schemes) to encourage the farming community to adopt agroforestry.</p> |  | Medium to long-term | <p>Policy framework and budget is available, implementation is required</p> <p>Stringent monitoring and evaluation are necessary</p> | <p>According to 2019 FSI Assessment Report, the tree cover of Madhya Pradesh is 8,339 sq km.</p> <p>Currently, the forest cover of Bhopal district is 11.87% of the total geographical area. In an assumed scenario of increased forest cover by 25%, over a period of 10 years, 8.79 MtCO₂e emissions would be sequestered.</p> |
| <p>Ensure ULBs regularly monitor survival of trees, post plantation:</p> <p>a) Thorough study to be done on suitability of the site and survival ratio of species (majorly native species) before initiating any plantation drive,</p> <p>b) Prepare an audit every year on the number of saplings surviving after plantation drives,</p> <p>c) Ensure geo-tagging of trees (along with site and species) for proper monitoring.</p> |  | Short to medium-term | <p>Monitoring and evaluation required</p> <p>Collaboration among different stakeholders required</p> | <p>To develop a "City Forest" in Bhopal, a target of 21 lakh saplings, set in 2020, was given to BMC, Bhopal Smart City Development Corporation Limited, Forest Department, BDA, Horticulture Department, School Education Department, Higher Education Department, RDC, Tribal Welfare Department, Bhopal's citizens, CPA, NHI, and other agencies, by the Divisional Commissioner.</p> |



| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|---|---|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Promote regeneration of degraded and open forest areas by developing awareness among locals on the importance of green spaces. |  | Long-term | Strengthen the existing policy framework Collaboration among different stakeholders | According to 2019 Forest Survey of India report, there is a decrease in forest cover by 25.33 sq km in Bhopal from 2017 assessment. |
| Various aspects of Joint Forest Management (JFM) need to be promoted: a) Capacity building and skill development of joint forest management committees in tribal and non-tribal areas through workshops and training. b) Initiate participatory forest management programmes at micro scale. |  | Short to medium-term | Exclusive communication strategy and IEC material to be developed and used Provisions of monetary support | According to 2015 ENVIS Database, total area under JFM in Madhya Pradesh is 66,87,390 ha. There are about 15,228 joint forest management committees. |
| Prevent invasion of non-indigenous species by adopting the following measures: a) Develop a database and update information on invasive species and their management, b) Raise awareness at regional levels, c) Strengthen and maintain institutions to coordinate invasive species programmes. |  | Medium to long-term | Research studies of flora specific to the region Exclusive communication strategy and IEC material to be developed and used Requires funding, monitoring and evaluation, stakeholder collaboration | <i>Lantana camara</i> , <i>Cassia tora</i> , <i>Ageratina adenophora</i> , <i>Ageratum conyzoides</i> and <i>Senna occidentalis</i> are some major invasive species of Madhya Pradesh. Preventing seed production helps in managing spread of invasive species. Removing flower heads prior to seed set will reduce the number of seeds available for spread by birds or other animals. ⁷ |
| Develop participatory forest fire management strategies such as: a) Collecting baseline forest fire data with respect to perceptions, beliefs, expectations and behaviour of local people in regard to forest fires, b) Training local communities to tackle forest fires, c) Organising awareness programmes in local schools, d) Capacity building to develop an early warning system. |  | Medium to long-term | Provisions of monetary support Exclusive communication strategy and information, education and communication (IEC) material to be developed and used Monitoring and evaluation required Collaboration among different stakeholders | According to Technical Information Series Volume-I, FSI Report 2019, 0.14%, 19.36% and 64.84% of the total forest cover area of Madhya Pradesh is under extreme fire prone, moderately fire prone and least fire prone area, respectively. |

7 Solanki H.A., 2018, Checklist of invasive plants of Gujarat and some most insidious plants of Gujarat, their hazards, its management and public perspective

6.1.5.1 AFOLU: Policy framework and concerned departments/agencies

| Sectors | Policies and programmes that can push forward the recommendation | Primary departments/agencies | Supporting departments/agencies |
|---------------------------|---|---|---|
| Agriculture | <ol style="list-style-type: none"> 1) Rashtriya Krishi Vikas Yojana: Remunerative Approaches for Agriculture and Allied Sector Rejuvenation (RAFTAAR) 2) National Mission for Sustainable Agriculture 3) Pradhan Mantri Krishi Sinchayee Yojana 4) PM KUSUM Yojana 5) Soil Health Card 6) National Mission on Food Security 7) National Mission on Micro-irrigation 8) CM Solar Pump Scheme 9) National Policy for Crop Residue Management 10) Price Support Scheme 11) CM Farmer Promotion Scheme 12) MP Kisan Anudan Yojana 13) Pradhan Mantri Garib Kalyan Abhiyan 14) National Food Security Mission 15) Krishi Vikas Yojana | <ol style="list-style-type: none"> 1) Farmers' Welfare and Agricultural Development Department, Government of Madhya Pradesh | <ol style="list-style-type: none"> 1) Panchayat and Rural Development Department, GoMP 2) Water Resources Department, GoMP 3) Energy Department, GoMP 4) Department of Animal Husbandry, GoMP 5) State Knowledge Management Centre on Climate Change (SKMCCC), EPCO – (for reporting) 6) Forest Department, GoMP 7) Madhya Pradesh State Agro Industries Development Corporation 8) Madhya Pradesh Small Farmers Agri- Business Consortium, Bhopal (MAPFAC) 9) Madhya Pradesh State Agriculture Marketing Board 10) APMCs 11) MPIDC 12) Proposed District level Committee on Climate Change and Environment |
| Livestock | <ol style="list-style-type: none"> 1) National Livestock Mission 2) Rashtriya Gokul Mission 3) Kisan Credit Cards to Livestock farmers 4) National Programme for Dairy Development 5) Livestock Health and Disease Control 6) National Programme for Dairy Development 7) Intensive Cattle Development Programme 8) Nandi Shala Yojana 9) Upgraded Animal Breeding Scheme 10) Supply of (10 + 1) goat unit on bank loans and grants 11) Acharya Vidyasagar Cow Promotion Scheme 12) VAT observance promotion scheme | <ol style="list-style-type: none"> 1) Department of Animal Husbandry, Government of Madhya Pradesh | <ol style="list-style-type: none"> 1) Forest Department, GoMP 2) Farmers' Welfare and Agricultural Development Department, GoMP 3) State Knowledge Management Centre on Climate Change (SKMCCC), EPCO 4) Proposed District level Committee on Climate Change and Environment |
| Forestry and green spaces | <ol style="list-style-type: none"> 1) National Afforestation Programme (NAP) 2) Project Tiger 3) Compensatory Afforestation Fund Management and Planning Authority (CAMPA) 4) Green India Mission (GIM) 5) Integrated Development of Wildlife Habitat (IDWH) 6) Intensification of Forest Management Scheme (IFMS) 7) Pradhan Mantri Ujjwala Yojana | <ol style="list-style-type: none"> 1) Forest Department, Government of Madhya Pradesh | <ol style="list-style-type: none"> 1) Farmers' Welfare and Agricultural Development Department, GoMP 2) State Knowledge Management Centre on Climate Change (SKMCCC), EPCO 3) All ULBs (BMC + other Municipalities) 4) Mineral Resources Department, GoMP 5) Urban Development and Housing Department, GoMP 6) Rural Development Department, GoMP 7) Proposed District level Committee on Climate Change and Environment 8) All PRIs |

6.1.6 Waste management: Recommendations, cross-cutting sectors, qualifying priority and district scenario

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|--|--|--|---|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Solid waste | | | | |
| Waste prevention: Reducing landfilling | | | | |
| <p>Minimising landfill waste disposal by:</p> <p>a) promoting reduction of waste at source through product reuse, extending lifetime (maximum use of resources) and right to repair,</p> <p>b) ensuring efficient and 100% segregated waste collection from across the district (both urban and rural); distributing colour-coded bins, monitoring waste collected from household and penalising households not practicing segregation,</p> <p>c) ensuring and maximising recycling, recovery, optimum resource utilisation throughout product lifecycle and treatment,</p> <p>d) promoting resource efficiency and circular economy practices across sectors.</p> |       | <p>a) Medium to long-term</p> <p>b) Short to medium-term</p> <p>c) Medium-term</p> <p>d) Long-term</p> | <p>a) Needs policy intervention, awareness generation and incentivisation</p> <p>b) Policy framework exists (section 6.1.6.1)</p> <p>c) Needs policy intervention and execution (Resource Efficiency Policy has been drafted by NITI Aayog, but has not been implemented yet)</p> | <p>Landfills are considered to be one of the largest anthropogenic source of methane emissions contributing to 11% of all global CH₄ emissions. Hence, reducing landfill load and emission is critical in achieving India's NDCs. Here are some initiatives adopted by Bhopal that will reduce landfill emissions in the city and can be adopted across the district as well:</p> <p>Bhopal is ranked as the Best 'Self-Sustainable State / National Capital or UT' (based on GFC/ODF/Cost Vs Revenue) and the seventh most clean city in India by Swachh Survekshan 2020 (cleanliness, hygiene and sanitation survey).</p> <p>Madhya Pradesh has 94% waste collection efficiency and 76% waste treatment rate. Bhopal has almost 100% collection efficiency with 30% processed in composting/vermin-compost plants, 1.5% routing to the bio-gas plant and the rest treated in the waste to energy plant operational from 2019.</p> <p>MP has adopted a 'cluster-based model of ULBs for effective integrated solid waste management (ISWM) based on the concepts of regional landfill and implementation through public private partnership (PPP) mode. Bhopal is one of the 26 clusters in the state having eight ULBs, viz., Ashta, Berasia, Bhopal, Ichhawar, Kothri, Mandideep, Obedullaganj, Sehore, belonging to the districts of Sehore, Bhopal and Raisen.</p> <p>MP has a target of 80% resource recovery out of the total solid waste generated. Bhopal cluster generates 1,060 TPD MSW and has one Waste to Energy plant.</p> <p>In Bhopal, the old Bhanpura landfill site (16 km from the city) is closed for recovery and a new site for ISWM of Bhopal cluster is opened at Adampur Chawni (at a distance of 15 km from the city).</p> <p>Bhopal Smart City has introduced 130 smart underground dustbins at 70 locations, each displaying LED indicator live waste capacity (each of 3m³ capacity), having separate blue-green sections for dry and wet waste, monitored through Integrated Control and Command Centre (ICCC). ICCC directs the waste collection vehicles for immediate transport of waste.</p> |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|---|---|---|---|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Minimising single use plastic (SUP): Detailed information and recommendations on SUP are given in section 6.1.6.2 |   | Short to medium-term | Already a national priority Policy framework exists (section 6.1.6.2), but can be accelerated with district level interventions / implementation. | Disposable SW take-back has not been implemented in Madhya Pradesh. About 32% of the total waste generated in Bhopal is inert and plastic waste. Paper waste is 9% and much of it can be treated/recycled. |
| Implementing producers (manufacturer/brand owners, etc) take-back mechanism (SWM Rules, 2016) either through financial assistance by the producers or a defined collection system facilitated by the producers for disposables, such as tin, glass, plastics packaging, sanitary napkins and diapers, for efficient management of these waste materials, thereby reducing landfill inert waste load. |   | Short to medium-term | Mandated by the SWM Rules (2016) Needs regional policy formulation and interventions | |
| Ensure 100% recycling of recyclables at landfill through material recycling facilities (MRFs), refuse derived fuel (RDF), waste to energy, etc. Encourage use of LDPE and HDPE plastic waste in road construction. ⁸ |   | Short to medium-term | Capacity enhancement of existing facilities required | |
| Management of construction and demolition (C&D) waste: a) Ensure segregation, collection, transport and proper management, b) Facilitate processing and recycling, c) Incentivise initiatives for C&D waste reuse in non-structural concrete, paving blocks, lower layers of road pavements, colony and rural roads, d) Mandatory procurement of C&D materials (10% to 20%) in municipal and government contracts (subject to quality control). |    | Short to medium-term | Mandated by the rules. CPCB guidelines exist (section 6.1.6.1) Needs state-level policy formulation, implementation and enforcement Capital investment in infrastructure required | |
| Increasing consumer awareness and access to recycling facilities and repair options within the district. |  | Short to medium-term | Dedicated awareness campaign required | |

8 <https://pib.gov.in/PressReleasePage.aspx?PRID=1736774>. Guidelines given by Indian Roads Congress in this regard can be followed

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|--|---|---|---|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Education and awareness drives for 100% at source segregation of biodegradable waste, non-biodegradable waste, domestic hazardous waste and household biomedical waste. |  | Short-term | Dedicated awareness campaign required | About 10% to 15% of global GHG emissions can be reduced through improved waste management that follows a lifecycle assessment approach ⁹ . Prevention and recovery of waste (as secondary material or energy) can significantly save GHG emissions across sectors such as energy, forestry, agriculture, mining, transport and manufacturing sectors. |
| Introduce fiscal instruments to encourage waste reduction, such as, mandatory carry bag charges, pay-per-bin schemes (charging residents for each community refuse bin). |   | Short-term | Needs district level scheme/notification and community participation | |
| Conduct behavioural change communication workshops targeting corporates, educational institutes, PSUs, government offices to influence behaviour at both individual and organisational level to better manage resource and reduce waste generated. For example, conducting weekly workshops at all public schools for waste reduction and recovery. These workshops can also address issues, such as energy efficiency and water conservation. |    | Short-term and continuous | Needs sustained campaign for the target groups | |
| Consumer awareness for demand-side management of product choices with: a) sustainable packaging, b) displayed higher product lifespan, c) displayed recycling/resource recovery efforts and information. |  | Short-term and continuous | Dedicated awareness campaign required | |
| Conduct waste audits at household level, corporate offices, institutes, etc. to identify scope of waste minimisation and promote the same as an evidence-based practice. |   | Short to medium-term | Needs research collaboration | |
| Ensure segregation, collection and treatment of sanitary waste (sanitary napkins and diapers) to reduce landfill load. |    | Short to medium-term | Mandated by the SWM Rules, 2016; capital investment in infrastructure development (for treatment) is required, which can be obtained from the producers | |
| Transitioning the district to a green market approach by: a) promoting local circular business models, b) mainstreaming of alternative sustainable business models for consumers to have a basket of choice. |   | Medium-term and continuous | Needs alternative business models, collaborations and awareness | |

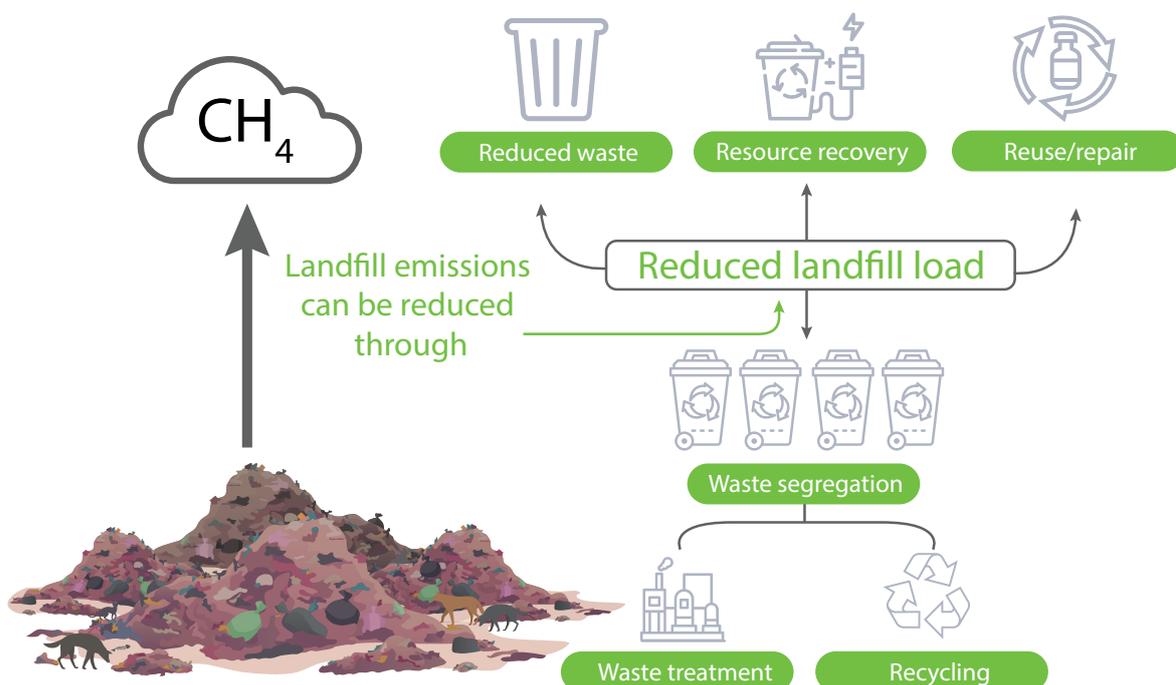
9 Global Waste Management Outlook - UNEP/ISWA, 2015

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|--|--|---|------------------------------|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| <p>Reduce emissions from waste transportation:</p> <p>a) Encourage shifting to electric or zero-emission vehicles for all kinds of waste transport, including municipal solid waste in all ULBs, bio-medical waste in all common bio-medical waste treatment facilities (CBWTFs) and hazardous waste in all treatment, storage and disposal facilities (TSDFs),</p> <p>b) Installation of waste bins with sensors to monitor volume and optimise the routes of collection vehicles to reduce consumption of fuels for waste transport and related emissions.</p> |   | Medium to long-term | Needs capital investments | <p>Current common landfill (cluster) waste disposal of eight ULBs requires very long distance (>100 kms) waste transportation.</p> <p>BMC is currently operating more than 420 vehicles for collection and transport of solid waste. Waste transport from within the city to Adampur Chawni landfill (15 km from the city) site can potentially lead to an emission of 9,006 kg/day, translating to about 3,287 tCO₂e/year.¹⁰ Solid waste transport emission profile of the district will be many times higher, considering the distance of ULBs from common landfill site. This emission can be avoided with a shift to ZEVs.</p> <p>Bhopal Smart City has set up nine waste transfer stations fully-automated with total waste segregation, compacting and waste-box pick-up by transfer vehicle hook facilities. This reduces the requirement for waste transport and improves efficiency of waste management.</p> <p>Though there are several specifications in place for CBWTF vehicles to ensure efficient management and monitoring of BMW, they do not factor-in the emission reduction part from transport.</p> |

¹⁰ Estimated by applying the average distance travelled by different category of vehicles and using the IPCC & NATCOM2 values for emission factors and Net Calorific Value of diesel.

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|--|---|---|--|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Waste treatment : Composting | | | | |
| Encourage 100% conversion of organic waste to biological waste processing (composting, bio-gas, etc). |     | Short to medium-term | <p>Policy framework exists (section 6.1.6.1)</p> <p>Needs awareness and infrastructure development</p> | Although organic treatment of compostable waste initially leads to emissions, it reduces GHG emissions drastically over the long run, as compared to landfill emissions. It takes at least three decades for landfill emissions to balance with those from aerobic composting. A number of best practices and technologies are available for reducing GHG emissions from composting. Even in the absence of gas management system, composting is considered a more environmentally sustainable practice as compared to methane capturing from landfilling of organic waste. |
| <p>Develop composting facilities at ULB level in addition to cluster level to avoid:</p> <p>a) loss of carbon content in long route organic waste transport, and</p> <p>b) reduce waste transport emissions.</p> |    | Medium-term | Needs land and infrastructural investment at ULB level | <p>In Bhopal, 56% of solid waste is biodegradable. Reportedly (MPPCB), 304 TPD waste is being composted now. Composting emission potential: 9,320 tCO₂e/year. Currently, there are no gas management systems at composting units.</p> |
| <p>a) Equip new composting units and upgrade/convert existing composting units with gas management systems for gas capture after conducting feasibility studies,</p> <p>b) Biomethane produced from wastewater and solid waste processing can be used as a fuel for industrial production, to provide energy services in buildings or as a transport fuel. A benefit of biomethane is that existing gas infrastructure can be utilised for transport and distribution. As a local, sustainable source of power and heat, biomethane offers communities and municipalities a flexible option that can contribute to lowering emissions.</p> |     | Long-term | Needs policy intervention, district-level capital investment and research collaboration | <p>Composting with gas management of 100% organic waste going to landfill can reduce emission by 13,293 tCO₂e/year in Bhopal.</p> |
| Emission profiling and reduction | | | | |
| Facilitating research and documentation on characteristics and percentage share of waste, moisture content, localised BODs for domestic wastewater and industrial wastewater, etc. is important for accurate city or district-level emission estimations from the waste sector. | | Short-term | Needs research collaboration | |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|--|--|---|--|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Ensure better compliance to waste management rules in terms of maintaining segregated waste collection and treatment data (solid waste, bio-medical waste, e-waste and hazardous waste) in the public domain (annual reports/websites), particularly at the district level. | | Short-term and continuous | Policy framework exists in most cases (section 6.1.6.1) | |
| Bio-medical waste and hazardous waste | | | | |
| <p>a) Promote installation of modern incinerators with energy-recovery facilities (like, use of recovered heat for preheating of waste to be burnt or use of incinerator steam to generate electricity) for new CBWTFs and TSDFs, and upgradation of the existing ones,</p> <p>b) Using smart controls, waste treatment plants equipped with energy recovery incineration facilities can be integrated as distributed energy sources into the electricity grid and as heat sources into the district energy network.</p> |   | Long-term | Need policy formulation and investment in infrastructure | Though not a recommended treatment due to its emission potential, incineration prevents manual scavenging and further contamination from certain kinds of infectious waste (particularly, the anatomical, contaminated waste, discarded medicines and chemical waste). Incineration is the best available and recommended practice right now in India. Wherever applicable, there should be a policy provision for modern incinerators with energy-recovery facilities (such as, use of recovered heat for preheating of waste to be burnt or use of incinerator steam to generate electricity). |
| Strict monitoring of adherence to recommended incineration technologies, standard and practices through regular monitoring by District Bio-medical waste Management Monitoring Committee. |  | Short-term and continuous | Mandated by the rules (section 6.1.6.1) Needs monitoring by district level BMWM committee | Current annual BMW incineration emission in the district is 184 tCO ₂ e/ year. Energy recovery incineration is not practiced. |
| Ensure 100% segregation, collection, and treatment of bio-medical waste through coverage and registration of all healthcare facilities to CBWTFs. |   | Short-term and continuous | Mandated by the rules (section 6.1.6.1) | District level HW generation/ incineration data not available |



| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|---|--|---|--|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Waste electrical and electronic equipment (WEEE) | | | | |
| <p>As per the provisions of E-waste Management Rules, 2016, a state level e-waste inventory with district level category wise e-waste generation information needs to be developed.</p> <p>The inventory must include all sources of generation and consider all WEEE categories as per the rules.</p> | | Short to medium-term | <p>Preparation of e-waste inventory is mandated by the rules (section 6.1.6.1)</p> <p>Need research collaborations</p> | |
| <p>Ensure stringent policy implementation: Trace informal routing, ensure proper collection, restrict informal processing of e-waste (open burning, metal smelting, etc.), ensure proper disposal of electrical waste (lighting infrastructure including mercury containing lamps) and strict monitoring to stop landfilling of the same.</p> |     | Short term and continuous | <p>Mandated by the rules (section 6.1.6.1).</p> <p>Needs monitoring, manufacturer collaboration and consumer awareness</p> | <p>About 95% of the e-waste in India is processed informally (including rudimentary operations like open burning, acid wash, open smelting, etc.)</p> <p>City-based studies show that efficient management and recycling of electrical and electronic waste (WEEE) can significantly contribute to emission reduction targets.</p> |
| <p>Tapping into the informal e-waste collection network and formalisation of the same to channelise e-waste disposal to the formal sector.</p> |   | Short to medium term | <p>Can be achieved through the producers/recyclers/Producer Responsibility Organisation (PROs)</p> | <p>There is no authentic database available for MP for the amount of e-waste generated annually and their routes to recycling or disposal. MP has an e-waste inventory dating back to 2011 made for Bhopal, Indore, Gwalior and Jabalpur divisions, which projects 62,928.76 MT/year WEEE generation in 2020 in Bhopal.</p> |
| <p>Improve consumer awareness on responsible e-waste disposal and make information readily available about e-waste collection points, recyclers, producers (manufacturer), producer responsibility organisations or local e-waste collection drives at the district level.</p> |   | Short-term and continuous | <p>Mandated by the rules for the producers (section 6.1.6.1)</p> <p>Dedicated awareness campaign required</p> <p>Can be achieved by collaborating with producers</p> | <p>However, only 534.43 MT/year WEEE was collected during 2018-19 in the entire state which clearly indicates informal routing of most of the e-waste generated.</p> |
| <p>Formulation of district level e-waste management programme.</p> |    | Short to medium-term | Needs inter-departmental collaboration | |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|--|--|---|--|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Wastewater: Domestic and industrial | | | | |
| <p>Achieve 100% domestic wastewater treatment through:</p> <p>a) In both urban and rural areas of the district, set up 100% closed and underground sewer collection network,</p> <p>b) Shift 100% domestic wastewater treatment to aerobic set ups by having only aerobic STPs for new constructions. Transition of old anaerobic STPs to aerobic set up,</p> <p>c) Operation and regular maintenance of sludge removal facilities of all STPs. The sludge can be used again for the bio-methanation of compost.</p> |     | Medium to long-term | Policy intervention and capital investment required | <p>Wastewater, if treated anaerobically, can be a huge source of methane and even nitrous oxide emissions. Being stagnant and subject to heating (anaerobic conditions), open sewers emit CH₄. Closed underground sewers, on the other hand, are considered to be an insignificant source of CH₄.</p> <p>Bhopal has seven STPs, of which five aerobic plants with 45.5 MLD capacity and two anaerobic plants with 35 MLD capacity are operational in the district.</p> |
| Development of rural wastewater disposal and treatment plan for the district. |   | Medium to long-term | Requires capital investment and inter-departmental collaboration | No information is available on coverage and treatment of rural sewerage. |
| <p>Create appropriate connecting infrastructure for the industries to utilise treated industrial and domestic wastewater.</p> <p>Provide subsidy/tax rebate provisions to industries, healthcare, hospitality sectors for smart recycled water investment.</p> |   | Medium to long-term | <p>Policy implementation required</p> <p>Needs capital investment in infrastructure and technology upgradation</p> | <p>Fully closed and underground sewers and centralized aerobic well-managed STPs can potentially reduce 47,401 tCO₂e emission from STPs, making them negligible or nearly non-existent in Bhopal.</p> <p>Case example: Ahmedabad Municipal Corporation has set up the first sewage sludge hygienisation plant in the country at Pirana (operational from 2019) which can convert 100 tonnes of dry sludge into fertiliser per day. A similar plant can be developed for Bhopal.</p> |
| Implement and operationalise the guidelines and regulations of National Policy on Faecal Sludge and Septage Management, 2017 to reduce emissions from faecal sludge. Regular collection and appropriate disposal of sludge shall also be ensured. |   | Medium to long-term | Needs ULB level implementation and capital investment in infrastructure | |
| Develop a policy mandate for data transparency and availability of waste and wastewater generation, treatment and discharge information for industrial sector. |   | Medium to long-term | Needs policy intervention, and inter-departmental collaboration | Data transparency on wastewater by industries is key to reducing water pollution. This can be achieved through rating of industries based on their emissions and effluent discharge and treatment. For example, under its Star Rating Programme, the Odisha State Pollution Control Board gives star rating to industries and presents it through their website. This can help in environmental compliance and encourage public participation. |
| Encourage data transparency by the industries for wastewater generation, treatment and discharge information including those of CETPs. |   | Short to medium-term | Needs collaborative efforts | |

6.1.6.1 Waste management: Policy framework and concerned departments/agencies

| Sectors | Policies and programmes that can push forward the recommendation | Primary departments/agencies | Supporting departments/agencies |
|--|--|---|---|
| Solid waste | <ol style="list-style-type: none"> 1) Solid Waste Management Rules, 2016 and Amendment, 2018 2) Plastic Waste Management Rules, 2016 and Amendment Rules, 2021 3) Construction & Demolition Waste Management Rules, 2016 4) Integrated Solid Waste Management Project 5) Swachh Bharat Mission - Urban and Rural 6) Bhopal Master Plan, 2021 and Bhopal Development Plan 7) National Smart Cities Mission 8) National Resource Efficiency Policy (draft) 9) Guidelines on Environmental Management of C&D Waste Management in India, CPCB 10) GPCB Solid Waste Annual Report | <ol style="list-style-type: none"> 1) Urban Development and Housing Department, GoMP 2) All ULBs 3) Panchayats and Rural Development Department, GoMP 4) All Gram Panchayats 5) Madhya Pradesh Pollution Control Board (MPPCB) | <ol style="list-style-type: none"> 1) Bhopal District Administration and the proposed District Level Climate Change and Environment Committee 2) Madhya Pradesh Urban Development Company Limited (MPUDCL) 3) Bhopal Development Authority (BDA) 4) Department of Housing and Environment, GoMP 5) Community or Residential Associations 6) State Knowledge Management Centre on Climate Change, EPCO, GoMP |
| Bio-medical waste and hazardous waste | <ol style="list-style-type: none"> 1) Bio-medical Waste Management Rules, 2016 2) Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016 3) Batteries (Management and Handling) Rules, 2001 4) MPPCB Annual Reports (for data availability) 5) Revised Guidelines for Common Bio-medical Waste Treatment and Disposal Facilities, 2016, CPCB | Research funding can be obtained from Department of Environment, GoMP; SKMCC-EPCO; MPPCB, etc. ¹¹ | <ol style="list-style-type: none"> 1) MPPCB 2) Bhopal District Administration 3) Proposed District Level Climate Change and Environment Committee 4) Healthcare facilities 5) CBWTF |
| Waste-electrical and electronic equipment (WEEE) | <ol style="list-style-type: none"> 1) E-waste Management Rules, 2016 2) Implementation Guidelines for E-Waste (Management) Rules, 2016, CPCB | Only implementation monitoring and research needs resources which can be obtained from the Dept of Environment, GoMP; SKMCC; MPPCB, etc. ¹² | <ol style="list-style-type: none"> 1) MPPCB 2) Bhopal District Administration 3) Proposed District Level Climate Change & Environment Committee 4) Electronic and Electrical Producer Manufacturers/Producers/Brand owners, Producer Responsibility Organisations |
| Wastewater : Domestic | <ol style="list-style-type: none"> 1) Atal Mission for Rejuvenation and Urban Transformation (AMRUT) 2) Jawaharlal Nehru National Urban Renewal Mission on Urban Infrastructure and Governance (JNNURM) 3) National River Conservation Plan 4) Integrated Urban Sanitation Programme 5) Swachh Bharat Mission (Urban) – MP 6) Swachh Bharat Mission (Rural) – MP 7) Bhopal Smart City Mission 8) Bhopal Master Plan, 2021 and Bhopal Development Plan | <ol style="list-style-type: none"> 1) Urban Development and Housing Department, GoMP 2) All ULBs 3) Panchayats and Rural Development Department, GoMP 4) MP Jal Nigam | <ol style="list-style-type: none"> 1) Bhopal Development Authority 2) MPUDCL 3) Bhopal Smart City Development Corporation 4) All Gram Panchayats 5) Bhopal District Administration and the proposed District Level Climate Change and Environment Committee |
| Wastewater: Industrial | <ol style="list-style-type: none"> 1) Common Effluent Treatment Plant System 2) Online Continuous Emission Monitoring System 3) MPPCB Annual Report | <ol style="list-style-type: none"> 1) Madhya Pradesh Pollution Control Board (MPPCB) 2) Madhya Pradesh Industrial Development Corporation (MPIDC) | <ol style="list-style-type: none"> 1) Bhopal District Administration and the proposed District Level Climate Change and Environment Committee |

11 Bio-medical and hazardous waste management is profitable and not funded by the government, except for providing the land, which generally belongs to the Industrial Development Corporation

12 E-waste management (collection, transport, disposal, treatment – dismantling or recycling) is profitable and is the responsibility of the producers, recyclers, producer responsibility organisations (PROs).

6.1.6.2 Single-use plastics (SUPs) – critical to replace

Definition

- SUPs are often referred to as disposable plastics and are commonly used for plastic packaging. They include items intended to be used only once before they are thrown away or recycled, such as grocery bags, food packaging, bottles, straws, containers, cups and cutlery (UNEP).

Concerns

- Since SUPs are made for single use, they increase waste load and are resource intensive.
- SUPs often get out of the collection and treatment network and a) are one of the biggest ocean polluters and are ingested by aquatic animals; b) stay in the environment forever, leading to microplastic pollution; and c) block waterways and intensify natural disasters.
- They have high carbon footprint and cost for collection, transport and treatment/recycling requirement.
- SUPs release harmful toxic chemical additives at their end-of-life disposal (unscientific) and further contaminate soil, water and the food chain.



Easily replaceable SUP, their alternatives and key user industries

| SUPs | Type of plastic majorly used | Key user industries | Alternatives | Pros and cons of various alternatives |
|---|--|--|--|---|
| Polythene Bags | Low Density Polyethylene (LDPE) | Fast Moving Consumer Goods (FMCG) | Cotton bags, jute bags, bio-plastics | <p>Cloth (cotton)</p> <ul style="list-style-type: none"> Pros: Natural fibre, durable, reusable, biodegradable, profitable and non-food crop Cons: High consumption of chemical fertilisers and pesticides in cotton farming, high cost, water intensive crop, not moisture resistant, needs to be reused many times to offset high degradation/recycling carbon footprint <p>Jute</p> <ul style="list-style-type: none"> Pros: Natural fibre, durable, reusable and biodegradable, high carbon assimilation rate Cons: Expensive, water-intensive crop, highly dependent on rainfall, product not moisture-resistant <p>Bioplastics</p> <ul style="list-style-type: none"> Pros: Bio-degradable, moisture resistant, inexpensive, light-weight Cons: Contains significant number of plastic polymers leading to microplastic pollution; needs commercial composting facility to degrade; can mistakenly be mixed with plastic recyclables in municipal solid waste; needs quality check and control <p>Paper</p> <ul style="list-style-type: none"> Pros: Bio-degradable, low manufacturing cost, can be made from recycled paper Cons: Water intensive, high carbon footprint, not durable, not moisture resistant <p>Glass</p> <ul style="list-style-type: none"> Pros: Inert, infinitely recyclable, no toxic chemical additives, low manufacturing carbon footprint Cons: Fragile, higher cost, injury and health risk, weight <p>Metal</p> <ul style="list-style-type: none"> Pros: Renewable resource, durable, can be recovered and infinitely recycled Cons: Expensive, higher transportation carbon footprint, tin-coated steel can leach into food and contaminate, heat conductor |
| Plastic packaging | a) LDPE b) Expanded Polystyrene (EPS) c) Paper + foil + LDPE/ PE + foil + paper/ Polyethylene Terephthalate (PET) + foil + LDPE, etc. d) LDPE | FMCG (food & beverages), hospitality and e-commerce | Bio-plastics, recycled paper | |
| Plastic bottles, tubes for household, personal care and cosmetics, sanitisers, toiletries, etc. | High density polyethylene (HDPE) | FMCG (personal care and cosmetics products /PCCP), food, household and toiletries, beauty, hospitality | Glass, metal (tin-plated steel, aluminium), bamboo, pottery and other ceramics | |
| Plastic sachet | LDPE | FMCG (food & beverages, PCCP), hospitality | Cellophane/ other bio-degradable alternatives | |
| Styrofoam products (plates, tray, cups) | Expanded polystyrene (EPS) | | Bioplastic, recycled paper, leaf, bamboo | |
| Biscuit tray, plastic box, air seal for food etc. | Polypropylene (PP) | FMCG (food & beverages), hospitality | Bioplastic | |
| Plastic water and other drink bottles | Polyethylene terephthalate (PET) | Hospitality, FMCG (food & beverages) | Glass, metal, ceramics, bulk vending | |
| Plastic cutlery, plates, cups, and stirrers | Polystyrene (PS) | Hospitality | Bioplastic, recycled paper, steel | |
| Plastic 'use and throw' pens | Polypropylene (PP) | FMCG (stationary) | Paper, bamboo, refillable pens | |
| Straws, stirrers, balloon sticks | Polypropylene (PP) | FMCG (stationary) | Bamboo, recycled paper | |
| Milk packets | LDPE | FMCG (food & beverages), hospitality | Tetra pack, bottling and bulk vending | |
| Face shields | Polycarbonate and polyester (PET) | Healthcare | Compostable/ bio-degradable face shield | |
| Sticks of cotton buds | | FMCG (PCCP) | Recycled paper, other eco-designed materials, bamboo | |
| Cigarette butts | Cellulose acetate | Tobacco industry | -- | |
| Freezer bags | LDPE | Hospitality, healthcare, R&D | Glass container, sealable stainless steel | |

Microplastics

- Definition: Microplastics are defined by UNEP as solid phase materials, particulates < 5mm, water insoluble, non-degradable and made of plastic. The European Commission defines them as man-made, conventional plastics including bio-degradable plastics, bio-based analogue plastics and bio-based alternative plastics with a particle size below 5 mm and include nanometer-sized plastics as well (nanoparticles).
- Major sources: a) vehicle tyres, b) fishing gear, rope, painting and maintenance of ships and boats, c) loss from plastic manufacturing industries, d) painting, construction and road marking, e) fibres from synthetic textile, f) microbeads in personal care and cosmetic products, g) breakdown of plastic products.
- Out of these sources, intentionally-added microbeads in cosmetics and personal care products are 'designed to drain' SUPs. Replacement of microbeads in PCCPs come under central regulation. However, at a district level, consumer awareness can make a change through shifting of demand to sustainable alternatives.

Regulatory provisions in India for single-use plastics

- Plastic Waste Management (Amendment) Rules, 2021 (announced on March 11, 2021): a) The manufacture, import, stocking, distribution, sale and use of the SUP commodities: Ear buds with plastic sticks, plastic sticks for balloons, plastic flags, candy sticks, ice-cream sticks, polystyrene (thermocool) for decoration shall be prohibited from January 1, 2022, b) The manufacture, import, stocking, distribution, sale and use of the SUPs (including polystyrene and expanded polystyrene) items – plates, cups, glasses, cutlery such as forks, spoons, knives, straw, trays, wrapping/packing films around sweet boxes; invitation cards; and cigarette packets, plastic/PVC banners less than 100 micron, stirrers shall be prohibited from July 1, 2022.
- Plastic Waste Management Rules, 2016 and Amendment Rules, 2018: a) Puts the onus on the producers, through extended producer responsibility (EPR), to collect plastic waste either individually or through the concerned local body; b) The primary responsibility is on producers, importers and brand owners (who introduce the products in the market) to collect used multi-layered plastic sachet, pouches and other packaging; c) Manufacturing and use of multi-layered plastic, which is non-recyclable or non-energy recoverable or with no alternate use, should be phased out in two years.
- Solid Waste Management Rules, 2016: a) Introduces EPR for manufacturers or brand owners of disposable products (including plastic packaging, sanitary napkins and diapers) to provide financial assistance to local authorities for waste management system and to set up a collection/take back system for packaging waste.
- Different policy frameworks for SUP ban or restrictions (of different kind) exist in at least 23 states and five union territories of India. Madhya Pradesh does not have any policy directive at the state-level as of now.

Recommendations¹³

- Implement the ban (as specified by the Plastic Waste Management Amendment Rules, 2021) on manufacture, import, stocking, distribution, sale and use of the single use plastic.
- Formulate policies with provisions to: a) mandate producer responsibility for awareness, labelling requirement on disposal, clean-up, collection and treatment of SUP products/packaging; b) mandate collection target (can be a differential target for different products) for SUP producers as part of EPR; c) penalise consumers for accepting banned SUP carrier bags or products; d) strict and random monitoring for implementation of bans in supermarkets, street vendors, shopping malls, large organised markets, etc; e) gradual phasing out of other selected categories of SUP products (by granting the producers some transition time). The phasing out can be achieved by sensitising key producers and sectors and encouraging them to take voluntary action.
- Promote eco-friendly alternatives to SUPs through: a) identifying alternative sustainable products; b) identifying micro-enterprises and cottage industries for the products; c) integrating them into the mainstream business models through connecting/cross-cutting policies; d) providing financial incentives for the alternative industries and for integrating sustainable products into mainstream business models, such as in the hospitality industry; e) strict quality control and certification requirement for plastic-free alternatives (for instance, resin or plastic powder should not be mixed in the product as an alternative).

13 Note: A sustainable solution to SUP products needs both state and district level collaborations at all levels including policy formulations and implementations

UNEP. 2018. Single use plastics: a roadmap for sustainability. Available at http://www.indiaenvironmentportal.org.in/files/file/singleUsePlastic_sustainability.pdf

Toxics Link. 2020. Single use plastic, the last straw: a watershed moment in the anthropogenic era.

MoEF&CC. 2016. Solid Waste Management Rules, 2016.

MoEF&CC. 2018. Plastic Waste Management (Amendment) Rules, 2018

- Promote extended lifespan and reuse of products (including sustainable ones) through continued and lasting campaigns for 'No Single Use' to ensure public participation. Replacing the concept of 'single use' is critical as biodegradability or recyclability have 'time' and 'conditions' (such as energy and water footprint, transport requirement, etc) attached to them.
- Introduce economic incentives/support: a) Invest in R&D to develop alternatives to different SUP products, b) support technology incubation and stimulate creation of micro-enterprises to drive job creation, c) introduce livelihood support schemes and/or include special provisions in the existing schemes to accommodate the job loss from plastic industry, d) tax rebate to alternative models, public-private partnerships, etc; e) incentivise plastic industries for shifting to sustainable alternatives.

6.2. Innovative financing

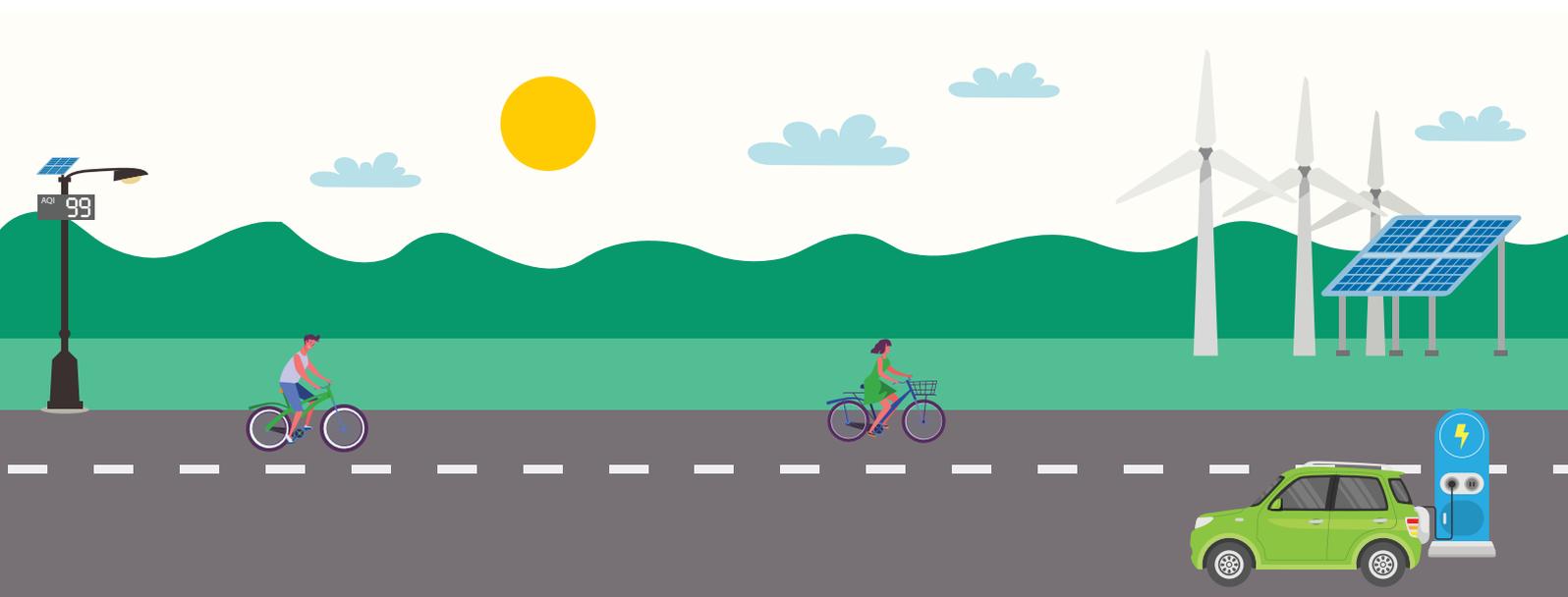
| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|--|---|---|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Promote green municipal bonds to mobilise untapped investments towards green projects, such as RE infrastructure, waste management etc. |      | Medium to long-term | <p>Needs policy formulation</p> <p>Collaboration among various stakeholders</p> <p>Create specific financial instruments</p> | Bhopal Municipal Corporation issued municipal bonds worth ₹ 175 crore (approximately) in 2018. The funds raised were to be used for various projects under AMRUT. |
| Voluntary carbon market mechanism can be developed for the district to motivate industries, ULBs and other sectors to lower their emission levels through monetary incentives. | All sectors | Medium-term | <p>Needs feasibility studies, research and interdepartmental and multi-stakeholder collaboration</p> <p>Institutional structure needs to be established</p> | <p>Case example: In 2020, Smart City Indore collected carbon credit of around ₹ 50 lakh through its two bio-methanisation plants. The gas generated from these plants is used by the city buses – City Bus and iBus.</p> <p>Through these projects, Indore has avoided emissions of 1,70,000 tCO₂e since 2019 and generated carbon credits.</p> |

6.3. Recommendations based on district-specific environmental problems: Recommendations, cross-cutting sectors, qualifying priority and district scenario

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario /case examples |
|--|---|---|--|---|
| | | Timeframe to attain the recommendations | Framework for implementation | |
| Urban wetlands | | | | |
| Periodic de-silting and dredging of the lakes, deepening and widening of spill channels and allocating dedicated funds for ensuring a sustained de-siltation. Use of excavated materials for agricultural and plantation lands. |  | Short-term and continuous | | <p>Bhoj Wetland (area: 3,201 ha) was declared a Ramsar site on August 19, 2002. The wetland consists of two contiguous human-made reservoirs – the Upper Lake created in the 11th century and the Lower Lake constructed nearly 200 years ago. The lakes are very rich in biodiversity, particularly for macrophytes, phytoplankton, zooplankton, both natural and cultured fish species, both resident and migratory birds, insects, and reptiles and amphibians.</p> <p>The Bhopal Development Plan 2005 prescribes the following regulatory measures for protection and management of lakes:</p> <p>a) Fringe areas of the lakes to be declared as sensitive zones. No construction and development activities in 50 m space from full tank level of the Upper Lake and 33 m space from the edge of the Lower Lake;</p> <p>b) Planting of indigenous trees and shrubs along the slopes of the lakes (to the extent of 50-100 m from max tank level) to arrest pollution and entrance of silt</p> <p>c) Water from the Upper Lake shall not be allowed to be used for water-based recreational activities that adversely affect water quality</p> <p>d) Discouraging practice of agriculture along the lake fringe to stop chemical pollution from agriculture.</p> |
| (a) Promote use of RE-powered sources for recreational activities around all three lakes of Bhopal (including lighting; electricity to stalls etc). RE can be sourced from decentralised solar panels around the periphery of the lakes. |  | | Sector-specific policy framework exists; need to ensure compliance | |
| (b) Phase out diesel-run boats (if any) and introduce RE based options. |  | (a) Short to medium-term (b) Medium-term (c) Short-term | | |
| (c) RE-powered aerators can be installed to avoid eutrophication in different pockets of the wetlands. |  | | | |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario /case examples |
|--|--|---|--|---|
| | | Timeframe to attain the recommendations | Framework for implementation | |
| <p>Promote/implement measures to protect the catchment area of the lakes, for example:</p> <p>a) Evaluate the carrying capacity of the Upper, Lower and Shahpura lakes and surrounding ecosystem and consider the same before permitting any new construction or activity around its periphery,</p> <p>b) Tap nonpoint source runoff (from the drains),</p> <p>c) Generate awareness through government extension services machinery to facilitate change in fertiliser consumption patterns (from chemical to organic) in the agricultural activities in lake catchment areas,</p> <p>d) De-motivate excessive ground water pumping in residential areas around the lakes. Incentivise rain-water harvesting systems for the nearby areas,</p> <p>e) Construct check dams, silt traps, toe walls, and cascading and garland drains to treat the catchment area.</p> |       | Short-term and continuous | Needs planning and infrastructural investment | <p>Bhopal Development Plan 2031 (Draft) mentions the constant threat of the wetland from discharge of sewage water, growth of thick mats of aquatic weeds in the peripheral areas and increasing silt load from the surrounding hills and its catchment area.</p> |
| <p>Promote aqua-culture for biological control of weeds, and carry out regular de-weeding activities in the wetland.</p> |  | Short-term and continuous | Existing wetland specific studies need to be considered for further planning | <p>Solar power projects are being developed along the VIP road near Upper Lake which will enable solar energy operation of Karbala pump and solar energy lit street lights on VIP road.</p> |
| <p>(a) Ensure monitoring to prevent encroachment in the lake fringe area; (b) manage waste; and (c) reduce traffic pressure in the Link Road and Lake View Promenade, created as a buffer between the lake and the human settlements.</p> |   | Short-term and continuous | | |
| <p>Restrict dumping of solid waste, inflow of untreated wastewater (both domestic and industrial) and agricultural run-off into the catchment area.</p> <p>Also ensure effective functioning of CETPs, STPs in and around the wetland.</p> |     | Short to medium-term and continuous | | |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario /case examples |
|--|--|---|--|---|
| | | Timeframe to attain the recommendations | Framework for implementation | |
| Promote the use of native species in any upcoming infrastructure development near wetland to protect native biodiversity. |  | Short-term and continuous | More research and collaboration needed | |
| Promote more focused research on the wetland biodiversity and its interactions with the habitat, hydrology, soils, and landform. | | Medium to long-term | | |
| Involve the stakeholders (fishermen community, local community, hawkers etc.) in spatial planning and wetland management activities whenever possible. |  | Medium to long-term | | |
| Ensure that all the principles/ wetland practices according to the Ramsar Convention are followed. |   | Short-term and continuous | | |
| Managing air pollution | | | | |
| Facilitate source apportionment studies to identify the sources and take particular containment measures. | | Short to medium-term | Needs research collaboration | MPPCB has developed an action plan to control air pollution in Bhopal, which mentions vehicular emission, road dust, construction activities, biomass and garbage burning, industrial emissions as the major source of air pollution in Bhopal. However, no source apportionment studies have been conducted. |



| Recommendations | Cross-cutting with | Qualifying priority | | District scenario /case examples |
|--|---|---|---|--|
| | | Timeframe to attain the recommendations | Framework for implementation | |
| <p>Increase the number of continuous ambient air quality monitoring stations (CAAQMS) to statistically, spatially and temporally, represent the mix of sources and range of pollution in the city.</p> <p>Also increase the number of air quality display facilities in public places.</p> |  | Short to medium-term | Policy framework and budgetary provisions exist | <p>Bhopal has two CAQMS by MPPCB, two CAQMS by CPCB and two manual air quality monitoring stations and a few air quality display screens placed in the city. The district needs more CAQMS and regular operation and information display of the same.</p> <p>Bhopal is categorised as one of the 124 non-attainment cities in India and one of the six in Madhya Pradesh for particulate matter concentration (PM₁₀) exceeding the prescribed norms by CPCB under the National Clean Air Programme (NCAP) with multiple timelines to clean air.</p> |
| <p>Increase the modal share of public and non-motorised transportation. Further, promote e-vehicles (detailed recommendation provided in the Transport sector: section 6.1.3).</p> |   | Medium to long-term | <p>Policy framework available</p> <p>Needs awareness generation</p> <p>Capital investment required</p> <p>Needs inter-departmental coordination</p> | |
| <p>Better traffic management, re-direction of traffic movement, development of multi-layered parking and ban on-street parking within specific perimeters of the multi-layered parking to ensure parking inside the facility.</p> |  | Short to medium-term | <p>Feasibility studies required</p> <p>Needs implementation of existing rules/policies</p> <p>Capital investment</p> | |
| <p>Increase/create green cover or green buffers along the major traffic corridors, roundabouts and industrial areas.</p> |    | Medium to long-term | <p>Needs inter-departmental coordination</p> <p>Needs efficient maintenance and monitoring of plantation sites</p> | |
| <p>Enforce environmental standards for stack emissions in industrial sector.</p> |  | Short-term and continuous | Requires robust M&E | |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario /case examples |
|---|---|---|---|---|
| | | Timeframe to attain the recommendations | Framework for implementation | |
| Sprinkling of water (preferably, recycled grey water) for road dust suspension during peak pollution episodes. |    | Short-term and continuous | Needs inter-departmental co-operation | |
| Open waste burning (of solid waste, biomass, plastic, horticulture waste etc.) should be regulated by the municipal corporation/nagar panchayats. |    | Short to medium-term | Needs implementation of existing rules/regulations | <p>Bhopal reportedly has 27 emission generating industries in the Govindpura Industrial Area which have adequate Air Pollution Control Devices (APCD).</p> <p>The city has: a) Thirty eight vehicle emission monitoring centres for periodic check-up and certification of PUC, b) Two multi-level parking operational in most congested areas, c) A 12 km cycle track and 80 cycle-stands under public bike sharing.</p> |
| Implementation of action plan for construction and demolition waste (as per CPCB guidelines) |    | Short to medium-term | Needs implementation of existing rules/regulations | |
| Ensure installation and operation of air pollution control devices in industries and adherence to emission standards. |  | Medium to long-term | <p>Requires implementation of existing rules/regulations</p> <p>Robust M&E required</p> | |

6.3.1 Recommendations based on district-specific environmental problems: Policy framework and concerned departments/agencies

| Sectors | Policies and programmes that can push forward the recommendation | Primary departments/agencies | Supporting departments/agencies |
|----------------|--|--|---|
| Urban wetlands | <ol style="list-style-type: none"> 1) Ramsar Convention, 1971 2) Water (Prevention and Control of Pollution) Act, 1974 3) Environment Protection Act, 1986 4) Wetlands (Conservation and Management) Rules, 2017 5) Madhya Pradesh Municipal Corporation Act, 1956 (as Amended in 1995) 6) National Water Mission 7) National Wetlands Conservation Programme (NWCP) 8) National Lake Conservation Plan (NLCP) | <ol style="list-style-type: none"> 1) Department of Housing and Environment, GoMP 2) Madhya Pradesh Forest Department, GoMP 3) Madhya Pradesh Pollution Control Board (MPPCB) 4) Madhya Pradesh State Biodiversity Board | <ol style="list-style-type: none"> 1) Urban Development and Housing Department, GoMP 2) Panchayat and Rural Development Department, GoMP 3) Department of Farmers Welfare and Agriculture Development, GoMP 4) Fisheries department, GoMP 5) Revenue department, GoMP 6) MP Tourism Department & MP Tourism Board, GoMP 7) Water Resources Department, GoMP 8) All ULB 9) All PRIs 10) Proposed District Level Climate Change and Environment Committee |
| Air Pollution | <ol style="list-style-type: none"> 1) Air (Prevention and Control of Pollution) Act- 1981 2) Environment (Protection) Act, 1986 3) National Clean Air Programme 4) Solid Waste Management Rules, 2016 and Amendment 2018 5) Construction & Demolition Waste Management Rules, 2016 | <ol style="list-style-type: none"> 1) MPPCB 2) System of Air Quality and Weather Forecasting And Research (SAFAR), IMD 3) All ULBs | <ol style="list-style-type: none"> 1) District Administration and the proposed District Level Climate Change and Environment Committee 2) Department of Housing and Environment, GoMP 3) SKMCC, GoMP 4) Transport Department, GoMP 5) Energy Department, GoMP 6) RTO 7) Proposed District Level Climate Change and Environment Committee |



6.4. Actions district authorities can recommend to state departments

| Recommendations that could be pursued by the district collector/ state-level committee | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|---|--|---|---|
| | | Time-frame for the action to be accomplished | Framework for implementation | |
| <p>POWER SECTOR: Upgrade DISCOM infrastructure and their supply network to reduce AT&C losses, billing inefficiencies etc. Furthermore, introduction of smart billing system would help curtail power thefts, and increase billing efficiency, helping the DISCOM generate more revenue.</p> |  | Short to medium-term | <p>Policy framework and targets exist (section 6.4.1)</p> <p>With optimum push, this initiative can help India align with the Paris Agreement targets</p> | <p>The current AT&C losses of MPMKVVCL are 25.8% – this is way higher than the international standard range of 6% to 8%.</p> <p>MPMKVVCL needs to upgrade its infrastructure, introduce smart metering, smart billing, etc. to increase its efficiency.</p> <p>For example: EESL has signed an MoU with Uttar Haryana Bijli Vitran Nigam and Dakshin Haryana Bijli Vitran Nigam for 10 lakh Smart meters.</p> <p>The deployment of smart meters in the country has led to 20% increase in monthly revenue per customer for DISCOMs, a 5% reduction in AT&C losses (on an average), remote disconnection provision for defaulters and has completely eliminated manual meter reading requirements, leading to reduced expenditure (as per EESL).</p> <p>MPMKVVCL can implement such pilot projects in Bhopal district.</p> |
| <p>HABITAT: Provide subsidies/tax rebates to builders/building owners to encourage adoption of ECBC or IGBC (eg. property tax/ water cess/IT rebate).</p> |  | Medium to long-term | <p>Policy framework exists (section 6.4.1), but targets need to be set</p> <p>Needs inter-departmental collaboration</p> | <p>ECBC buildings deliver 20% to 25% of energy savings, in different climates, when compared with the conventional buildings (BEE, 2017).</p> <p>By 2025, if 30% of the commercial area in the district becomes ECBC compliant, around 0.3 MtCO₂e emissions can be avoided.</p> |
| <p>TRANSPORT: Energy efficiency of infrastructure in railways can be enhanced through the following measures:</p> <ol style="list-style-type: none"> Installing solar panels along electrified tracks and on railway station rooftops, Installing optimal light control systems and appliances, smart sensors and building management systems at station buildings, Ensuring regeneration of energy (through rolling stock) parallel to the grid. |  | Medium-term | <p>Needs inter-departmental collaboration</p> | <p>Rail Land Development Authority and National Building Construction Corporation have signed an MoU for redevelopment of 10 railway stations across India as 'smart railway stations'.</p> <p>Railway stations in Bhopal district can also be developed along similar lines.</p> |

| Recommendations that could be pursued by the district collector/ state-level committee | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|--|---|--|--|
| | | Time-frame for the action to be accomplished | Framework for implementation | |
| <p>TRANSPORT: Use fiscal instruments to discourage the use of personal vehicles like</p> <p>a) increasing charges on registration of internal combustion engines (ICE) vehicles,</p> <p>b) levying congestion charges and other green tax,</p> <p>c) phasing out of older, more polluting vehicles.</p> |   | Short-term and continuous | Proper policy backing based on research and inter-departmental cooperation is required | In January 2021, the Ministry of Road Transport and Highways announced additional taxes on old vehicles that are unfit for roads as 'green taxes'. |
| <p>TRANSPORT: Identify and shift key commercial / business centres from all the ULBs to outside city limits to reduce traffic load.</p> | | Long-term | Proper policy backing based on research and inter-departmental cooperation is needed | Development of areas outside BMC limits to accommodate the shifting of industries, business centres, IT parks etc. is required. |
| <p>District authorities while gradually rolling out EV infrastructure, can advocate to state and national governments for standardised EV cables and infrastructures for easier integration and interoperability for implementation of smart charging on a large scale.</p> |  | Medium to long-term | Needs policy intervention | |
| <p>INDUSTRY: a) Ensure regular PAT compliance of DISCOMs and other designated consumers (DCs) in the district;</p> <p>b) Increase the number of designated consumers for the PAT scheme and ensure the compliance of targets.</p> |  | <p>a) Short-term and continuous</p> <p>b) Medium to long-term</p> | <p>Policy framework exists (section 6.4.1), but targets need to be revised gradually</p> <p>Ensure M&E</p> <p>Collaboration required</p> | <p>Until PAT Cycle VI (2020-21), only two DCs had volunteered under the scheme.</p> <p>Over the years, various DCs from the district have helped avoid around 11.94 MtCO₂e by improving their systemic energy efficiency, under the PAT scheme.</p> |
| <p>INDUSTRY/ENERGY: Ensure compliance to renewable purchase obligations (RPOs) and (gradually) increase the RPO targets.</p> |  | Medium to long-term | Policy framework exists (section 6.4.1) | For FY 2021-22, the RPO target for industries is 17%. |

| Recommendations that could be pursued by the district collector/ state-level committee | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|--|--|--|
| | | Time-frame for the action to be accomplished | Framework for implementation | |
| <p>AGRICULTURE: Encourage millet cultivation (requires less water to grow, shows good productivity under extreme climate conditions and is rich in nutrition).</p> |  | Medium to long-term | <p>Needs creation of appropriate financial mechanisms to encourage farmers to grow millets</p> <p>Requires research collaboration</p> <p>This would also enable achievement of the following targets of SDG#2 (Zero Hunger): 2.1, 2.3, 2.4</p> | <p>In Bhopal, jowar production has continuously decreased from 1,000 tonnes in 2016-17 to 33 tonnes in 2018-19.</p> |
| <p>AGRICULTURE: To compensate for predicted decrease in crop productivity, initiate research on high yield, drought and temperature resilient genotypes for various food and cash crops in association with agricultural institutes/ universities.</p> |  | Medium to long-term | <p>Needs research collaboration and capital investment</p> <p>This would also enable achievement of the following targets of SDG#2 (Zero Hunger): Targets 2.1, 2.3, 2.4, 2.a.</p> | <p>Rainfed area (for agriculture) of Bhopal decreased significantly from 1.47 lakh ha (in 2010-11) to 1.25 lakh ha (2015-16). However, the irrigated area increased from 0.96 lakh ha (2010-11) to 1.04 lakh ha (2015-16).</p> <p>Area under wheat cultivation decreased from 81,000 ha to 51,175 ha (between 2017-18 and 2018-19), and production reduced from 2.356 lakh MT to 1.75 lakh MT (between 2016-17 and 2018-19), and the yield reduced by 17.5%. In order to meet the food demand in the future, crop failures need to be reduced through the adoption of climate-smart agriculture.</p> <p>Area under paddy cultivation increased from 8,950 ha (2017-18) to 12,920 ha (2018-19). Production increased significantly from 8,480 MT (2017-18) to 18,125 MT (2018-19), leading to higher GHG emissions. Therefore, temperature and drought resilient rice varieties having climate-friendly irrigation practices/water regimes should be preferred. Moreover, avoid rice cultivation in non-traditional rice areas.</p> |
| <p>AGRICULTURE: For overall reduction in electricity and water consumption in agriculture, subsidies need to be reduced in a phased manner.</p> |    | Medium to long-term | <p>Policy intervention needed</p> <p>Requires awareness generation and collaboration with the farming communities</p> | <p>The tariffs are as per different consumption slabs as well as the horsepower of pump being used.</p> <p>As per the Madhya Pradesh Electricity Regulatory Commission, Aggregate Revenue Requirement and Retail Supply Tariff Order for FY 2020-21, 645 paise/unit and 469 paise/unit is the energy charge for domestic and agriculture and allied activities respectively, upon utilisation of 300 units.</p> <p>Electricity tariff policies, in conjunction with large subsidies for agricultural power, have caused rapid groundwater depletion in many regions as well as massive financial losses to power utilities and governments – both state and central.</p> <p>Flat tariffs lead to more equitable distribution of electricity between high-income and marginal consumers, but fail to encourage water conservation. Metered tariffs have the potential to promote water conservation, but are difficult to manage and are expensive for low-income farmers.¹⁴</p> |

14 Sindhu B.S. et. al, Power tariffs for groundwater irrigation in India: A comparative analysis of the environmental, equity, and economic trade-offs

| Recommendations that could be pursued by the district collector/ state-level committee | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|--|--|--|
| | | Time-frame for the action to be accomplished | Framework for implementation | |
| <p>FORESTRY/GREEN SPACES: Promote regeneration of degraded and open forest areas through corporate social responsibility (CSR) (or similar mandates) and encourage corporates to dedicate some percentage of their profit for greening of open spaces in the district.</p> |    | Long-term | <p>Needs strengthening of the existing policy framework</p> <p>Needs stakeholder collaboration</p> | Green belts help in mitigating air pollution, increasing urban cover, thereby leading to carbon sequestration. |
| <p>E-WASTE: Adopting 'green marketing' by: (a) Promoting green products; (b) Displaying product lifespan on the label of e-products to influence purchase decisions, thereby, using the labels as behavioural intervention.</p> |   | Medium to long-term | Needs policy intervention, collaborations and awareness | |

6.4.1 Actions district authorities can recommend to state departments: Policy framework and concerned departments/agencies

| Sub-sectors | Policies and programmes that can push forward the recommendation | Primary departments / agencies | Supporting departments/ agencies |
|--------------|--|--|---|
| Power sector | <ol style="list-style-type: none"> 1) National Smart Grid Mission 2) Smart Metering National Programme 3) Integrated Power Development Scheme (IPDS) 4) Restructured Accelerated Power Development and Reforms Programme (R-APDRP) 5) UDAY Scheme, 2015 6) National Mission on energy Efficiency, specifically PAT (Perform, Achieve and Trade) Scheme 7) MP Solar Power Policy, 2012 8) Policy for Decentralized Renewable projects, 2016 9) Standards and Labelling Programme | <ol style="list-style-type: none"> 1) MPPMCL-MPMKVVCL, GoMP 2) MNRE, GoI 3) MPUVNL, GoMP 4) BEE (EESL) | <ol style="list-style-type: none"> 1) State Knowledge Management Centre on Climate Change (SKMCCC)-EPCO 2) West Central Railways - Bhopal Division 3) Proposed District Level Climate Change and Environment Committee |
| Habitat | <ol style="list-style-type: none"> 1) ECBC 2017 | <ol style="list-style-type: none"> 1) Urban Development and Housing Department, GoMP 2) All ULBs 3) Bhopal Smart City Development Corporation Limited (BSDCL) | <ol style="list-style-type: none"> 1) Proposed District Level Climate Change and Environment Committee 2) MPUVNL |

| Sub-sectors | Policies and programmes that can push forward the recommendation | Primary departments / agencies | Supporting departments/ agencies |
|-------------|---|---|---|
| Transport | <ol style="list-style-type: none"> 1) ECBC 2) JNNURM 3) Smart Cities Mission 4) AMRUT | <ol style="list-style-type: none"> 1) Madhya Pradesh Transport Department 2) All RTOs 3) ALL ULBs | <ol style="list-style-type: none"> 1) MPSRTC 2) MPUVNL 3) Bhopal Smart City Development Corporation Limited 4) West Central Railways - Bhopal Division |
| Industry | <ol style="list-style-type: none"> 1) PAT Scheme 2) Industrial Promotion Policy, 2014 | <ol style="list-style-type: none"> 1) Department of Industry Policy and Investment Promotion, GoMP | <ol style="list-style-type: none"> 1) Industries Commissionerate 2) District Industries Centre 3) Proposed District Level Climate Change and Environment Committee |
| AFOLU | <ol style="list-style-type: none"> 1) National Mission on Food Security 2) Rashtriya Krishi Vikas Yojana: Remunerative Approaches for Agriculture and Allied Sector Rejuvenation (RAFTAAR) 3) National Mission for Sustainable Agriculture 4) Price Support Scheme 5) National Afforestation Programme (NAP) 6) Green India Mission 7) CSR Act, 2013 | <ol style="list-style-type: none"> 1) Farmers' Welfare and Agricultural Development Department, Government of Madhya Pradesh 2) Forest Department, Government of Madhya Pradesh | <ol style="list-style-type: none"> 1) APMCs 2) MPIDC 3) Energy Department, GoMP 4) Madhya Pradesh State Agro Industries Development Corporation 5) Mineral Resources Department, GoMP 6) Madhya Pradesh State Agriculture Marketing Board 7) Proposed District level Committee on Climate Change and Environment |
| Waste | <ol style="list-style-type: none"> 1) E-waste Management Rules, 2016 | <ol style="list-style-type: none"> 1) Science and Technology Department, GoMP | <ol style="list-style-type: none"> 1) Proposed District Level Climate Change and Environment Committee |

6.5. Sustainable Development Goals being addressed

| SDGs | Targets | Sector (sub-sectors) addressing the recommendation |
|---|---|--|
|  SDG 1: No Poverty | Target 1.4: Ensure that all men and women, in particular the poor and the vulnerable, have access to basic services | Waste |
|  SDG 2: Zero Hunger | Target 2.1: End hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round | AFOLU (agriculture) |
| | Target 2.3: Double Agricultural Productivity | AFOLU (agriculture) |
| | Target 2.4: Implement resilient agricultural practices that increase productivity and production | AFOLU (agriculture) |
| | Target 2.a: Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research | AFOLU (agriculture) |
| | Target 2.a; Article 10.3.e: Development of sustainable irrigation programmes for both crops and livestock. | AFOLU (agriculture and livestock) |

| SDGs | Targets | Sector (sub-sectors) addressing the recommendation |
|--|--|---|
| SDG 3: Good Health and Well-being  | Target 3.3: End the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases | Co-benefits from waste |
| | Target 3.4: Reduce by one-third premature mortality from non-communicable diseases through prevention | Co-benefits from waste |
| | Target 3.9: Substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination | Waste, air pollution Waste, energy (industry) |
| SDG 6: Clean Water & Sanitation  | Target 6.3: Improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally | |
| | Target 6.4: Substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals | Energy (habitat – demand-side management, by-laws for new construction; industry); AFOLU (agriculture and green spaces) |
| | Target 6.5: Implement integrated water resources management at all levels | AFOLU (agriculture and green spaces/forestry) |
| | Target 6.8: Support and strengthen the participation of local communities | Waste |
| | Target 6.a: Expand international cooperation and capacity-building support to developing countries in water-and sanitation-related activities and programmes, including wastewater treatment, recycling and reuse technologies | Waste; AFOLU; Transport |
| SDG 7: Affordable & Clean Energy  | Target 7.1: Ensure universal access to affordable, reliable and modern energy services | Energy (power and energy; habitat); AFOLU (agriculture) |
| | Target 7.2: Increase share of renewable energy in energy mix | Energy (power and energy; transport; habitat – energy efficiency in building and bye-laws for new construction; industry) |
| | Target 7.3: Double the global rate of improvement in energy efficiency | Energy (power and energy; habitat; industry) |
| | Target 7.a: Enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology | Energy (power and energy) |
| | Target 7.b: Expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries in accordance with their respective programmes of support | Energy (power and energy); AFOLU |
| SDG 8: Decent Work and Economic Growth  | All targets | AFOLU (agriculture and livestock) |
| | Target 8.2: Achieve higher levels of economic production through diversification, upgradation and innovation | Energy; AFOLU (agriculture and livestock) |
| | Target 8.4: Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production | Waste |
| | Target 8.9: Devise and implement policies to promote sustainable tourism | Wetland; AFOLU (agriculture and livestock) |

| SDGs | Targets | Sector (sub-sectors) addressing the recommendation |
|--|---|--|
| SDG 9: Industry, Innovation and Infrastructure  | Target 9.1: Develop quality, reliable, sustainable and resilient infrastructure | Energy (habitat – energy-efficiency in building and transport); waste |
| | Target 9.2: Promote inclusive and sustainable industrialization | Energy (industry) |
| | Target 9.3: Improving access and connectivity to industries/other enterprises | Energy (transport) |
| | Target 9.4: Upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes | AFOLU (agriculture); waste; energy (industry) |
| | Target 9.5: Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending | Energy (power and energy); waste |
| | Target 9.b: Research and innovation in developing countries, including by ensuring a conducive policy environment | Waste; energy (power and energy, industry); air pollution |
| SDG 11: Sustainable Cities and Communities  | Target 11.1: Ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums | Waste |
| | Target 11.2: Safe, affordable, accessible and sustainable transport systems for all | Energy (transport); air pollution |
| | Target 11.3: Enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management | Waste; energy (power and energy; habitat – energy efficient building); all district-specific sectors |
| | Target 11.4: Strengthen efforts to protect and safeguard the world's cultural and natural heritage | Wetland |
| | Target 11.6: Reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management | Waste, energy (power and energy, transport, industry) and air pollution |
| | Target 11.7: Provide universal access to safe, inclusive and accessible, green and public spaces | AFOLU (green spaces); habitat; air pollution |
| | Target 11.a: Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening regional development planning | Energy (transport and industry); AFOLU |
| Target 11.b: Substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change | Energy; AFOLU; waste | |

| SDGs | Targets | Sector (sub-sectors) addressing the recommendation |
|--|---|--|
| SDG 12: Responsible Consumption and Production  | Target 12.1: Implement the 10-year framework of programmes on sustainable consumption and production, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries | Energy; waste |
| | Target 12.2: Achieve the sustainable management and efficient use of natural resources | Energy; AFOLU; waste; air pollution |
| | Target 12.3: Halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses | AFOLU; waste |
| | Target 12.4: Achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil | AFOLU; waste; air pollution |
| | Target 12.5: Substantially reduce waste generation through prevention, reduction, recycling and reuse | Waste; energy (habitat and industry) |
| | Target 12.6: Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle | Waste; energy (industry) |
| | Target 12.8: Ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature | Individual action and behavioural change communication |
| | Target 12.a: Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production | Waste; AFOLU (agriculture and livestock) |
| SDG 13: Climate Action  | All targets | All sectors |
| SDG 14: Life under Water  | Target 14.1: Prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution. | Waste (single use plastic) |
| SDG 15: Life on Land  | Target 15.1: Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements | AFOLU; waste; and wetland |
| | Target 15.2: Promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation | AFOLU (forestry/green spaces) |
| | Target 15.3: Combat desertification, restore degraded land and soil | AFOLU (forestry/green spaces) |
| | Target 15.5: Take urgent and significant action to reduce degradation of natural habitats, halt loss of biodiversity | Wetland, AFOLU |
| | Target 15.9: Integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies | AFOLU |
| | Target 15.a and 15.b: Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity, ecosystems and sustainable forest management | AFOLU; wetland |
| SDG 17: Partnerships for the Goals  | Target 17.7: Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries | Energy; AFOLU; waste |
| | Target 17.16: Enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the sustainable development goals in all countries, in particular developing countries | Energy; AFOLU; waste |

6.6. Promoting voluntary individual climate action

Waste management



- 1 Practice source segregation and handover segregated waste: biodegradable, non-biodegradable, domestic hazardous waste and household clinical waste.
- 2 Go for sustainable tourism/eco-tourism or tourism efforts for lowered waste footprint.
- 3 Electronic brand website gives information on e-waste collection points, ensure formal recycling of your electronic products by going through the collection points.
- 4 Responsibly dispose your e-waste: send them to a recycler, producer (manufacturer), producer responsibility organisation or dispose during local e-waste collection drives.
- 5 Say no to personal care products using microplastics/microbeads, read the labels before buying.
- 6 Say no to easily avoidable single use plastic products, like, plastic cutlery, straws, plastic carry bags, pouch products, food wraps, multi-layered packaging products.
- 7 Choose products with: a) less packaging waste, b) sustainable packaging, c) displayed higher product lifespan, d) displayed recycling/resource recovery efforts and information.

Housing

- 1 Insulate the building as much as possible, ensure proper sealing of doors and windows to avoid cooling/heating leakage.
- 2 Develop and maintain provision for rainwater harvesting.
- 3 Install solar rooftop panels, if feasible.
- 4 Adopt wastewater recycling and reuse.
- 5 Rooftop gardens can considerably reduce space cooling requirement.



Lighting



- 1 Switch off lights and fans when not required.
- 2 Replace incandescent bulbs with LEDs.
- 3 De-dust lighting fixtures to maintain illumination.
- 4 Smart LEDs are even more convenient – they can be controlled even when the person is not at home.

Kitchen

- 1 While cooking on gas stove, use moderate flame setting to conserve LPG.
- 2 Prefer the use of pressure cookers.
- 3 Keep the burner clean.
- 4 Use lids to cover the pan while cooking.
- 5 Use flat bottomed pan on electric stove.
- 6 Turn off electric stove several minutes before the specified cooking time.



Other climate-conscious precepts



Be mindful of water consumption. Use bucket instead of shower. Use bucket instead of hose for cleaning cars/ porch/back-yard. Opt for dual-flush toilets. Close the tap while brushing. Reuse RO reject water.



Carry your own bottled water, adopt minimalist lifestyle to reduce overconsumption of resource, purchase only when necessary.



Go for climate conscious producers/ manufacturers. Develop a knowledge and preference for locally available and sustainably produced and designed products.



If possible, opt for work from home option for a few days in a week.



Encourage elected representatives and policy makers to opt for green choices/deals/decisions.



Choose standard shipping while ordering online.



Buy locally available produces, especially food, items vegetables and other perishable products.



Invest time and effort in greening local areas through collective community action.



Develop a habit of repair and reusing appliances and products at home instead of buying new ones. Follow reduce, reuse and recycle principles in the household to reduce footprint.



Include more meat-free meals and limit food wastage.



Buy local and organic food items not only for health but also to cut down emissions from transport and chemical fertilisers.



Opt for water saving fittings and fix any leakages in the house.

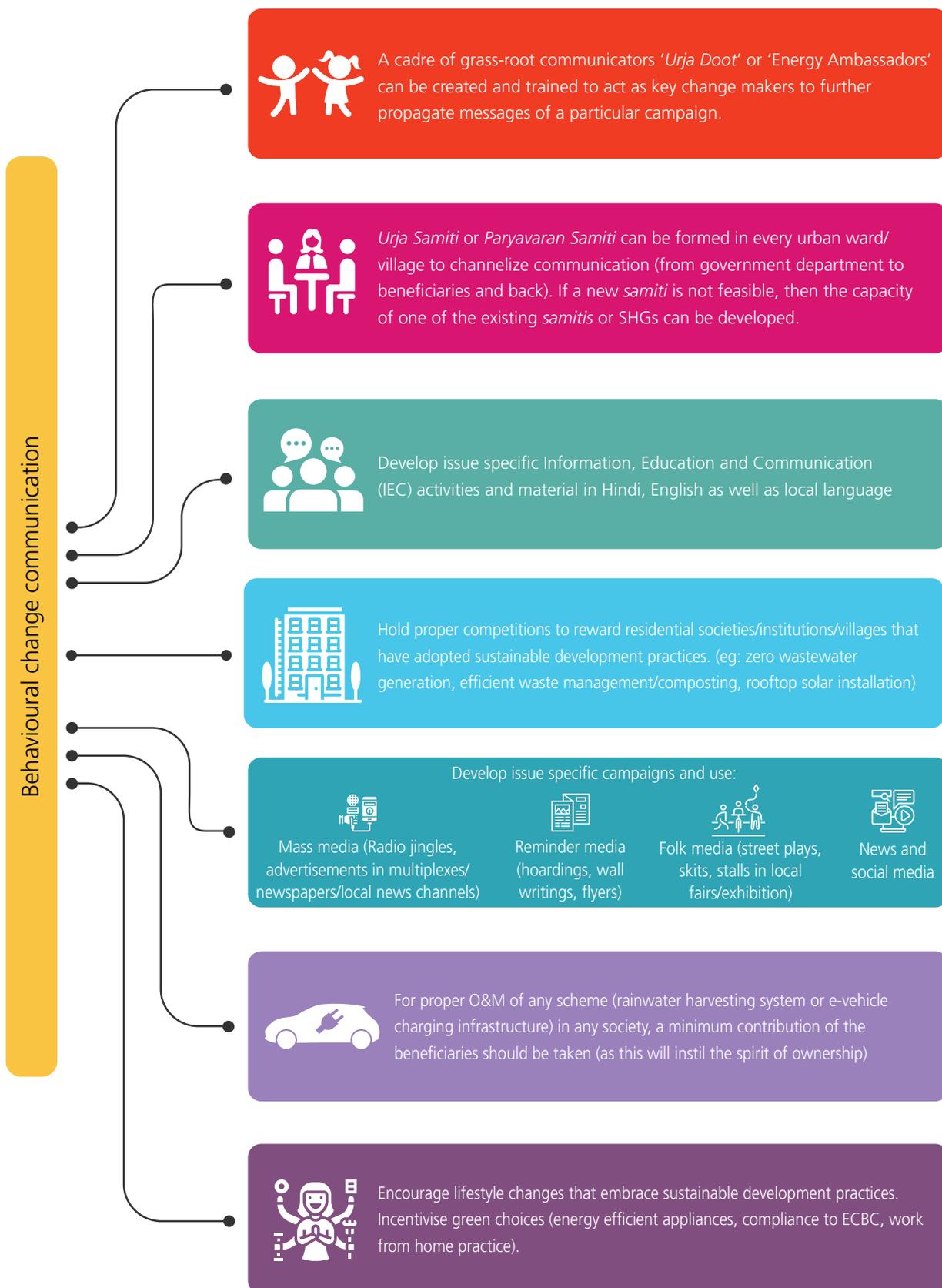
Daily use appliance

-  Purchase BEE star-rated energy efficient appliances
-  Shift consumption to off-peak hours (i.e. other than 10 am to 8 pm)
-  Replace electric water heater with a solar water heater, if feasible
-  Unplug idle devices/appliances.
-  A power strip can be used to reduce plug load. Devices such as desktops, TVs, microwaves, etc. use standby power even when off. Switching off the power strip has the same effect as unplugging all devices
-  Proper maintenance of air conditioners helps to increase efficiency
-  Do not overload the refrigerator
-  Set the AC thermostat at 25°-26°C, for optimum cooling

Transport

-  Choose direct flights to reduce carbon footprint
-  Travel light to reduce carbon emissions
-  Strictly abide by pollution norms
-  Put on your shoes for short trips
-  Ensure regular maintenance of vehicles
-  Choose inter-modal transport (private + public)
-  Reduce demand for vehicle travel by expanding personal mobility choices such as car-sharing and bike-sharing
-  Shift to clean, non-petroleum fuels such as electricity (through RE) to power vehicles
-  Car pool to work, Use bicycles park and ride
-  Switch off the ignition at traffic signals

6.7. Behavioural change communication (BCC) techniques





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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