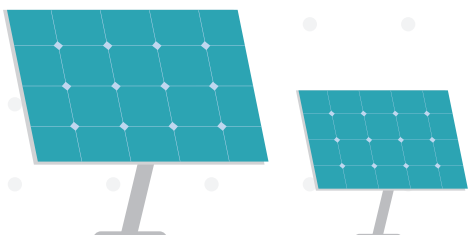


January, 2022



Climate Change and Environment Action Plan of **Nagpur District** **Recommendations**



Prepared By



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.

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 under 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

Nagpur, Maharashtra

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Top left image:












Korari thermal power station, Nagpur

Bottom right:

Western coal field

Land use map of Nagpur district:

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

| | | | | |
|---|--|---|--|---|
|  Built-up land |  Cropland |  Fallow land |  Coal mine |  Barren land |
|  Forest (Deciduous, broadleaf) |  Mixed forest |  Plantations |  Shrubland |  Wasteland |
|  Water bodies | | | | |



Climate Change and
Environment Action Plan of

Nagpur District

Recommendations

Prepared By



Supported By





R. Vimala I.A.S.

Collector & District Magistrate



Foreword

Climate change has emerged as a global threat, prompting nations to come together to tackle the challenge. India announced its intention to achieve net zero emissions by 2070 and other ambitious targets at COP26 at Glasgow in November, 2021.

To achieve these goals, it is imperative that all the states commence their climate actions immediately and contribute towards the national targets. Maharashtra is leading by example through its ambitious initiatives to combat climate change such as the Majhi Vasundhara Abhiyan, the Project on Climate Resilient Agriculture (PoCRA) and the latest Electric Vehicle Policy, among many others. Further, Maharashtra has joined the Race to Resilience, and 43 cities in the state, including Nagpur, have announced their commitment for Race to Zero, both international pledges aimed at sustainable and low carbon development. In recognition of its efforts, the Maharashtra government received an award for 'Inspiring Regional Leadership' at the COP26 summit.

While state level policies and initiatives are being put in place, I am happy to share, a first of its kind, 'Climate Change and Environment Action Plan'(CCEAP) of Nagpur district prepared by Vasudha Foundation with support from Shakti Sustainable Energy Foundation. This Action Plan has been developed in consultation with the district administration and Nagpur Municipal Corporation with an aim to contribute towards state and national climate actions. The action plan is a comprehensive assessment of the climate variability and projections, sectoral greenhouse gas emissions, and climate change drivers in the district. Based on the assessment, the plan identifies various local level interventions, which are in line with state and national-level policies and programmes. It also incorporates a comprehensive set of recommendations, in alignment with Sustainable Development Goals (SDGs), for various climate-related sectors and environmental issues of Nagpur district, as well as estimates mitigation potential of each sector.

I appreciate the efforts made towards developing the CCEAP for Nagpur district. The recommendations given in this Action Plan may be used by the relevant departments for mainstreaming climate action in alignment with the district's development priorities.

With best wishes,

(R. Vimala)

13/11/2022

Shri Radhakrishnan B., IAS
Municipal Commissioner
NMC
Government of Maharashtra

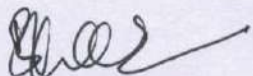
Preface

The recently concluded United Nations climate summit, COP26 at Glasgow, was a much-awaited conference specially for climate vulnerable countries seeking tangible action on anthropogenic GHG emissions. India has made ambitious commitments of generating 500 GW energy from non-fossil fuel sources and achieving net zero by 2070 at COP26.

Owing to its sheer size and diversity, India is one of the most climate vulnerable countries in the world. In the past few decades, India has witnessed an alarming rise in the frequency and intensity of extreme events such as floods, droughts and heatwaves among others. To tackle these emerging threats, India formulated its National Action Plan for Climate Change more than a decade ago and has since then also taken many initiatives and participated in multiple international commitments to combat climate action.

In addition to this, formulation of State Action Plans for Climate Change has helped streamline action at the state level. The Government of Maharashtra has made several proactive commitments to ensure low carbon growth and sustainable development through various initiatives. Following the concept of bottom-up approach a "Climate Change and Environment Action Plan" for Nagpur district has been developed. This Action Plan captures the current profile and priorities of Nagpur and provides region specific recommendations for various climate relevant sectors.

I am certain that this Action Plan will serve as a roadmap for both district and municipal level planning efforts to integrate climate action and development. I appreciate that Vasudha Foundation with support from Shakti Sustainable Energy Foundation has undertaken this detailed study in consultation with Nagpur Municipal Corporation, district administration and other stakeholders.


(Radhakrishnan B.)

ACKNOWLEDGEMENTS

We would like to thank Ravindra H Thakare, IAS (Collector & DM, Nagpur) for his inputs and appreciation of the plan, which have been vital in the development of the Climate Change and Environment Action Plan for Nagpur district.

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

We extend our gratitude towards other departments and organizations – Shweta Banerjee (Superintending Engineer, Environment, NMC), Pradeep Dasarwar (Deputy Municipal Commissioner, NMC), M.K. Rao, IFS (PCCF (IT&P), Nagpur), A.P. Dharamadhikari (Joint Director of Industries, Nagpur), Kaushik Chakraborty (GM, Environment, WCL) and officials from Forest Department and MEDA for inputs and suggestions to refine the action plan.

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.



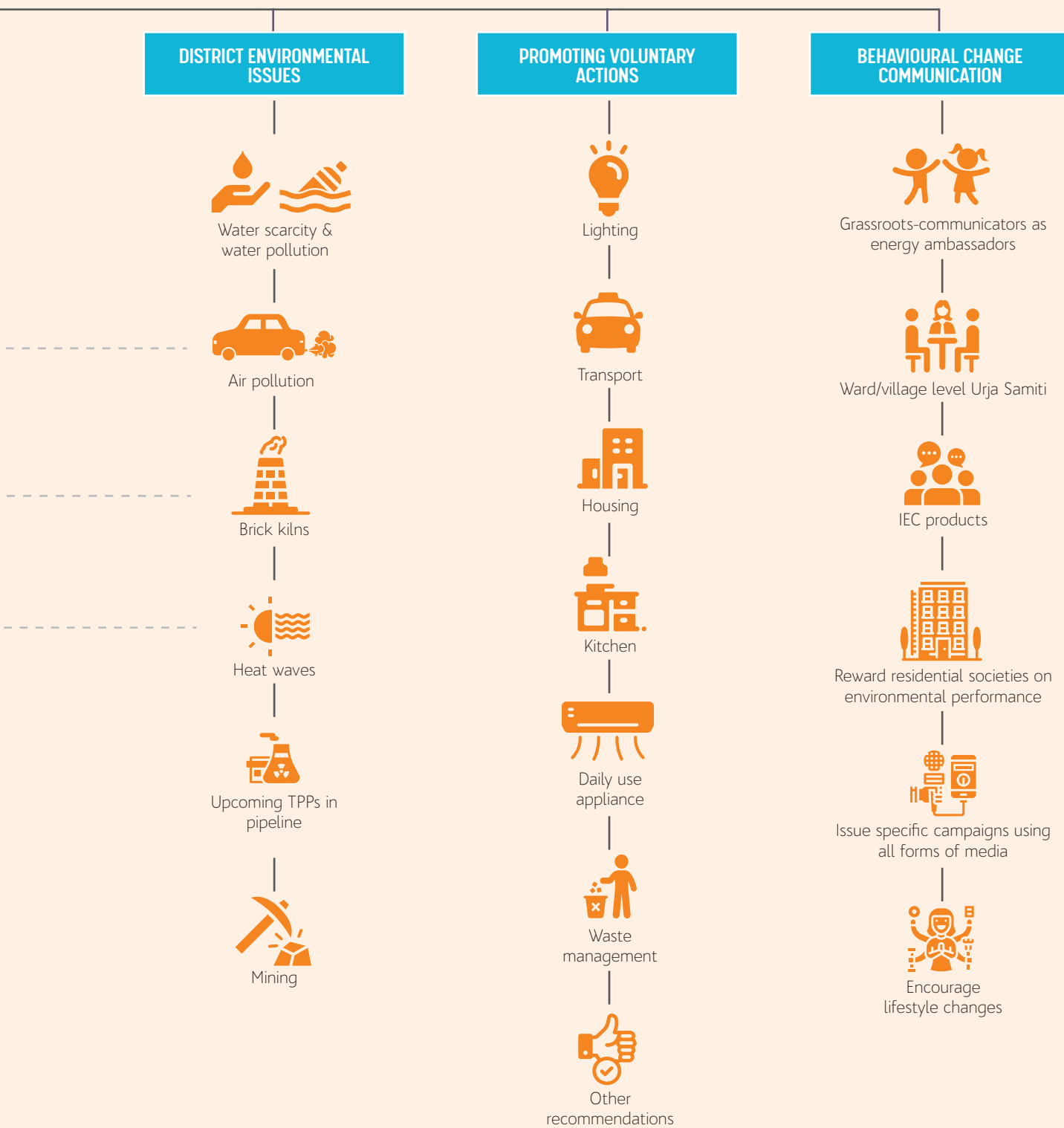
RECOMMENDATIONS



Existing parking spaces can be equipped with e-vehicle charging infrastructure



Figure 2 Recommendations for CCEAP Nagpur



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

1. 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 Action 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.
- The recommendations, if implemented, have the potential to mitigate 68,66,857 tCO₂e in the energy sector, 17,54,734 tCO₂e in AFOLU and 44,914.26 tCO₂e in waste sector.
- 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 recommendations are based on district-specific ground realities and situations.
- The state and district vision documents were factored in while developing the recommendations. Additionally, the recommendations are developed in synergy with actions in Maharashtra government's Majhi Vasundhara mission.
- Information provided on timeframe and framework for implementation would help the district authorities and concerned departments prioritise actions.
- List of existing policies, programmes and schemes that can help streamline actions is provided along with the concerned primary and supporting departments in a 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 | | | | |
| Increase the share of renewable energy (RE) generation by advancing rooftop and ground-mounted installations and other RE installations. |   | Short to medium-term (government buildings) Medium-term (commercial buildings) Medium to long-term (residential and others) | Policy framework and RE targets exist (section 6.1.1.1) Need to create awareness in residential sector | <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>Maharashtra has only 647.73MW (as of February 2021) of solar rooftop capacity.</p> <p>In Maharashtra, in 2020, off-grid solar rooftops were installed by MEDA in 26 out of targeted 31 government buildings, with an upper cap of 20kW.</p> <p><i>Case example calculation:</i></p> <p>a) If equipped with solar rooftops, the government schools in Nagpur district alone can generate 55.34 MUs of electricity, thereby avoiding 47,600 tCO₂e emissions, annually.</p> <p>b) If 50% households are equipped with solar rooftops, total potential installed capacity would be 4,800 MW, which can help avoid 6.29 Mt CO₂e emissions, annually.</p> <p>Meeting the solar rooftop targets can be expedited by making it mandatory for the hospitality industry / new construction (having a built-up area greater than 20,000 sq. ft) / private healthcare infrastructure (above certain bed-capacity).</p> <p>Ground mounted solar: The current installed capacity of ground mounted solar in Maharashtra stands at 1.64 GW (as of February, 2021).</p> <p>Nagpur district has a huge potential for solar power generation (rooftop and ground mounted). In the highly industrialised and urbanised Nagpur city, solar rooftop installation can be promoted. For the remaining part of the district, ground mounted solar installations can be more viable.</p> |
| Battery storage for RE to be aggressively promoted. |    | Short to medium-term | Additional financial support can be created | <p>MEDA has installed 650 Ah (Ampere hour) batteries for a few solar projects in Maharashtra.</p> <p>MEDA has also proposed, and installed a few hybrid inverters for RE projects across Maharashtra. Hybrid inverters take power from RE/battery installation up to a particular load, and on increased load demand, switch to the grid supply.</p> |







| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|---|--|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Encourage captive use of renewable energy, particularly in rural areas for small industries and creation of local entrepreneurs. |   | Short to medium-term | <p>Policy framework exists (section 6.1.1.1)</p> <p>Need to create awareness</p> | <p>By 2030, the electricity demand for Nagpur district is expected to be around 11,000 MUs annually. If all of this electricity demand were to be met from coal, it would lead to 9.5 MtCO₂e emissions, 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>Cold storage and other rural non farm productive use appliances across the district can be powered by DRE. Such set-ups could also be used for reliable storage of vaccines besides farm produce.</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 | <p>Policy framework and schemes exist (section 6.1.1.1)</p> | <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 (International Energy Agency, 2021).</p> <p>SLNP had a national target of replacing 1.34 crore conventional street lamps with LED lamps by March 2020, but as of September 16, 2021, only 1.22 crore LED lamps have been installed.</p> <p>Replacement of the existing 79,548 conventional lamps in Nagpur district with LED lamps under SLNP can potentially avoid 41,898 tCO₂e emissions, annually.</p> |
|---|---|------------|---|---|



| 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 MSEDCL 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 such as:</p> <p>(a) Time of day (TOD)/time of use (TOU) billing</p> <p>(b) Prediction and management of peak demand</p> <p>(c) Providing real time energy consumption data to the consumer</p> <p>(d) Prepaid billing facility</p> <p>(e) Remote connection and disconnection of load</p> <p>(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 meters across the country with smart meters.</p> <p><i>Case example:</i></p> <p>Adani Electricity Mumbai Limited has announced plans to install over 7,00,000 smart meters in Mumbai. The Maharashtra Electricity Regulatory Commission (MERC) has approved capital expenditure schemes for the installation of smart meters.</p> <p>In Delhi, Tata Power Delhi Distribution Limited has installed 2,00,000 smart meters in partnership with Landis+Gyr and Siemens across its domestic, industrial and commercial consumer segments under its AMI project. These smart meters have proved to be extremely beneficial for the DISCOM in raising bills based on actual readings instead of provisional ones during the lockdown in April-May 2020. The company managed to raise over 3,50,000 bills during this period, and avoided over 1,50,000 visits to consumer premises per month.</p> <p>Under National Smart Grid Mission, smart grid pilot project was planned for MSEDCL to be implemented at Congress Nagar, Nagpur in 2016. The approved project cost is ₹ 139.15 crore and the project aimed to cover 1.25 lakh consumers. So far, there is no progress reported for this in the monthly update documents on the NSGM.</p> <p>Commencement of the project can help MSEDCL, and subsequently Nagpur district would reap the benefits.</p> |






| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|---|---|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| Replace/upgrade existing inefficient pumping infrastructure with energy efficient pumps/ solar pumps (where possible) for supply of piped drinking water in both rural and urban pockets of Nagpur district. |   | 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>One of the objectives of the Maharashtra State Energy Conservation Policy, 2017 is to promote energy conservation measures in the street lighting systems and water pumping systems, both of which show significant energy conservation potential. Around 4% of the energy consumed in the state is through the state water supply and around 2% is through street lighting systems.</p> <p>MEDA provides financial assistance of up to ₹ 50 lakh through Energy Service Company (ESCO) to ULBs for implementing energy savings projects of street lighting and water pumping schemes.</p> <p>All the ULBs in Nagpur, in co-ordination with the relevant departments can avail the financial assistance/ benefits of the scheme to make their systems energy efficient.</p> |
| In agriculture, promote energy-efficient water pumps (provided by EESL) and solar pumps, wherever possible (through PM-KUSUM Yojana). |   | Short to medium-term | Policy framework exists (section 6.1.1.1) | <p>According to BEE, 30% to 40% energy savings are possible in agriculture by adoption of energy-efficient star labelled pump sets.</p> <p>Conversion of the existing electricity/ diesel-operated tube-wells (those with permissions of operation under the Groundwater Development and Management Rules, 2018) to solar in Nagpur district can potentially reduce substantial GHG emissions.</p> |
| <p>Increase community awareness on and access to energy-efficient appliances and fixtures.</p> <p>Provide additional incentives over and above existing schemes/ programmes on energy-efficient appliances.</p> <p>(Other recommendations pertaining to energy efficiency are listed under sections on 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 can be created</p> <p>Create awareness through dedicated IEC and long running campaigns</p> | <p>Case example: BSES Yamuna Power Ltd. (BYPL) launched an AC replacement scheme in Delhi NCR, with the objective to promote energy efficiency and green initiatives among households and bring down the power consumption in the National Capital Region. Under the programme, upfront rebate per air conditioner (BEE 5 star rated/ inverter) has been offered by BYPL to the consumer in exchange of their old non-star rated air conditioner.</p> <p>MSEDCL can implement a similar scheme in its area of supply, with a pilot in Nagpur district.</p> |

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







| Sub-sectors | Policies and programmes ¹ 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. Maharashtra State Renewable Energy Policy, 2020 2. Policy for Grid-connected Solar Projects 3. Off-Grid Policy, 2020 4. Grid connected Wind power projects 5. National Solar Mission 6. i-SMART Project 7. PM KUSUM | <ol style="list-style-type: none"> 1. MEDA, GoM 2. Industries, Energy and Labour Department, GoM | <ol style="list-style-type: none"> 1. ALL ULBs 2. Maharashtra Electricity Regulatory Commission (MERC). 3. Urban Development Department, GoM 4. Department of Rural Development and Panchayat Raj, GoM 5. Department of Housing, GoM 6. Department of Environment and Climate Change, GoM 7. MSEDCL 8. Department of Agriculture, GoM 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. Maharashtra State Energy Conservation Policy, 2017 2. Smart Meter National Programme (SMNP) 3. National Smart Grid Mission 4. Integrated Power Development Scheme, 2014 5. Streetlight National Programme (SLNP), 2015 6. UJALA Scheme, 2015 7. Standards and Labelling Programme 8. Sustainable Habitat Mission 9. Smart Cities Mission 10. National Mission for Enhanced Energy Efficiency 11. Municipal Energy Efficiency Programme (MEEP) 12. PM KUSUM 13. Maharashtra State Renewable Energy Policy, 2020 | <ol style="list-style-type: none"> 1. MSEDCL 2. MEDA, GoM 3. BEE (EESL) 4. All ULBs 5. Panchayati Raj Institutions (PRIs) 6. Industries, Energy and Labour Department, GoM | <ol style="list-style-type: none"> 1. Department of Environment and Climate Change, GoM 2. Department of Agriculture, GoM 3. Urban Development Department, GoM 4. Nagpur Smart and Sustainable City Development Corporation Limited (NSSCDCL) 5. Proposed District level Committee on Climate Change and Environment |









¹ This column enlists information on policies, programmes, rules, schemes and other regulatory provisions pertaining to the sector

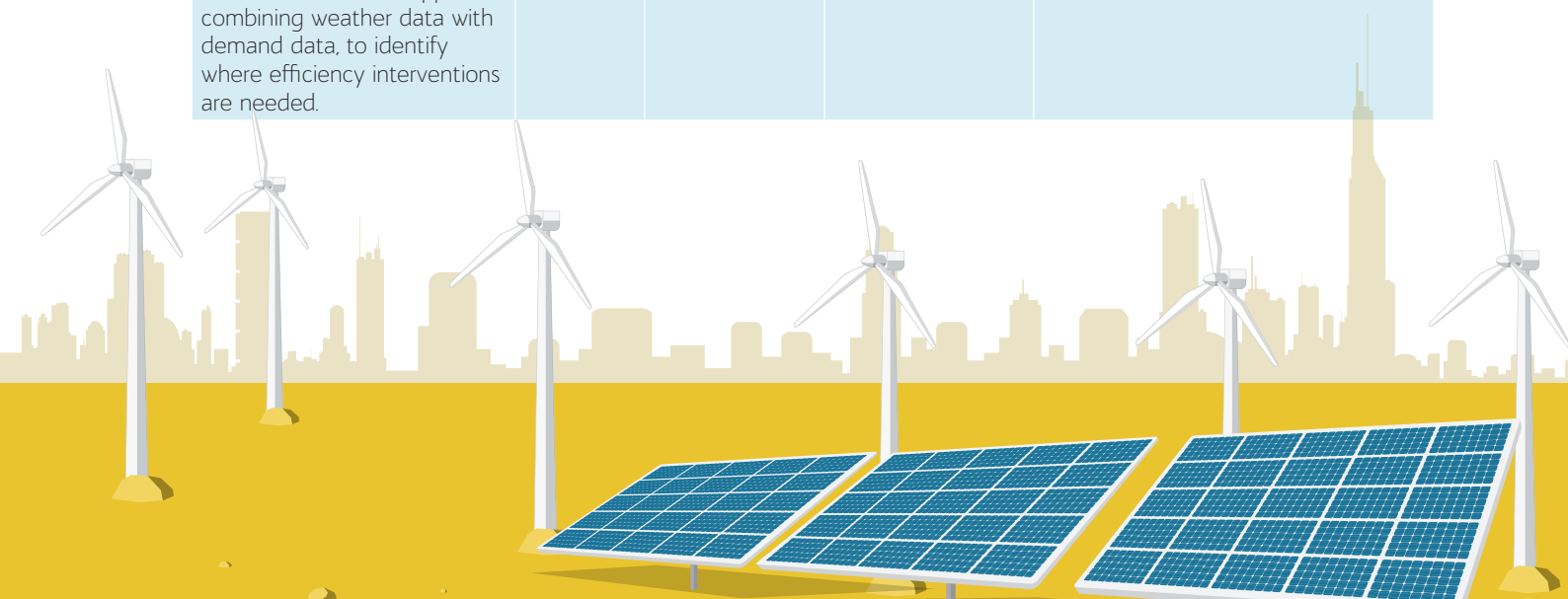
6.1.2 Habitat (urban and rural development): Recommendations, cross-cutting sectors, qualifying priority and district scenario

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|--|---|---|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Energy efficiency in buildings | | | | |
| Incorporate Energy Conservation Building Code (ECBC) in the building bye-laws and encourage green building rating programs by incentivising ULBs, as a pathway to buildings having net zero energy consumption. |    | Medium to long-term | Policy framework exists (section 6.1.2.1) Inter-departmental collaboration required Need capital incentives/relevant exemptions over and above the existing provisions from the district administration | The residential and commercial sectors in Nagpur contribute to around 27% of the total electricity consumed in the district. MEDA is working to incorporate ECBC into building compliance systems in Maharashtra. In 2019, Indian Green Building Council (IGBC), agreed to sign an MoU with Nagpur Smart and Sustainable City Development Corporation Limited (NSSCDCL) for a period of three years to construct all new buildings as per the green building norms to use less water, optimise energy use, conserve natural resources, and generate less waste as compared to conventional buildings. |
| District administration, in collaboration with the ULBs can implement the India Cooling Action Plan (ICAP) and achieve its objectives. District administration can also explore the possibilities of piloting solar-passive architecture/other renewable energy technologies in a few of its iconic buildings. Implementing this at the district level could help avoid significant GHG emissions. |   | Medium-term | Policy framework exists (section 6.1.2.1) Needs inter-departmental collaboration Need capital incentives/relevant exemptions from the district administration | In September 2018, India became the first country in the world to have a Cooling Action Plan which seeks to: (i) Reduce cooling demand across sectors by 20% to 25% by 2037-38, (ii) Reduce refrigerant demand by 25% to 30% by 2037-38, (iii) Reduce cooling energy requirements by 25% to 40% by 2037-38, (iv) Recognise “cooling and related areas” as a thrust area of research under national S&T Programme, (v) Training and certification of 1,00,000 servicing sector technicians by 2022-23, synergising with Skill India Mission. The plan aims to provide the following benefits: (i) thermal comfort for all – provision for cooling for 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. |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|---|--|---|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Replace diesel powered backup with solar-powered or other RE powered backup in a phased manner. This can essentially be promoted in government / commercial / institutional buildings with built-up area above certain sq. ft. |  | Short to medium-term (government buildings) Medium to long-term (privately owned, commercial, institutional, and others) | Policy intervention is required Proper policy backup can mitigate GHG emissions and align India with Paris targets Needs inter-departmental collaboration | A DG set of 200kW, (used in industries/huge commercial buildings) operating at full-load consumes approximately 45 litres diesel/hour. This results to an emission of around 117 kgCO ₂ e/hour. Replacing DG sets with solar powered backup could help in avoiding these emissions. If 50% of the DG sets in the district are replaced with solar powered backup then 67,359 tCO ₂ e emissions could be averted annually. |
| Upgrade public transport infrastructure to include RE and ECBC compliance. Roadside hoardings near such infrastructure can also be powered through RE. |   | Short to medium-term | Can be pushed forward by aligning with existing policy framework for solar rooftop (section 6.1.2.1) ECBC compliance of public transport infrastructure to be mandated by building bye-laws | Nagpur district can adopt and implement initiatives, similar to the one in Lucknow, where the municipal corporation has planned to set up 200 solar-powered bus stops. |
| 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. 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 for the energy market. |  | Medium-term | Deploying public funding schemes like feed-in tariffs, leverage national and international funds, and providing digital upskilling opportunities to citizens can help promote the initiative. | |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|--|---|---|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Encourage fast penetration of UJALA scheme in every household of Nagpur district. |  | Short to medium-term | Schemes and programmes are available (section 6.1.2.1) | <p>The UJALA scheme provides an LED bulb at a nominal price for replacement of incandescent lamps / conventional bulbs.</p> <p>A projected estimated number of LED bulbs to be used in the households of Nagpur district through implementation of UJALA scheme by 2025 can potentially avoid emission of 0.42 MtCO₂e annually.</p> <p>Under the recently launched Gram Ujala programme by CESL (Convergence Energy Services Ltd.), 7 watt and 12-watt LED bulbs with three years of warranty will be given to rural consumers on submission of working incandescent bulbs, at a price of ₹ 10/LED bulb. Consumers can exchange a maximum of five incandescent bulbs with LED bulbs. In the first phase of this programme, 15 million LED bulbs will be distributed across villages of Aarah (Bihar), Varanasi (Uttar Pradesh), Vijaywada (Andhra Pradesh), Nagpur (Maharashtra), and villages in western Gujarat. The programme will be financed entirely through carbon credits and will be the first such programme in India.</p> |
| Enhance public awareness for switching to energy efficient BEE star-labelled home appliances. |   | Short-term and continuous | Needs collaboration and awareness | |
| Demand-side management for Habitat | | | | |
| Promote and subsidise good practices for all ULBs, such as installing rainwater harvesting setups in buildings, to considerably reduce energy dependence (submersible motors) for groundwater pumping. |    | Short-term | <p>Schemes and programmes exist (section 6.1.2.1)</p> <p>Need to generate awareness</p> | <p>Since 2005, rainwater harvesting is mandatory in all buildings, layouts of open spaces, amenity spaces of housing societies and new constructions of area equal to or more than 300 sq. m in Nagpur. They shall have one or more rainwater harvesting structures such as an open well or bore well, or underground storage tank or percolation pits. The bye-law envisages that no building permission will be granted unless provision is made for rainwater harvesting. The owner/society also has to ensure the maintenance of these structures. In the case of non-compliance with the aforementioned rules, NMC would levy a fine of up to ₹ 1000/annum/100 sq. m of built-up area.</p> |


| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|--|--|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| 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 required Need to create awareness | Water metering can help save 25 to 30% water every year. In November 2011, NMC launched its uninterrupted water supply scheme, called 24x7 Water Supply Scheme. One of the objectives of the scheme was to install water meters in 3.09 lakh households in Nagpur by 2018, against which only 1.60 lakh were installed. The project is being implemented by private operator – Orange City Water Private Limited. |
| Encourage residential societies to install 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 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, Nagpur 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) Maharashtra State Energy Conservation Policy, 2017 2) ECBC 2017 / IGBC rating system 3) India Cooling Action Plan, 2018 4) UJALA Scheme, 2015 5) Maharashtra State Renewable Energy Policy, 2020 6) Policy for Grid-connected Solar projects 7) Off-Grid Policy, 2020 8) Smart Cities Mission 9) Sustainable Habitat Mission | <ol style="list-style-type: none"> 1) Department of Housing, GoM 2) MEDA 3) All ULBs 4) Nagpur Smart and Sustainable City Development Corporation (NSSCDCL) 5) Panchayati Raj Institutions (PRIs) | <ol style="list-style-type: none"> 1) MSEDCL 2) Department of Environment and Climate Change, GoM 3) Urban Development Department, GoM 4) Department of Rural Development and Panchayat Raj BEE (EESL) 5) Maharashtra State Road Development Corporation Limited (MSRDCL) 6) Maharashtra Transport Department 7) Proposed District level Committee on Climate Change and Environment |
| Demand-side management for Habitat | <ol style="list-style-type: none"> 1) Maharashtra State Energy Conservation Policy, 2017 2) Maharashtra State Water Policy, 2019 3) ECBC 4) Building bye-laws | <ol style="list-style-type: none"> 1) Department of Housing, GoM 2) All ULBs 3) Panchayati Raj Institutions (PRIs) | <ol style="list-style-type: none"> 1) Urban Development Department, GoM 2) Department of Rural Development and Panchayat Raj, GoM 3) Water Supply and Sanitation Department, Maharashtra, GoM 4) Nagpur Smart and Sustainable City Development Corporation (NSSCDCL) 5) Proposed District level Committee on Climate Change and Environment 6) Department of Environment and Climate Change, GoM |

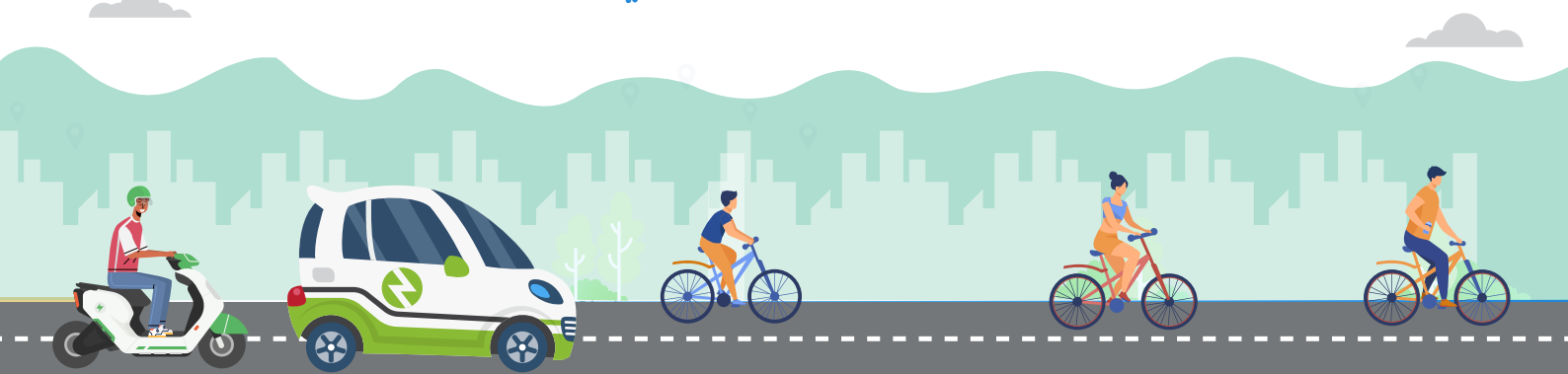
6.1.3 Transport: Recommendations, cross-cutting sectors, qualifying priority and district scenario







| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|--|--|---|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Promote e-mobility | | | | |
| Generate awareness and disseminate information to encourage adoption of electric vehicles. |  | Short-term and continuous | Inter-departmental collaboration and dedicated long-running campaigns required | <p>Maharashtra EV Policy, 2021 aims to promote a sustainable transport system through EV infrastructure development in major urban centres in the state, including Nagpur.</p> <p>The policy states that awareness programs will be designed and implemented by the state government in partnership with industry players and civil society organisations. The programme will aim to create awareness on EVs, their benefits and incentive support available under state and central government policies.</p> |







| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|--|--|--|---|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Increase 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 | <p>The Maharashtra Electric Vehicle Policy, 2021 aims to increase the modal share of electric vehicles in major cities of Maharashtra, including Nagpur, through introduction of electric buses, two wheelers, three-wheelers, and cars in cities. The policy has set a target that by 2025, 10% of all new vehicle registrations in the state should be of electric vehicles.</p> <p>Further, to promote EV adoption, the policy offers subsidy of ₹ 5000/kWh on purchase of electric two, three and four-wheelers (capped at ₹ 10,000, ₹ 30,000 and ₹ 1,50,000, respectively), with further benefits to promote purchase of EV vehicles within the year.</p> |
| Make all public transport (PT) modes low carbon intensive, such as shifting of 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 | <p>In 2019, Nagpur Municipal Corporation launched India's first electric bus fleet for women in public transportation service under its 'Tejaswini' initiative. Six electric buses with CCTV security were launched in the city.</p> <p>Further, in 2020, NMC announced plans to procure 40 electric buses under FAME II.</p> <p>The Maharashtra EV Policy 2021 aims to electrify 25% of all public transport in major cities of the state including Nagpur.</p> <p>Furthermore, 15% of all MSRTC buses will be electrified by 2025.</p> <p>The policy provides incentives of up to ₹ 20,00,000 on purchase of electric buses to state transport undertakings.</p> |
| <p>Similarly, initiate transition of intermediate public transport (IPT) vehicles to electric by incentivising IPT operators through:</p> <ol style="list-style-type: none"> subsidies, separate lanes, dedicated parking spaces, replacement of lead acid battery-powered electric IPT vehicles with more sustainable Li-ion battery e-vehicles in a phased manner. |     | Medium-term | Policy framework exists (section 6.1.3.1) | <p>The Maharashtra EV Policy 2021 aims to promote transition of IPT to electric in the state through a number of incentives and non-fiscal benefits. Some major provisions regarding subsidies and parking spaces are as follows:</p> <ol style="list-style-type: none"> An incentive of ₹ 5,000/kWh to three-wheelers up to ₹ 30,000 is offered. Additional incentives for assured buyback and battery warranty of at least five years. ULBs are encouraged to provide lane and parking preferences to EVs. At least 25% of the total capacity of all dedicated off-road public parking spaces and the parking spaces of all institutional and commercial complexes to be made EV ready by 2023² Free parking provisions for EVs in all future public parking spaces. The state government shall engage and encourage financial institutions and banks to offer preferential interest rates for EV customer segments such as e-autos, goods carriers, and taxis. |

² A parking spot is defined as EV ready when it is provided with charging infrastructure and a separate meter connection








| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|--|---|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| 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. |    | Short to medium-term | Policy framework exists (section 6.1.3.1) | <p>The Maharashtra EV Policy, 2021 has announced that new vehicles inducted into the government fleet starting April 2022 will be electric-only.</p> <p>Further, it pushes for 100% conversion of the parking spaces of all government office complexes to be EV ready by 2025.</p> |
| <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) Adopt relevant policies,</p> <p>c) Prioritise land acquisition for setting up charging infrastructure,</p> <p>d) Introduce dedicated parking spaces for EVs with charging facilities,</p> <p>e) Incentivise restaurants and restaurant owners, fuel stops and other commercial spaces along the highways to install charging infrastructure for e-vehicles in order to make long journeys with e-vehicles hassle-free,</p> <p>f) Install integrated EV charging points within lampposts as a cost effective solution to reduce street clutter and to open access to charging facilities, particularly for those without garages. This can be initiated as a trial solution and scaled up further in the future.</p> |    | Medium-term | <p>Policy framework exists (section 6.1.3.1)</p> <p>Inter-departmental collaboration required</p> | <p>Nagpur was the first city in the country to have an electric charging station in 2017 (Business Standard, 2019). In 2020, first fast charging station for all types of electric vehicles in Nagpur was set (Hindustan Times Auto, 2020)</p> <p>Maharashtra State Electricity Distribution Company Ltd. (MSEDCL) has sanctioned installation of 500 electric vehicle charging stations across the state. In the first phase, it allocated funds for the installation of 10 electric charging stations across Nagpur.</p> <p>The Maharashtra EV Policy, 2021 aims to establish 150 charging stations in Nagpur by 2025. The policy provides incentives for setting up public and semi-public charging stations, both slow and fast across the city as well as offers rebates in property tax to residential owners setting up private charging stations.</p> <p>These incentives will only be provided after the charging station is functional.</p> <p>The policy mandates new residential buildings as well as institutional and commercial complexes to make at least 20% and 25% respectively of total parking spaces EV ready.</p> <p>The policy has also targeted creation of low-emission zones that shall be served primarily by zero tailpipe emission vehicles.</p> |

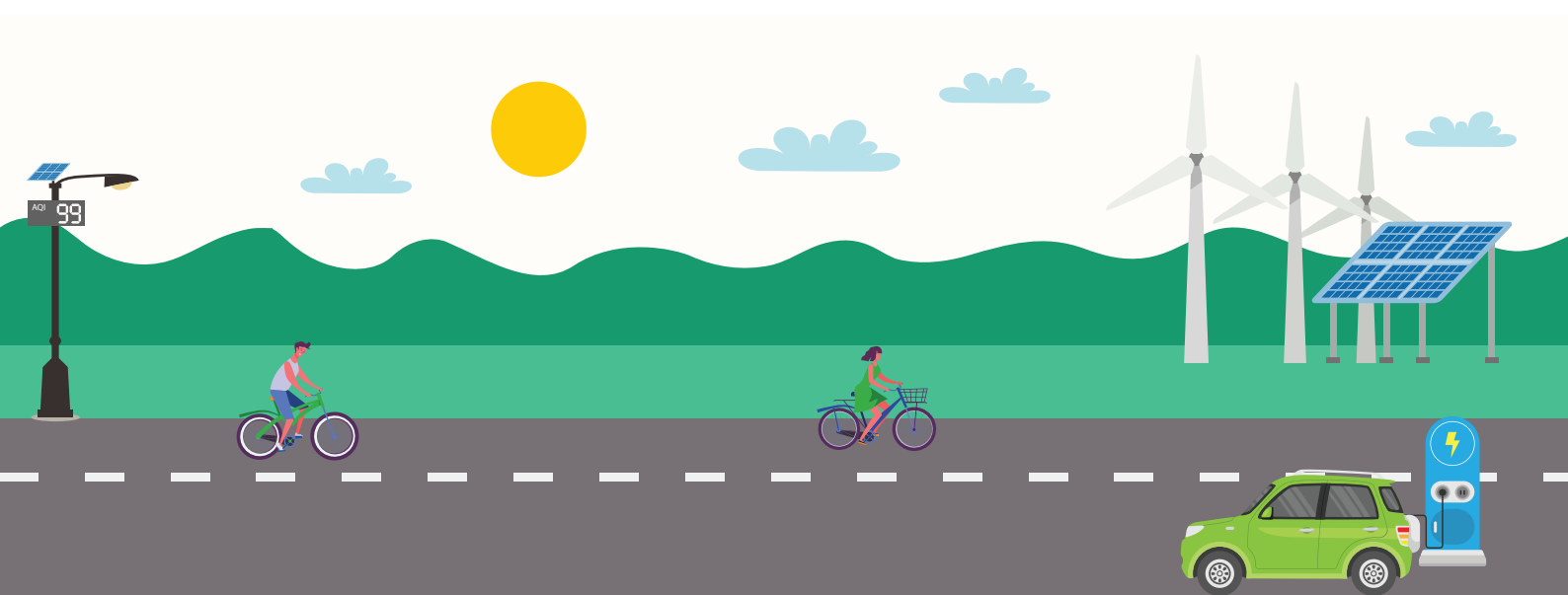






| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|---|--|---|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| <p>The district administration, in collaboration with the ULBs and state officials, may explore options to provide incentives to e-vehicle owners over and above existing programmes through:</p> <p>a) exemptions on road tax, b) exclusive parking for e-vehicles, c) additional subsidy scheme for women and students.</p> |   | Short-term | Enhancing the existing policy frameworks towards holistic integration of e-vehicles | The Maharashtra EV Policy, 2021 has a target of increasing the modal share of EVs by adding at least 300,000 electric vehicles in the state by 2025 and has recommendations suggesting means to promote EVs (as listed in the point above). Nagpur can lead by example in the state and the country by easing transition to EV through additional incentives, as suggested. |
| Promote fast registration of EVs at RTO. |  | Short-term | Policy framework exists Create awareness to popularise EVs | Maharashtra EV Policy, 2021 has provisions to incentivise and fast-track adoption of EVs by exempting them from road tax and registration charges and renewal of registration. |
| 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 and PPP models to be explored | <p>Nagpur can initiate e-vehicle rental service, similar to many other cities in India, including Ahmedabad, Bengaluru, Pune, Delhi among others.</p> <p>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.</p> |
| Encourage and promote adoption of EVs for all delivery operations within the district. |  | Short to medium-term | Policy framework exists (section 6.1.31) | <p>Currently, most delivery partners for food, courier and other kinds of services rely on self-owned fossil fuel-based two- or four-wheelers. In cities like Delhi, Mumbai and Bengaluru, e-commerce food delivery companies such as Zomato are working towards developing an EV fleet.</p> <p>The Maharashtra EV policy, 2021 also endeavours towards fast-tracking and ensuring time-bound registration of EV fleets owned by aggregators, last mile delivery providers, logistics players etc.</p> |
| 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 in popularising EVs, as it would allow users to plan routes that have charging points. |  | Medium to long-term | Needs support for digitalisation | |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|---|--|--|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Smart lampposts can radically improve electrical efficiency and enable a number of new services, such as being equipped with PV modules to harvest and store solar energy during the day to power lighting at night. They can also come 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 | |
| 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 micro-mobility schemes,</p> <p>c) increasing fleet strength,</p> <p>d) increasing frequency,</p> <p>e) adding more stops,</p> <p>f) enhanced reach to low or non-served 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>As per the Updated Comprehensive Mobility Report 2018, the share of public transport in Nagpur is 16% and is relatively low compared to India's most populous cities.</p> <p>Aapli bus, the public transport service in Nagpur, has a fleet of 438 buses, including 237 standard buses, 150 midi, 45 mini and six electric buses. Further, NMC is also in the process of procuring 40 electric buses.</p> <p>Nagpur Metro launched Maha Card in collaboration with NMC and SBI for pre-paid payments for travel via metro in 2019. It plans to expand the use of the card for payments for public transport, NMC parking areas, e-commerce transactions, shopping etc.</p> <p>Peri-urban areas are currently connected through MSRTC services. The frequency of services can be enhanced, and the number of stops can also be increased to cover these areas.</p> <p>As per the Updated Comprehensive Mobility Report for Nagpur, 2018 the share of IPT in Nagpur is 19.8%. RTO data from 2019 states that between 2016 and 2019, only 2,440 e-rickshaws were registered comprising only 13.32% of all autorickshaw registrations in Nagpur. Currently, the IPT sector is not formalised completely and the connectivity is limited to certain routes, majorly in and around popular commercial and residential areas.</p> <p>The informal IPT modes operating in the peri-urban areas of the district include mini buses, shared autos, and taxis. Residents in city outskirts/ peri-urban areas majorly rely on private vehicles or walking.</p> <p>Formalising this mode and transitioning it to a low-carbon regime is essential to reduce GHG emissions from the transport sector in Nagpur.</p> |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|--|--|---|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| District administration can collaborate with ULBs to develop fiscal measures to discourage the use of personal vehicles like variable parking charges for peak hours. |    | Short-term and continuous | Requires policy intervention based on research and interdepartmental cooperation | Nagpur 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. |
| 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 | To discourage use of private vehicles in the district, initiatives such as the ones stated below can be adopted: 1) Sikkim Parking Policy, 2010 mandates that only houses with parking slots can procure vehicles. 2) Gujarat University, in February 2016, announced that 1 st and 15 th of each month will be observed as no vehicle days, when only public transport and pedestrian movement will be allowed. |
| 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 | Proper policy based on research and inter-departmental cooperation is required | Current modal split in Nagpur indicates that the share of NMT is approximately 16% and has been decreasing over the years. NSSCDCL has planned an 18 km bicycle track in the city, mostly concentrated in lanes surrounding main roads. Further, 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 | |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|--|---|---|---|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Promote cycle hire service in key locations across the district. |   | Short-term | <p>Policy framework needs to be enhanced</p> <p>Further, PPP models can be explored for successful implementation</p> | <p>Bicycle hire services have been initiated in many cities across the country, including, Pune, Bhopal, Indore, Delhi, Bangalore among others. However, very few of them have been successful, due to lack of awareness and non-strategic placement.</p> <p>Nagpur Smart and Sustainable City Development Corporation has planned development of an 18 km bicycle track in the city. Further, the Maharashtra State Urban Transport Policy, 2017 as well as the National Urban Transport Policy, 2006 promote development of cycling infrastructure in cities.</p> |
| 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 | Requires research, multi-stakeholder engagement and inter-departmental collaboration | <p>Nagpur district can adopt the following best practices to minimise congestion during peak hours:</p> <p>In 2019, the Delhi government 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. A 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) Promote business/corporate centres to have mandatory private parking with sufficient parking slots 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 does not exist</p> <p>Multi-stakeholder and inter-departmental cooperation are required</p> | <p>Roadside parking in Nagpur reduces effective right of way on main streets in the city. Development of parking zones in a strategic manner and popularising the parking spaces through awareness initiatives can ensure better utilisation of the parking infrastructures developed by NMC.</p> |





| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|--|--|--|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Develop dedicated areas for street vendors in order to deter them from encroaching pavements. This will also avoid traffic congestion on the roadsides. |   | Short to medium-term | While the policy framework exists, implementation is irregular and for short timeframes Multi-stakeholder and inter-departmental cooperation are required | Providing dedicated areas for their business can ensure their livelihoods as well as help in decongestion. |
| 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 | While the policy framework exists, implementation is lacking in some areas Multi-stakeholder and inter-departmental cooperation are required | |








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) Maharashtra EV Policy, 2021 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) MSEDCL 4) EESL | <ol style="list-style-type: none"> 1) Housing and Urban Development Department, GoM 2) MEDA 3) Department of Motor Vehicle, GoM 4) Roads and Buildings Department, GoM 5) State Knowledge Management Centre on Climate Change (SKMCC) Department of Environment 6) Rural Development Department, GoM 7) Nagpur Metropolitan Region Development Authority (NMRDA) 8) Nagpur Smart and Sustainable City Development Corporation Limited (NSSCDCL) 9) PRIs 10) Airport Authority of India, 11) South East Central Railways - Nagpur Division 12) 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) NSSCDCL 3) NMRDA 4) Nagpur Metro 5) MSRTC | <ol style="list-style-type: none"> 1) Housing and Urban Development Department, GoM 2) Transport Department, GoM 3) RTOs 4) Roads and Buildings Department, GoM 5) State Knowledge Management Centre on Climate Change (SKMCC)- Environment Department 6) Rural Development Department, GoM 7) MEDA, MSEDCL 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 |
|---------------------------------|--|---------------------------------------|--|
| Augment non-motorised transport | 1) Smart Cities Mission 2) AMRUT 3) National Urban Transport Policy, 2006 4) Maharashtra State Urban Transport Policy, 2017 | 1) All ULBs 2) NSSCDCL 3) NMRDA | 1) Housing and Urban Development Department, GoM 2) Roads and Buildings Department, GoM 3) State Knowledge Management Centre on Climate Change (SKMCC)- Environment Department 4) Rural Development Department, GoM 5) PRIs 6) MEDA, MSEDCL 7) Maharashtra State Police 8) Proposed District level Committee on Climate Change and Environment |
| Improving traffic flow | 1) BRTS 2) JNNURM 3) ECBC 4) Smart Cities Mission 5) AMRUT 6) National Urban Transport Policy, 2006 | 1) All ULBs 2) NSSCDCL 3) RTOs | 1) Urban Development and Housing Department, GoM 2) Roads and Buildings Department, GoM 3) State Knowledge Management Centre on Climate Change (SKMCC)- Environment Department 4) Rural Development Department, GoM 5) Maharashtra State Police 6) Industries, Energy and Labour Department, GoM 7) PRIs 8) MIDC 9) NMRDA 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 |
|--|---|--|--|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| The district can develop an incentive system, similar to a "cap and trade" system / or like PAT scheme, for enhancing energy efficiency of MSMEs, in coordination with the state Industries, Energy and Labour Department. |  | Medium-term | Requires policy intervention based on research and inter-departmental cooperation | |
| Promote combined heat and power (CHP)/ co-generation for running captive power plants. |  | Medium-term | Policy framework exists Inter-departmental collaboration required Need create awareness to popularise the initiative | 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 |
|--|--|--|---|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Optimise equipment efficiency. Equipment that are not usually turned off during down time, 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) | <p>As per Maharashtra State Energy Conservation Policy, 2017:</p> <p>a) It will be binding on all commercial consumers like malls, multiplexes and industrial consumers in the state whose contract demand is 1000 kVA or more, to get energy audit conducted through companies registered with MEDA and to implement the audit report within two years.</p> <p>b) Industries will be encouraged for energy management system certification. Financial assistance of 50% of the cost of such certification and training program up to a maximum of ₹ 50,000/- will be provided to industries by MEDA.</p> <p>c) There are about five lakh MSMEs functioning in Maharashtra where enhancing energy efficiency is extremely essential. Cluster development programme will be implemented by MEDA, in collaboration with the Department of Industries, on a pilot basis. Information from successful programmes will be shared with other industries so that they too can implement similar energy conservation programme. A target is set to implement such pilot programmes in at least 100 clusters by 2022.</p> <p>d) A special training programme based on energy efficiency is planned for capacity building of technical staff in various industries for enhancing industrial energy efficiency.</p> |
| 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 | |
| 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 | |
| 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. | |








6.1.4.1 Industry: Policies frameworks and concerned departments/agencies

| Sector | Policies and programmes that can push forward the recommendation | Primary departments/agencies | Supporting departments/agencies |
|----------|--|--|---|
| Industry | <ol style="list-style-type: none"> 1) Maharashtra State Energy Conservation Policy, 2017 2) Maharashtra State Renewable Energy Policy, 2020 3) National Mission on Enhanced Energy Efficiency | <ol style="list-style-type: none"> 1) Industries, Energy and Labour Department, GoM | <ol style="list-style-type: none"> 1) Maharashtra Industrial Development Corporation (MIDC) 2) District Industries Centre 3) BEE 4) MSEDCL, GoM 5) Proposed District level Committee on Climate Change and Environment |




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

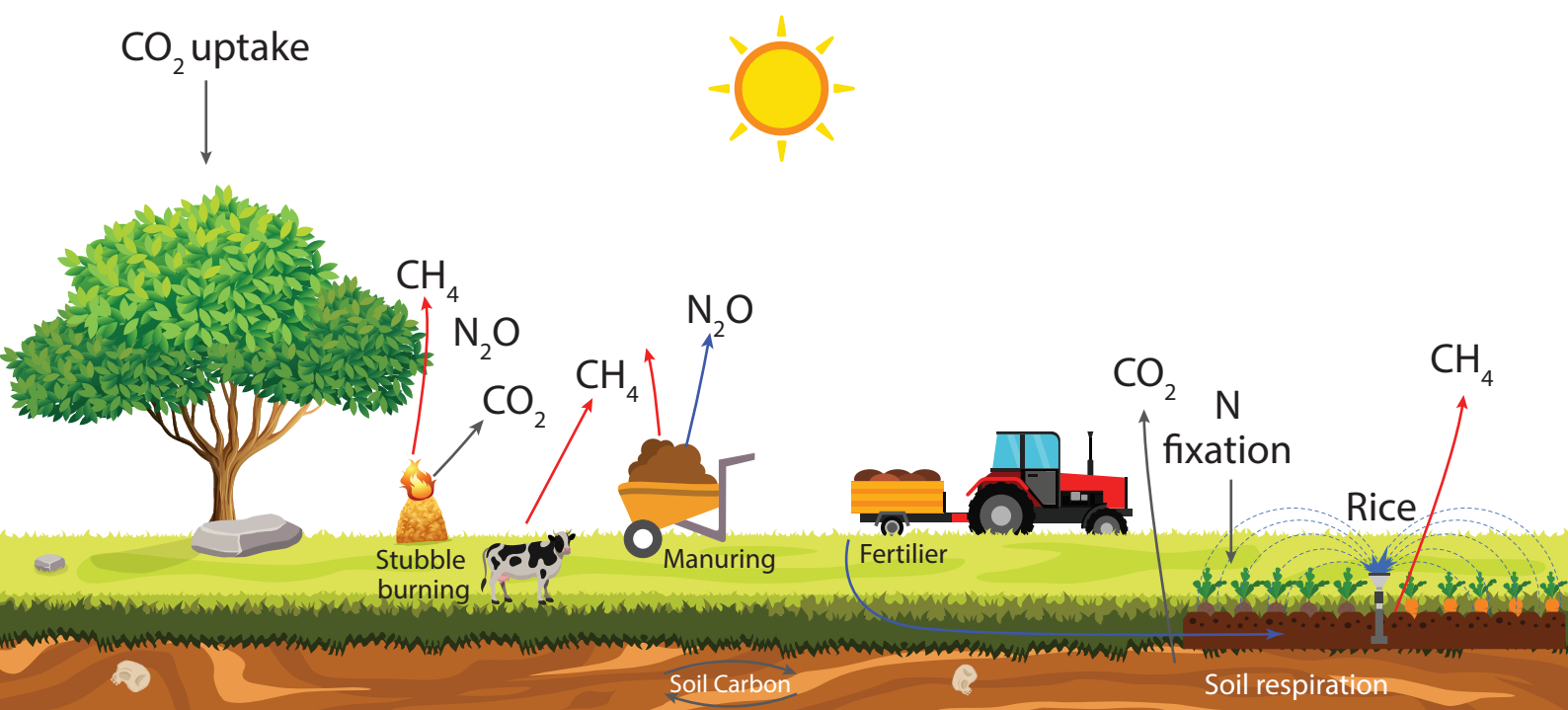
| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|--|--|---|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| AFOLU: Agriculture | | | | |
| Promote sustainable farming practices and programmes, such as the use of non-chemical fertilisers and zero budget natural farming in the district. |    | Short to medium-term | Policy framework exists (section 6.1.5.1) Budgetary provisions are available | In 2017-18, Nagpur used approximately 79,337 tonnes of urea for cultivation. Replacement of 10% of this with non-chemical fertilisers can help avoid 5,818 tonnes of CO ₂ e emissions/annum. This initiative would also contribute towards a) cutting down of compostable solid waste from landfilling/dumping and converting it to organic waste, which can be used to make organic fertilisers, thereby reducing emission from the waste sector; b) reducing harmful agricultural run-off (thereby, reducing water pollution and eutrophication). |
| Promote adoption of alternative ways for crop residue management other than burning. Promote 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. Stubble can be used as feedstock for different industries to make products including paper, cardboard, furniture, organic fertiliser and animal feed. This will also act as an alternative source of income for the farmers. |    | Short to medium-term | Policy framework required Collaboration required Farmers to have easy access to markets/industries that would take crop residue/stubble This also helps meet the following targets of SDG#8: 8.2; and SDG#12: 12.5, 12. a | Improved harvesting practices, such as the use of happy seeder, have the capacity to eliminate 78% of GHG emission (from crop residue burning). They can potentially 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. Other feasibility studies or projects can be initiated, such as the development of biofuel pellets from crop residue. |
| Farmers should be encouraged to follow the recommendation given in soil health cards. |  | Short to medium-term | Can be implemented by generating awareness | According to the Soil Health Card Portal, so far 28,51,525 samples have been tested in cycle-II in Maharashtra. In Nagpur, 7% and 8% of all the soil samples tested, have reported very low nitrogen and phosphorus, respectively. Micronutrient (Zn, Fe, Cu, Mn, B, S) status is reported to be sufficient. |







| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|--|--|---|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Promotion of micro-irrigation (MI) to improve water use efficiency. It saves water, energy and fertiliser consumption. |    | 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>The district may consider providing additional subsidies</p> | According to PMKSY Achievement Report, 3,564.01 ha of land was covered under MI in Nagpur during 2019-20, which should have led to avoidance of approximately 3012.97 tonnes of CO ₂ emissions /annum (w.r.t to conventional irrigation through groundwater). |
| <p>Encourage adoption of latest technologies, such as:</p> <p>a) Solar pumps (under PM KUSUM Yojana and Mukhyamantri Saur Krushi Pump Yojana (MSKPY))</p> <p>b) Star-rated energy efficient pump system (EEPS)</p> <p>c) Smart control panels and internet of things (IoT) based systems for optimum resource utilisation (water, energy).</p> |     | 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>In order to facilitate day time irrigation to the farmers and to promote use of renewable source of energy, GoM announced 'Mukhyamantri Saur Krushi Pump Yojana (MSKPY)' aiming to install 1,00,000 off-grid 3 HP and 5 HP solar photovoltaic water pumping systems in a phased manner. The solar power generated can be used to operate the agricultural pumps during the day as well as to meet the household electricity demands at night, particularly during times of power failure.</p> <p>Replacement of 1 lakh diesel pumps with solar pumps, over a period of 5 years, would result in diesel use mitigation of 900 million litres over the lifecycle of solar pumps, which translates into diesel subsidy saving of ₹ 840 crore and CO₂ emission abatement of 2.53 million tonnes.</p> <p>These initiatives will increase farmers' income, provide reliable sources for irrigation and reduce dependence on diesel in the farm sector.</p> |
| Enhance the efficiency/ network of cold storage systems and initiate a gradual shift towards powering them with renewable energy. |   | Medium to long-term | <p>Policy framework exists and can be enhanced (section 6.1.5.1)</p> <p>Capital Investment required</p> <p>Align with solar rooftop policies and ECBC</p> | According to a PIB press release, dated September 23, 2020, Maharashtra has 619 cold storages with a storage capacity of 10,09,693 MT. |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|---|--|---|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| 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 | Encouraging intensive cultivation of <i>Sesbania grandiflora</i> , which produces about 7.8 kg/tree/year or 936 MT/year/ha, and feeding them to lactating crossbred cows can increase milk yield by 11.97%. ³ Straws from millets, corn and maize have better feeding quality than straws from rice, barley and wheat. This change in quality of forage specie leads to better productivity and an estimated 30% reduction in emission. |
| 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 is essential to maintain the balance between resilience and productivity. Currently, in most areas flock sizes are negatively impacting 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) Awareness generation Monetary support to the pastoral community is required | These initiatives will help meet the growing demand of milk, while keeping the livestock headcount low. In Nagpur, a 10% decrease in the number of indigenous cattle over a period of five years, will lead to loss in milk production of 29,923.8 litres, while emission of around 17,595.2 tCO ₂ e will be avoided. To compensate for this loss in milk production, a total of 17,767.25 new crossbred cattle is required, resulting in 16,043.8 tCO ₂ e emissions. The net emissions avoided per year will be 1,553.62 tCO 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, such as, 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 essentials nutrients required for crop production. In comparison to cow manure, it is two to three times richer in inorganic fertiliser content. |
| AFOLU: Forestry and green spaces | | | | |
| 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. Funds for continuous tree improvement and tree breeding programmes can be ensured through the Compensatory Afforestation Fund Management and Planning Authority (CAMPA). |  | Short to medium-term | Policy framework and budget provisions exist (section 6.1.5.1) Policy implementation required Stringent monitoring and evaluation | According to the Environmental Clearance Report, 2017, 4,271.67 ha of total forest area in Nagpur has been diverted since 1980. In 2019, Maharashtra received ₹ 5,770 crore from CAMPA, which aims to promote afforestation and regeneration activities as a way of compensating for forest land diverted to non-forest uses. |

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

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|---|--|---|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| <p>Measures to increase trees outside forest (TOF) area and green spaces in Nagpur:</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, Initiating afforestation activities on wastelands and fallow lands, Plantation along village roads can be taken up under MGNREGS, Tree census should be conducted periodically, Development of green belt along the major terrain roads, and surrounding the industrial areas. |    | Medium to long-term | <p>Policy framework is available (section 6.1.5.1)</p> <p>Capital investment, research collaboration and inter-departmental cooperation is required</p> | <p>As per the FSI report 2019, Maharashtra has 26,945 sq. km extent of TOF, which is the largest in the country.</p> <p>In 2018, NMC has adopted self-watering tree guard's technology for plantation, which has a higher survival rate than the traditional technique of planting saplings. Over 90% of the 447 saplings planted by the civic body's Garden Department in 2018 are now at least 25-30 feet tall. Common species planted were Ashoka, Neem, Bakul, Bougainvillea, etc.</p> <p>There is no recent tree census study available for Nagpur, which could have provided the CO₂ sequestration potential of the urban and sub-urban forest in the district.</p> <p>Green belts help mitigate air pollution and increase urban green cover, thereby leading to carbon sequestration.</p> |









| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|--|--|---|---|
| | | Time frame 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 along with adoption of the following measures:</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 farming community to adopt agroforestry</p> <p>d) Encourage plantation of most found local, fast-growing species, particularly key stone species, fodder trees, fruit bearing trees, like, peepal (<i>Ficus religiosa</i>), neem (<i>Azadirachta indica</i>), etc. through various techniques/strategies (Miyawaki) to aid increase of tree density.</p> |     | Medium to long-term | <p>Policy framework and budget is available, implementation required</p> <p>Stringent monitoring and evaluation are necessary</p> | <p>Currently, the forest cover of Nagpur district is 20.22% of the total geographical area. In an assumed scenario of increased forest cover to 25% over a period of 10 years, 11.89 MtCO₂e emissions would be sequestered.</p> <p>Miyawaki urban forestry method has reported 15% faster growth rate per year compared to other reforestation methods.</p> <p>Social Forestry Department of Nagpur has turned a barren land in Patansawangi into an Oxygen Park through Miyawaki Forest Method. Since then, it has become a haven for birds. Tree species such as neem, bahava (<i>Cassia fistula</i>), shishu (<i>Dalbergia sissoo</i>), mahua (<i>Madhuca longifolia</i>), mango (<i>Mangifera indica</i>), etc were planted. The survival rate is proven to be 100%.</p> |
| <p>Ensure ULBs regularly monitor survival of the trees, post plantation.</p> <p>a) Undertake thorough study on the 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 that survive 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>According to the minister for state forest, between 2017 and 2019, a target of 28.50 crore trees was set and approximately 28.34 crore trees were planted in the district, out of which 81.63% survived.</p> |










| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|---|--|--|---|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Promote regeneration of degraded and open forest areas by developing awareness among locals regarding the importance of green spaces. |    | Long-term | <p>Strengthen the existing policy framework</p> <p>Collaboration among different stakeholders is required</p> | According to 2019 Forest Survey of India report, there is a decrease in forest cover by 1862 sq. km in Nagpur from 2017 assessment. |
| <p>Various aspects of joint forest management need to be promoted:</p> <p>a) Capacity building and skill development of joint forest management committees in tribal and non-tribal areas by conducting workshops and training.</p> <p>b) Initiate participatory forest management programmes at the micro scale.</p> |  | Short to medium-term | <p>Exclusive communication strategy and information, education and communication (IEC) material to be developed and used</p> <p>Provisions of monetary support</p> | As per ENVIS-Committees and Forest Area Under JFM till 2015, total area covered under JFM in Maharashtra is 24,03,344 ha with about 12,665 joint forest management committees. |
| <p>Prevent invasion of non-indigenous species by adopting the following measures:</p> <p>a) Develop a database and update information on invasive species and their management</p> <p>b) Raise awareness at regional levels</p> <p>c) Strengthen and maintain institutions to coordinate invasive species programmes.</p> |  | Medium to long-term | <p>Undertake research studies of flora specific to the region</p> <p>Exclusive communication strategy and IEC material to be developed and used</p> <p>Requires funding, monitoring and evaluation and stakeholder collaboration</p> | <p><i>Prosopis juliflora</i>, <i>Lantana camara</i>, <i>Parthenium hysterophorus</i>, <i>Gliricidia Sepium</i> are some major invasive species in Maharashtra.</p> <p>Preventing seed production helps manage the 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.</p> |
| <p>Develop participatory forest fire management strategies such as:</p> <p>a) Collecting baseline forest fire data w.r.t perceptions, beliefs, expectations and behaviour of local people pertaining to forest fires.</p> <p>b) Training local communities to tackle forest fires</p> <p>c) Organising awareness programmes in local schools</p> <p>d) Capacity building to develop an early warning system</p> |  | Medium to long-term | <p>Provisions of monetary support</p> <p>Exclusive communication strategy and IEC material to be developed and used</p> <p>Monitoring and evaluation required</p> <p>Need collaboration among different stakeholders</p> | According to the Technical Information Series Volume-I FSI Report 2019, 3.4% of the total forest cover area in Maharashtra lies under extreme fire prone area, 16.65% under moderately fire prone area and 60.34% under least fire prone area. |

6.1.5.1 AFOLU: Policies 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) Saur Krishi Vahini Yojana 9) National Policy for Crop Residue Management 10) Maharashtra Agriculture Pump Electricity Policy, 2020 11) Integrated Cold Chain, Value Addition and Preservation Infrastructure Scheme | <ol style="list-style-type: none"> 1) Department of Agriculture, Government of Maharashtra | <ol style="list-style-type: none"> 1) Department of Environment and Climate Change, GoM 2) Rural Development and Panchayat Raj Department, GoM 3) Water Resources Department, GoM 4) State Energy Department, GoM 5) Industries, Energy and Labour Department, GoM 6) Forests and Environment Department, GoM 7) Directorate of Industries, GoM 8) Department of <i>Animal Husbandry</i>, GoM 9) APMCs 10) MIDC 11) Proposed District level Committee on Climate Change and Environment |
| Livestock | <ol style="list-style-type: none"> 1) National Livestock Mission 2) Rastriya 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) Navinya Purna Yojana 9) National Mission on Food Security 10) Rashtriya Krishi Vikash Yojana | <ol style="list-style-type: none"> 1) Department of Animal Husbandry, Government of Maharashtra | <ol style="list-style-type: none"> 1) Maharashtra Forest Department, GoM 2) Department of Agriculture, GoM 3) Department of Environment and Climate Change, GoM 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 8) Atal Bamboo Samrudhi Yojana | <ol style="list-style-type: none"> 1) Maharashtra Forest Department, GoM | <ol style="list-style-type: none"> 1) Department of Agriculture, GoM 2) Department of Environment and Climate Change, GoM 3) All ULBs 4) Directorate of Geology and Mining, GoM 5) Department of Housing, GoM 6) UDD & RDD, GoM 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 |
|---|--|--|---|--|
| | | Time frame 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) by distributing colour-coded bins; monitoring waste collected from households 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) and d) Needs policy intervention and execution (Resource Efficiency Policy has been drafted by NITI Aayog but has not been implemented)</p> | <p>Landfills are considered to be one of the largest anthropogenic sources of methane emissions contributing to 11% of all global CH₄ emissions. Hence, reducing landfill load and emission is critical in achieving India's NDCs. Following are some initiatives adopted in Nagpur (mostly the city area) that will reduce landfill emissions in the city and can be adopted in the district as well:</p> <p>(a) According to the latest MPCB report (2018-19), Nagpur district generates 1,347.09 TPD solid waste of which 289.37, i.e., about 21.5% gets treated. Nagpur Municipal Corporation (NMC) generates 1,200 TPD solid waste and has 100% waste collection efficiency.</p> <p>(b) Nagpur city has introduced door-to-door collection, eliminating more than 80% of the waste-bins of the city.</p> <p>(c) Treatment facilities include composting, vermi-composting, recycling plant, RDF palette making facility, waste bioremediation at the dumpsite.</p> <p>(d) Bhandewadi is the open dumpsite for NMC, operating since 1966. A part of the waste from the dumpsite was shifted and capping was provided over an area of 40,630 sq. m in 2011. NMC has already reclaimed 25 acres of land in the Bhandewadi through bio-mining.</p> |






| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|--|---|--|---|--|
| | | Time frame 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 Maharashtra as of now. City plastic waste management plan is in preparation to implement EPR. About 25.7% of the total waste generated in Nagpur is inert waste and 19% is paper waste, much of which can be treated/recycled, thereby potentially leading to a huge reduction in landfill waste. |
| Implement 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, etc. – 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 (MRF), refuse derived fuel (RDF), waste to energy (W2E), etc. Encourage use of LDPE and HDPE plastic waste in road construction. ⁴ |   | 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) Make procurement of C&D materials (10% to 20%) in municipal and government contracts mandatory (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 | |










⁴ <https://pib.gov.in/PressReleasePage.aspx?PRID=1736774>












| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|---|---|--|---|---|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Increasing consumer awareness and access to recycling facilities and repair options within the district. |  | Short to medium-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 ⁵ . Prevention and recovery of waste (as secondary material or energy) can significantly save GHG emissions from across the sectors of the economy, including energy, forestry, agriculture, mining, transport and manufacturing sectors. |
| Education and awareness drives for 100% at source segregation of biodegradable waste, non-biodegradable waste, domestic hazardous waste and household biomedical waste. | | Short-term | | |
| 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, like 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 | |



| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|--|---|--|--|---|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Ensure segregation, collection and treatment of sanitary waste (sanitary napkins and diapers) to reduce landfill load. |    | Short to medium-term | <p>Mandated by the SWM Rules, 2016</p> <p>Capital investment in infrastructure development is required, which can be obtained from the producers</p> | Sanitary waste segregation and treatment is currently not practiced in the district. |
| <p>Transitioning the district to a green market approach by:</p> <p>a) Promoting local circular business models,</p> <p>b) mainstreaming of alternative sustainable business models for the consumers to have basket of choices.</p> |   | Medium-term and continuous | Needs alternative business models, collaborations and awareness | |
| <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>GIS based route map and vehicle tracking system for waste transport has been initiated within NMC to reduce transport emission and better monitoring. NMC has 153 smaller primary transport vehicles, 39 secondary transport vehicles (heavy) and 45 transport equipment for waste management. These vehicles take an average of 3-5 trips/day/vehicle. The Bhandewadi dumpsite is 10 km from the city centre. Hence, waste collection and transport are potentially leading to significant emission which can be avoided with a shift to ZEVs.</p> <p>Though, there are several specifications in place for CBWTF vehicles to ensure efficient management and monitoring of BMW, it does not consider the emission reduction part from transport.</p> |

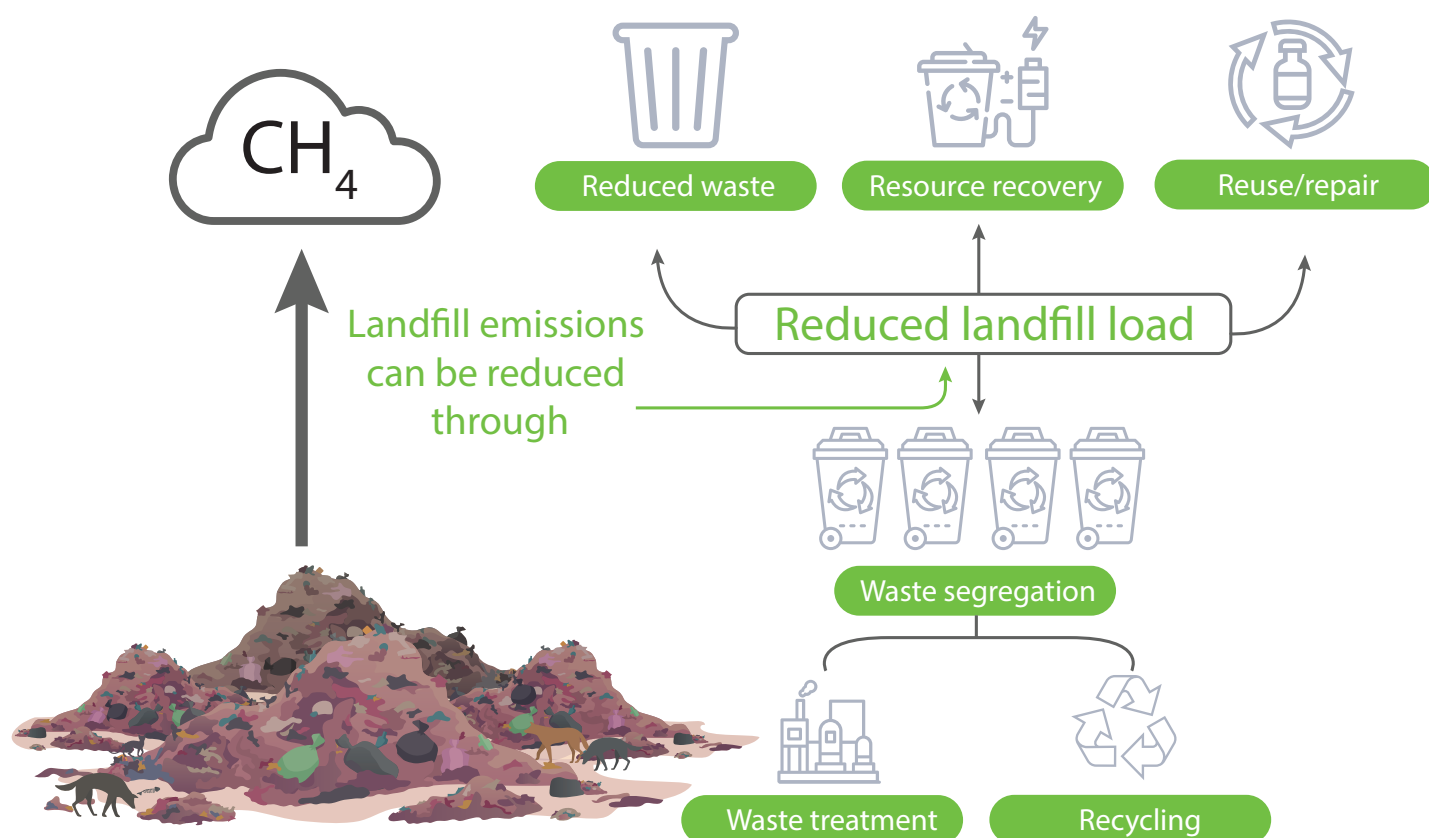
| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|---|--|--|---|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Waste treatment: Composting | | | | |
| Encourage 100% conversion of organic waste to biological waste processing (composting, bio-gas, etc.). |     | Short to medium-term | Policy framework exists (section 6.1.6.1) Needs awareness and infrastructure development | Organic treatment of compostable waste though initially leads to emission, but 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. |
| Develop composting facilities at ULB level in addition to cluster level to avoid: a) loss of carbon content in long route organic waste transport, b) reduce waste transport emission. |    | Medium-term | Needs land and infrastructural investment at ULB level. | 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. Composting also avoids multi-layered pollution potentials and reduces landfill loads. About 41% of the solid waste generated in the district is biodegradable, out of which currently only about 21% is getting treated biologically. However, composting units do not have any gas management system to capture CH ₄ emission. Composting emission potential of the district is 8,585 tCO ₂ e/year. |
| a) Equip new composting units and upgrade/convert existing composting units with gas management systems for gas capture after conducting feasibility studies. 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 the 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. |     | Long-term | Needs policy intervention, district-level capital investment and research collaboration. | Maharashtra is the only state to have registered its own brand of “Harit Maha City Compost” for promotion of marketing and sale of city compost, which fulfils the FCO standards and SWM Rules, 2016. Composting with gas management of the entire organic waste going to landfill can reduce emission by 14,710 tCO ₂ e/year in Nagpur district. |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|---|--|--|---|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| 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 | |
| Ensure better compliance to the 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 | | | | |
| a) Promote installation of modern incinerators with energy-recovery facilities (such as, the 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, 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. |   | Long-term | Needs 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 kind of infectious waste, (particularly, the anatomical, contaminated waste, discarded medicines and chemical waste). Incineration is the best available and recommended practice currently in India. Current annual BMW incineration emission in the district is 469.76 tCO ₂ e/year. Energy recovery incineration is not practiced. |
| Strict monitoring of adherence to recommended incineration technologies, standards and practices through regular monitoring by the District Bio-medical waste Management Monitoring Committee. |  | Short-term and continuous | Mandated by the BMWM Rules, 2016 Needs monitoring by district level BMWM committee | Nagpur has one TSDF that received 28,071.94 MT/year hazardous waste during 2018-19, out of which 2,983.9 MT/year was incinerated leading to an annual emission of 2,461.73 tCO ₂ e. There is no district-wise hazardous waste generation data available to evaluate the incineration emission of just the district. |
| 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 BMWM Rules, 2016 | |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|--|--|--|---|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| Waste electrical and electronic equipment (WEEE) | | | | |
| 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. The inventory must include all sources of generation and consider all WEEE categories as per the rules. | | Short to medium-term | Preparation of e-waste inventory is mandated by the rules (section 6.1.6.1) Needs research collaborations | About 95% of the e-waste in India is processed informally (including rudimentary operations, like open burning, acid wash, open smelting, etc). City-based studies show that efficient management and recycling of electrical and electronic waste (WEEE) can significantly contribute to emission reduction targets. There is no authentic database available either at district (Nagpur) or at state level of the amount of e-waste generated annually and their routes to recycling or disposal. According to MPCB (2018-19), only 9,475 tonnes of WEEE was collected formally in the entire state, while a dated (2007) e-waste assessment of Mumbai-Pune area considering only four categories (cell phone, TV, PC, refrigerator) projected 50,000 tonnes and 3,500 tonnes of e-waste generation in Mumbai and Pune respectively in 2015 (MPCB, 2007). It should be noted that the E-waste Management Rules, 2016 mentions 17 major WEEE categories. Hence, it is evident that most of the e-waste generated in the state is routed informally. Nagpur – a popular choice as the upcoming IT hub after saturation of Mumbai and Pune – might outgrow its current e-waste generation at large margin soon. |
| 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. |     | Short-term and continuous | Mandated by the rules (section 6.1.6.1) Needs monitoring, manufacturer collaboration and consumer awareness | |
| Tapping into the informal e-waste collection network and formalisation of the same to channelise e-waste disposal to the formal sector. |   | Short to medium-term | Can be achieved through the recyclers/producer responsibility organisations (PROs) | |
| Improve consumer awareness on responsible e-waste disposal and make information readily available about e-waste collection points, recyclers, producers (manufacturer), producer responsibility organisations (PROs) or local e-waste collection drives at the district level. | | Short-term and continuous | Mandated by the rules for the producers (section 6.1.6.1) Dedicated campaign required Can be achieved by collaborating with producers | |
| Formulation of district level e-waste management programme. |    | Short to medium-term | Needs inter-departmental collaboration | |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|--|--|--|--|---|
| | | Time frame 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 and transition of old anaerobic STPs to aerobic set up.</p> <p>c) 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>Nagpur city had a sewerage generation of 345 MLD in 2015, of which only 29% was getting treated by the city's only STP of 100 MLD capacity at Bhandewadi. Projected sewerage generation is 472 MLD in 2021 and 752 MLD in 2041. About 96% of the city properties are connected with sewerage network (1,670 km length of sewer line) of which 70% is underground sewer network. The remaining sewer collected in the network is disposed untreated in Gosikhud Dam. Sewerage in some areas of the city outfalls into open drains and rivers.</p> |
| <p>Development of rural wastewater disposal and treatment plan for the district.</p> |   | Medium to long-term | Requires capital investment and inter-departmental collaboration | <p>NMC has prepared a sewerage master plan and is planning to augment its sewer network under JNNURM from 100 MLD to 200 MLD sewerage treatment capacity (Ministry of Urban Development, Gol & World Bank, 2015).</p> |
| <p>Create appropriate connecting infrastructure for the industries to utilise treated industrial and domestic wastewater.</p> <p>Provide subsidy/tax rebate to industries, healthcare, hospitality sectors for smart recycled water investments.</p> |   | Medium to long-term | <p>Policy implementation required</p> <p>Needs capital investment in infrastructure and technology upgradation</p> | <p>100% closed and underground sewer connection and centralised aerobic well managed STPs can potentially reduce 30,204.26 tCO₂e emission from STPs to negligible or almost non-existent in Nagpur.</p> |
| <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 should also be ensured.</p> |    | Medium to long-term | Needs ULB level implementation and capital investment in infrastructure | <p>Maharashtra government has mandated the reuse of treated wastewater for cooling thermal power plants and introduced 'Maharashtra Water Resources Regulatory Authority Water Entitlement Transfer (WET) and Wastewater Reuse Certificates (WRC) Platform Regulations, 2019'.</p> <p><i>Case example:</i> 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. Similar plant can be developed for Nagpur.</p> |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario/ case examples |
|--|--|--|--|--|
| | | Time frame for the action to be accomplished | Framework for implementation | |
| 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 | <p>Nagpur region has only one CETP of 5 MLD capacity and has treated 4.8 MLD industrial effluent during the year 2018-19.</p> <p>Data transparency on wastewater by industries is key to reducing water pollution. This can be achieved through rating of industries based on their emission 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.</p> |
| 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

| Sub-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 & Amendment, 2018 2) Plastic Waste Management Rules, 2016 & Amendment Rules, 2021 3) Construction & Demolition Waste Management Rules, 2016 4) Integrated Solid Waste Management Project 5) Swachh Bharat Mission - Urban & Rural 6) Nagpur Master Plan, 2032 and City Development Plan, 2041 7) Nagpur Smart Cities Mission 8) National Resource Efficiency Policy (draft) 9) Guidelines on Environmental Management of C&D Waste Management in India, CPCB 10) Maharashtra Water Resources Regulatory Authority Water Entitlement Transfer (WET) and Wastewater Reuse Certificates (WRC) Platform Regulations, 2019 11) MPCB Annual Report | <ol style="list-style-type: none"> 1) Urban Development Department, GoM 2) All ULBs 3) Rural Development and Panchayat Raj Department, GoM 4) All Gram Panchayats 5) Maharashtra Pollution Control Board (MPCB) | <ol style="list-style-type: none"> 1) Nagpur District Administration and the proposed District Level Climate Change and Environment Committee 2) Maharashtra Urban Infrastructure Development Company Limited (MUIDCL) 3) Nagpur Metropolitan Region Development Authority (NMRDA) 4) Department of Environment and Climate Change, GoM |
| 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 & Transboundary Movement) Rules, 2016 3) Batteries (Management & Handling) Rules, 2001 4) MPCB Annual Reports 5) Revised Guidelines for Common Bio-medical Waste Treatment and Disposal Facilities, 2016, CPCB | Research funding can be obtained from the Department of Environment and Climate Change, GoM, MPCB, etc. ⁶ | <ol style="list-style-type: none"> 1) MPCB 2) Nagpur District Administration 3) Proposed District Level Climate Change & 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 and Climate Change, GoM; MPCB, etc. ⁷ | <ol style="list-style-type: none"> 1) MPCB 2) Nagpur District Administration 3) Proposed District Level Climate Change and Environment Committee 4) Electronic and Electrical Producer Manufacturers/Producers/Brand owners, Producer Responsibility Organisations |

⁶ Bio-medical and hazardous waste management is profitable and not funded by the government except for providing the land, which generally are the Industrial Development Corporation lands

⁷ E-waste management (collection, transport, disposal, treatment – dismantling or recycling) is profitable and is the responsibility of the producers, recyclers, producer responsibility organisations (PROs).

| Sub-sectors | Policies and programmes that can push forward the recommendation | Primary departments/agencies | Supporting departments/agencies |
|------------------------|---|--|--|
| Wastewater: Domestic | 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) – Maharashtra 6) Swachh Bharat Mission (Rural) – Maharashtra 7) Nagpur Smart City Mission 8) Nagpur City Development Plan, 2041 9) Nagpur Metropolitan Area Development Plan, 2032 | 1) Urban Development Department, GoM 2) All ULBs 3) Rural Development and Panchayat Raj Department, GoM 4) Maharashtra Jeevan Pradhikaran (Water Supply and Sanitation Department), GoM | 1) NMRDA 2) MUIDCL 3) Nagpur Smart City Development Corporation 4) All Gram Panchayats 5) Nagpur District Administration and the proposed District Level Climate Change and Environment Committee |
| Wastewater: Industrial | 1) Common effluent treatment plant system 2) Online continuous emission monitoring system 3) MPCB Annual Report | 1) MPCB 2) MIDC | 1) City and Industrial Development Corporation (CIDCO) 2) Department of Environment and Climate Change, GoM 3) Nagpur District Administration & the proposed District Level Climate Change & Environment Committee |

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, 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. Food packaging b. Insulated food packaging, fragile item protective packaging c. Multi-layered packaging (chips, biscuits, noodle, etc) d. Packaging for online delivery | 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/ another bio-degradable alternative | |
| 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 Pak, bottling and bulk vending | |
| Face shields | Polycarbonate and polyester (PET) | Healthcare | Compostable/bi-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 nanometre-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 in favour of 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 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, and 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. Government of Maharashtra published the 'Maharashtra Plastic and Thermocol Products (Manufacture, Usage, Sale, Transport, Handling and Storage) Notification, 2018' under 'Maharashtra Non-Biodegradable Garbage (Control) Act, 2006'. The notification bans manufacture, usage, transport, distribution, wholesale and retail sale and storage, import of plastic bags with handle and without handle, and the disposable products manufactured from plastic and thermocol (polystyrene) such as single use disposable dish, cups, plates, glasses, fork, bowl, container, disposable dish/ bowl used for packaging food in hotels, spoon, straw, non-woven polypropylene bags, cups/ pouches to store liquid, packaging with plastic to wrap or store the products, packaging of food items and food grain material in the state of Maharashtra. The ban also applies to plastic and thermocol for decoration (Environment Department, GoM, 2018).

Recommendations⁸

- 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.

8 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 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).
- 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 |
|--|--|--|--|---|
| | | Time frame 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> | <p>Since 2017, NMC is working to launch municipal bonds to raise capital for execution of developmental projects.</p> <p>Case example: In June 2017, Pune Municipal Corporation had raised ₹ 200 crore through municipal bonds (listed on BSE) at an interest of 7.59% to finance its 24x7 water supply project, under AMRUT.</p> <p>NMC can follow the Pune model.</p> |
| 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 inter-departmental 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 the smart city's 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 tCO₂ 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 |
|--|---|--|--|--|
| | | Time frame for the action to be accomplished | Framework for Implementation | |
| Managing air pollution | | | | |
| Increase the number of continuous air quality monitoring stations (CAQMS) to statistically, spatially, and temporally, represent the mix of sources and range of pollution. Increase the number of air quality display facilities in public places. |  | Short to medium-term | Policy framework and budgetary provisions exist | Nagpur is one of the 18 non-attainment cities in Maharashtra and amongst the 124 cities in India where particulate matter concentration (PM ₁₀ and PM _{2.5}) exceeds the prescribed norms set by the CPCB under the National Clean Air Programme (NCAP). The Action Plan to control air pollution in Nagpur city was developed by MPCB and has been revised recently to include inputs for FY 2020-21. The action plan identifies vehicular emissions, dust re-suspension, landfilling/open waste and biomass burning, industrial operations, construction and demolition activities and domestic fuel combustion as the major sources of local air pollution in the city. A source apportionment study of PM _{2.5} in Nagpur shows vehicular emissions (62%) followed by inorganic aerosol (15%), re-suspended dust (8%) as the major sources of air pollution (Pipalatkhar, Khaparde, Gajghate, & Bawase, 2014). While the sources were relatively similar across all of the sites studied, their percent contributions changed depending on the intensity of ongoing operations, emphasizing the need for a detailed source apportionment to address the issue. Nagpur currently has five ambient air quality monitoring stations (AAQMS), out of which two are located in residential areas, one in industrial area, one in commercial area and one in rural area (Civil Lines, Nagpur; IOE, North Ambazari Road, MIDC Office, Hingna Road, Govt. Polytechnic College, Sadar and Nagpur CAAQMS). Civil Lines is the only automated station out of the five; rest are manual AAQMS (MPCB, 2020). |
| a) Enforce environmental standards on exhaust fumes/ emissions from industries. b) Promote installation of air pollution control devices at point source of emissions. |   | a) Short-term and continuous b) Medium-term | Requires robust M&E | |
| Sprinkling of water (preferably, recycled grey water) to settle suspended road dust 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 | |
| Implementation of action plan for construction and demolition waste (C&D) (as per the CPCB guidelines). |    | Short to medium-term | Needs implementation of existing rules/ regulations | |
| Facilitate source apportionment studies to identify the sources, and take specific containment measures. | | Short to medium-term | Needs support for research | |
| Ensure installation and operation of air pollution control devices in industries and adhere to emission standards. | | Medium to long-term | Implementation of existing rules/ regulations is required Robust M&E required | |








| Recommendations | Cross-cutting with | Qualifying priority | | District scenario / case examples |
|--|---|--|--|---|
| | | Time frame for the action to be accomplished | Framework for Implementation | |
| <p>Increase the modal share of public and non-motorised transportation. Further, promote e-vehicles (detailed recommendations under Transport, section 6.1.3).</p> <p>Ban on registration of diesel and petrol-driven auto-rickshaw and complete conversion to CNG/gas engine.</p> |   | Medium to long-term | <p>Policy framework available</p> <p>Awareness generation required</p> <p>Capital investment required</p> <p>Needs inter-departmental coordination</p> | <p>Maharashtra State Urban Transport Policy aims to decongest traffic by discouraging private vehicle ownership; promoting public transport, walking and cycling to enhance air quality; and making transport infrastructure focused on people as opposed to vehicles.</p> <p>Only a partial conversion of polluting auto-rickshaws to CNG/gas engines is recommended in Nagpur City's Action Plan to Control Air Pollution. Auto-rickshaws that run on diesel, petrol, and LPG dual combination are still operational in the district.</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 needed</p> <p>Needs implementation of existing rules/policies</p> <p>Capital investment required</p> | <p>India's first multi-modal e-mobility project was also implemented in Nagpur with electric fleet by Ola (combination of e-rickshaws and e-cabs) and charging stations at fuel pumps.</p> <p>Several provisions in the latest Maharashtra state E-vehicle Policy, 2021 can aid these recommendations (see Transport, section 6.1.3).</p> <p>Nagpur city has intelligent CCTV surveillance and automated traffic management systems installed at traffic intersections.</p> <p>In addition to existing NMC parking facility, parking lots in Dhantoli and along Ramdaspath to Kachipura square and some other congested areas are proposed in the MPCB action plan.</p> |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario / case examples |
|--|---|--|---|--|
| | | Time frame for the action to be accomplished | Framework for Implementation | |
| Increase/create green cover or green buffers along the major traffic corridors, roundabouts and industrial areas. |    | Medium to long-term | <p>Inter-departmental coordination required</p> <p>Needs efficient maintenance and monitoring of plantation sites</p> | <p>About 16,759 sq. m green buffers at road dividers, channeliser, traffic islands and on both sides of the roads have been developed in Nagpur. But these do not cover all major polluting roads.</p> <p>Till date, 95 gardens have been constructed over a total area of 126.46 acres in the city. 22 new gardens have been proposed, with 8 (62.46 acres) falling under the AMRUT mission and 14 falling under the Chief Minister's special fund.</p> <p>As per the MPCB action plan, there is a proposed plan of ₹ 1.90 crore for creation of green buffers along the traffic corridors in Nagpur city under NCAP.</p> |
| <p>a) Shifting of industries from non-conforming zones (refer Development Control and Promotion Regulations for Nagpur Metropolitan Regional Development Authority).</p> <p>b) Switching over to clean technologies, clean fuels and pollution control devices.</p> <p>c) Development of green belt around the industrial zones.</p> |   | <p>a) Medium to long-term</p> <p>b & c) Short to medium-term</p> | <p>Policy framework exists</p> <p>Needs compliance</p> | <p>Major industries leading to air pollution in Nagpur are: Brick kilns, mining, coal-fired thermal power plant, oil-fired furnace/boiler, stone crusher, lime kilns, foundry, etc. Industrial development exists along fringe areas like Kamptee, Hingna, Wadi, Khapri, Butibori and Kalmeshwar.</p> <p>The New Industrial Policy, 2019 offers financial assistance for pollution control systems and captive RE power plants.</p> |




















| Recommendations | Cross-cutting with | Qualifying priority | | District scenario / case examples |
|---|--|--|--|---|
| | | Time frame for the action to be accomplished | Framework for Implementation | |
| Making brick kilns sustainable | | | | |
| Adopt cleaner kiln technologies like zig-zag kilns and vertical shaft brick kiln (VSBK) to replace fixed chimney bull trench kilns (FCBTKs) and down draught kiln (DDKs). |      | Medium to long-term | Needs to be aligned with the existing standards Mandate required to ensure compliance | Zig-zag kilns appear to be the logical replacement for FCBTKs because of low-capital investment, easy integration with the existing production process and the possibility of retrofitting FCBTKs into zig-zag firing. |
| Promote mechanised coal stoking systems in brick manufacturing. | | Medium-term | Capital investment required | High particulate matter and black carbon emissions in FCBTKs occur during the period of fuel feeding. Continuous feeding of properly sized fuel, using a coal stoker in an FCBTK or a zig-zag kiln, can reduce the emissions significantly. |
| Promote sustainable brick types (eg., clay-fly ash bricks and fly ash bricks). | | Long-term | Needs awareness generation Needs to be aligned with existing policies Market/ demand needs to be generated | Preparing clay-fly ash bricks with around 30% fly ash content (when using black soil) can: a) Prevent consumption of around 30-40 tonnes of alluvial soil or 100-125 tonnes of black soil per lakh bricks, thereby reducing land-degradation and retaining the carbon content in soil. b) Save 3-7 tonnes of coal per lakh bricks produced. c) Increase the strength of the brick by 30% to 40%. |
| Promote modern RE technologies in brick making. Also, enhance communication through media engagement and outreach, mass awareness, engaging public, health and academic institutions, stakeholder discussions, etc. | | Long-term | Research collaboration needed Capital investment required | |
| Thermal Power Plants in Nagpur: Operational and in pipeline | | | | |
| Ensure new TPPs are ‘designated consumers’ (DCs) under the PAT scheme. |   | Short to medium-term | Policy framework exists | Of the six existing TPPs in Nagpur, four are PAT compliant – Koradi TPP, Khaparkheda TPP, Mouda TPP and Butibori TPP. These PAT compliant TPPs have saved approximately 7.7 lakh tCO ₂ e emissions till date. |




| Recommendations | Cross-cutting with | Qualifying priority | | District scenario / case examples |
|---|---|--|--|---|
| | | Time frame for the action to be accomplished | Framework for Implementation | |
| <p>Thermal power plants can reduce their specific water consumption (m^3/MWh) and achieve zero liquid discharge through:</p> <p>(a) air-cooling of the cooling tower,</p> <p>(b) brine recovery systems, and</p> <p>(c) using recycled water.</p> |      | Medium to long-term | <p>Policy framework exists</p> <p>Capital investment required</p> <p>Awareness generation among the stakeholders is required</p> | <p>Data from the Government of Maharashtra and Nagpur district, as well as a power sector mapping exercise done by Vasudha Foundation indicate that five coal-based TPPs, with a proposed cumulative capacity of 2,910 MW are in pipeline.</p> <p>As per the Environment (Protection) Amendment Rules, 2015 issued by MoEFCC, all the power plants being setup after 2017 are required to use a maximum of 2.5 m^3/MWh water as specific water consumption and achieve zero liquid discharge, as compared to earlier standard of specific water consumption limit ($3.5\text{m}^3/\text{MWh}$).</p> <p>In 2013, MahaGenco and NMC agreed to build and operate a 130 MLD STP at Bhandewadi to deliver recycled water to three Koradi TPP units. Since then, Koradi TPP has been using recycled water.</p> |
| <p>Promote installation of technologies to curtail NO_x emissions from the plants.</p> <p>NO_x emissions can be reduced through:</p> <p>(a) Primary strategies: implementing NO_x reduction technology at the primary source- installing low NO_x burners (LNBs).</p> <p>(b) Secondary strategies: installing selective catalytic reduction (SCR) / selective non-catalytic reduction (SNCR).</p> |     | Medium to long-term | <p>Policy framework to be enhanced</p> <p>Capital investment required</p> <p>Awareness generation among the stakeholders</p> | <p>A plan submitted by the Ministry of Power in December 2017, suggested pre-combustion modification such as in-situ modification in boiler, installation of low NO_x burners and over-fired air (OFA) to be adopted besides installation of selective catalytic reduction (SCR) / selective non-catalytic reduction (SNCR) systems by 2022. An affidavit dated August 20, 2018 (SCI 2019), was filed by the CEA with respect to NO_x requesting for change of norm from $300 \text{ mg}/\text{Nm}^3$ and $100 \text{ mg}/\text{Nm}^3$ for thermal units installed after December 31, 2003 to $450 \text{ mg}/\text{Nm}^3$, which is practically achievable with the combustion modification.</p> <p>With the help of a separate over fired air (SOFA) provided in the boiler, NO_x level can be maintained at $450 \text{ mg}/\text{Nm}^3$. However, one of the most advanced primary NO_x reduction techniques consists of advanced burner technology in conjunction with carefully designed air supply system for combustion. This method can fulfill $300\text{mg}/\text{Nm}^3$ NO_x emission requirement.</p> |










| Recommendations | Cross-cutting with | Qualifying priority | | District scenario / case examples |
|---|---|--|---|--|
| | | Time frame for the action to be accomplished | Framework for Implementation | |
| Promote installation of flue gas de-sulphurisers (FGD) before the inlet of power plant stack/flue gas stack to curtail SO _x emission from power plants. ⁹ |     | Medium to long-term | Policy framework exists Capital investment required Awareness generation needed | The status of FGD implementation of TPPs in Nagpur district is as below: a) Koradi TPP Unit 6 and Unit 7: Feasibility study carried out, b) Koradi TPP Unit 8, 9 and 10: Bid opened, c) Butibori TPP Unit 1 and 2: notice inviting tender, d) Mauda TPP Unit 1,2,3 and 4: Bid awarded, e) Khaparkheda TPP Unit 1,2,3 and 4: Feasibility study carried out, f) Khaparkheda TPP Unit 5: Bid opened. |
| Water scarcity and water pollution | | | | |
| Conduct assessment and mapping of zone-wise water challenges in the district. |     | Short-term | Stakeholder and research collaboration required | Just as the central administration has undertaken the groundwater recharge priority mapping, the state government/district administration can do a more holistic mapping of the water challenges of the district. |
| Prepare a comprehensive district action plan for integrated water resource management with a bottom-up approach. Establish sustainable and inclusive water governance in the district to develop, implement, evaluate as well as share information on programmes for water resource management in a transparent and inclusive manner with mandatory stakeholder engagement and public participation. |      | Short to medium-term | Policy intervention required Stakeholder and research collaboration required | Maharashtra Government had launched the Jalyukt Shivar Abhiyaan in 2015-16 to make the state drought-free by 2019. This inter-departmental collaborative scheme also covered Nagpur district with activities like, groundwater survey and development engineering, drainage deepening and widening, dam repairing and construction of minor irrigation ponds, water reservoir and drain dams, etc., in different blocks of the district (Water Resource Department, GoM, 2019). The programme introduced water budgeting as one of the key concepts and took initiatives which led to an increase in groundwater levels of 1.5 to 2 metres. Additionally, 11,000 villages have been declared drought-free and agricultural productivity has increased by 30% to 50% in the areas of implementation in Maharashtra (Niti Aayog, 2019). |

⁹ FGD removes SO_x content from flue gas using chemical processes. For a typical coal-fired power station, FGD may remove more than 90% of the SO_x from flue gases. Various types of FGD technologies such as wet type FGD (using limestone, ammonia and sea water as raw material), semi-dry type FGD and dry sorbent injection FGD can be used. However, wet type FGD with limestone is the most popular, on account of lower capital and operational expenditure.

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario / case examples |
|--|---|--|---|--|
| | | Time frame for the action to be accomplished | Framework for Implementation | |
| Ensure proper implementation of Maharashtra Groundwater Development and Management Rules, 2018 (enacted as per the Model Bill for the Conservation, Protection, Regulation, Management of Ground Water, 2017) at the district level. |      | Short-term and continuous | <p>Policy framework exists</p> <p>Needs strict implementation at the district level</p> | Maharashtra Government has introduced the Maharashtra Groundwater Development and Management Rules (MGDMR), 2018 with provisions such as mandatory registration of wells and permission requirement for digging new wells, which is contingent on building a groundwater recharge structure alongside. Additionally, MGDMRs also have provisions to regulate, and in some cases even prohibit, extraction of groundwater through wells, to limit unsustainable groundwater use practices undertaken by farmers in the state. |
| <p>Promote rainwater conservation through:</p> <p>a) renovation of existing rainwater harvesting structures,</p> <p>b) ensuring inclusion of rainwater harvesting structures in new construction of residential buildings, institutional, commercial centres, and industries in the district, as per building bye-laws,</p> <p>c) Mandatory rainwater harvesting at the upstream to halt run-off and recharge groundwater.</p> |     | Short to medium-term | <p>Policy framework exists</p> <p>Align with existing regulations</p> <p>Needs infrastructural investment</p> | <p>The pre-monsoon decadal ground water level trend (2010-2019) shows a rise in several parts of Maharashtra, including the Nagpur region. However, the post-monsoon decadal water level trend shows a declining trend of more than 0.1 m/year in isolated parts of Nagpur (CGWB, 2021).</p> <p>Under the Revised Development Control Regulation of Maharashtra, 2009, rainwater harvesting is mandatory in all buildings, layouts of open spaces, amenity spaces of housing societies and new constructions of area ≥ 300 sq. m in Maharashtra. They shall have one or more rainwater harvesting structures such as an open well or a borewell, or underground storage tank or percolation pits. The bye-law envisages that no building permission will be granted unless provision is made for rainwater harvesting. The owner/society also has to ensure the maintenance of these structures. In case of non-compliance with the aforementioned rules, the municipal corporation/council would levy a fine of up to ₹ 1,000/annum/100 sq. m of built-up area.</p> |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario / case examples |
|---|--|--|---|---|
| | | Time frame for the action to be accomplished | Framework for Implementation | |
| |   | Medium-term | Research collaboration required | According to the Water Works Department of NMC, the average non-revenue water (NRW) within Nagpur city is 45.26% (against the national average of 15%) owing to pilferage, including leakage in pipes, theft, illegal diversion or non-metering (The Times of India, 2020). |
| Ensure minimum 'non-revenue water' (NRW), i.e., technical loss due to leakage, seepage or unauthorised use (theft). | | | | |
| Promote 'net zero water' construction and infrastructure upgradation in urban areas, in alignment with ECBC norms. |    | Medium-term | Policy level interventions required | In November 2011, NMC launched its uninterrupted water supply scheme, called 24x7 Water Supply Scheme in PPP model. The project has helped the city improve water access, enhance efficiency, as well as reduce losses attributable to non-revenue water. Under this scheme, 85,000 of the 3,21,000 conventional connections were replaced with metered connections along 450 km of the pipeline coverage. Close to 1,00,000 unauthorised connections have been identified during the rehabilitation phase, and commercial losses have reduced and NMC revenues have increased. Service delivery issues are being tackled through infrastructure augmentation and increase in capacity of elevated service reservoirs (NITI Aayog, 2019). |
| Water billing based on water metering rather than fixed charges. |   | Medium to long-term | Policy framework exists | Under NMC's, '24x7 Water Supply Scheme' 1.60 lakh water meters were installed within the city. The scheme target was 3.09 lakh households in Nagpur by 2018. The project is being implemented by a private operator – Orange City Water Private Limited (PPP model) (NITI Aayog, 2019). |
| Promote dual-flush systems to reduce water consumption, energy consumption, and wastewater generation. |  | Short to medium-term | Align with the existing policies Could be implemented as a part of green buildings | |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario / case examples |
|--|---|--|---|--|
| | | Time frame for the action to be accomplished | Framework for Implementation | |
| <p>Identification of non-point sources of pollutants, including chemicals from agriculture runoff, city sewerage from commercial and residential sector and untreated industrial effluent into the rivers and any other surface or groundwater sources.</p> <p>Improved inter-departmental exchanges and proactive measures by respective ULBs and MPCB to halt effluent discharge and waste dumping at water courses.</p> <p>Immediate investment into wastewater management infrastructure, ensure the functionality of the existing ones along the river courses, improve treatment status of wastewater before disposal and reuse of treated wastewater for industrial purposes.</p> |    | Short to medium-term | <p>Policy framework exists</p> <p>Monitoring and reporting required</p> <p>Needs infrastructural investment</p> | <p>A comprehensive sewerage system is proposed and sanctioned with 1,362 km of sewerage network length, three STPs (48 MLD) on Nag River and two STPs (43 MLD) on Pilli River targeting to make the rivers pollution free by 2023. Polluting streams are planned to be diverted to Bhandewadi STP for treatment. Unfortunately, even after getting the first approval in 2008, the project is yet to start for a number of administrative hitches (Numerical, 2019).</p> <p>Maharashtra Government has mandated the reuse of treated wastewater for cooling TPPs and introduced Maharashtra Water Resources Regulatory Authority Water Entitlement Transfer (WET) and Wastewater Reuse Certificates (WRC) Platform Regulations, 2019.</p> <p>NMC and MahaGenco have initiated a CETP of 130 MLD capacity under JNNURAM which is supplying the treated water to the Koradi TPP, run by MahaGenco.</p> |

| Recommendations | Cross-cutting with | Qualifying priority | | District scenario / case examples |
|---|---|--|---|---|
| | | Time frame for the action to be accomplished | Framework for Implementation | |
| <p>Action towards sustainable development of river basins:</p> <p>a) Research on interrelations between urbanisation, river basin ecosystem and climate,</p> <p>b) better administration of rivers including frequent testing and increased number of water quality parameters,</p> <p>c) evaluation according to regulatory standards.</p> | | Short to medium-term | Needs research collaboration | |
| <p>Adoption of aggressive awareness campaigns, in localities.</p> <p>Digital water quality status, impact and advisory display boards at important points along the rivers and lakes.</p> <p>Launch a district specific 'pollution check' mobile application for the citizens to be informed and get engaged by notifying the authorities for cases of violation in their notice.</p> |   | Short-term and continuous | Needs outreach strategy and collaborations | <p>The rivers, Nag, Pilli and Pora flow through Nagpur district. Reportedly, heavy sewage, storm water and untreated industrial effluents are being discharged into these rivers making them highly polluted.</p> <p>Currently, MPCB publishes Annual Water Quality Report at the state level, which also includes Nagpur zonal status. MPCB has only three monitoring locations on Nag river and two on Pilli river.</p> |
| Complete ban on direct intentional activities causing pollution, like, bathing, washing, waste dumping in rivers, etc. |  | Short term | Needs policy intervention Awareness and infrastructural investment | For the city range of Nag river, a Nag River Pollution Abatement Plan is under development, with proposals of several wastewater treatment plants (at Chikhali Khurd area, Hudkeshwar Narsada, NIT and one by NRCP). NMC also carried out Nag and Pilli river campaigns. |
| De-siltation and river cleaning drives engaging the citizens for Nag, Pilli and Pora rivers. Demarcation of definite river and lake boundaries and immediate removal of encroachments. |   | Short-term and continuous | Policy framework exists Needs financial investment | NMC carries out de-silting activities from time to time in different lakes and river stretches within city limits, eg., de-siltation of Gorewada lake, widening and de-siltation of Grenada 47 km stretch of Nag, Pilli and Pora river, etc. |
| Development of buffer zones and green belts along the river banks and lakes to prevent soil erosion, run-off and to protect water quality. |   | Medium to long-term | Needs policy interventions and integration into developmental plans | |
| Creating potential revenue generating activities and alternative community livelihood sources from lake ecosystem, eg., boating, fisheries, beautification of banks, aquatic plants, floating markets, etc. |   | Medium to long-term | Needs collaborative efforts and investment | |

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

| Sectors | Policies and programs that can push forward the recommendation | Primary departments/agencies | Supporting departments/agencies |
|--|--|--|--|
| Managing 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, 2020 4) Solid Waste Management Rules, 2016 and Amendment, 2018 5) Construction and Demolition Waste Management Rules, 2016 | <ol style="list-style-type: none"> 1) MPCB 2) All ULBs 3) All Gram Panchayats | <ol style="list-style-type: none"> 1) District Administration and the proposed District Level Climate Change and Environment Committee 2) Department of Environment and Climate Change, GoM 3) Department of Forest, GoM 4) Department of Transport, GoM 5) RTO |
| Making brick kilns sustainable | <ol style="list-style-type: none"> 1) Energy Efficient Enterprise (E3) Certification Scheme for Burnt Clay Brick Manufacturing Industry 2) Maharashtra Industrial Policy, 2019 3) Environment Protection Act, 1986 – Section 6 and 25. 4) Air (Prevention and Control of Pollution) Act, 1981 – Section 18(1) (b) for the prevention and control of air pollution in different types of brick kilns | <ol style="list-style-type: none"> 1) Industries, Energy and Labour Department, GoM | <ol style="list-style-type: none"> 1) Proposed District Level Climate Change and Environment Committee 2) MPCB 3) District Industries Centre 4) Land and Revenue Department |
| Thermal power plants: Operational and in pipeline. | <ol style="list-style-type: none"> 1) Environment Protection Act, Amendment Rules, 2015 2) Air (Prevention and Control of Pollution) Act, 1981 3) National Clean Air Programme 4) PAT Scheme | <ol style="list-style-type: none"> 1) Maharashtra State Power Generation Company 2) NTPC Limited (National Thermal Power Corporation Limited) 3) Vidarbha Industries Power Limited (VIPL) 4) Ideal Energy Power Limited 5) Abhijeet MADC Nagpur Energy Pvt. Limited | <ol style="list-style-type: none"> 1) District Administration and the proposed District Level Climate Change and Environment Committee 2) Urban Development Department, GoM 3) All ULBs 4) Rural Development and Panchayat Raj Department, GoM 5) Department of Forest, GoM 6) Water supply and sanitation department, GoM |
| Water scarcity and water pollution | <ol style="list-style-type: none"> 1) Model Bill for the Conservation, Protection, Regulation, Management of Ground Water, 2017 2) Water Prevention and Control of Pollution Act, 1974 3) National Water Mission, 2008 4) Maharashtra Groundwater Development and Management Rules, 2018 5) Maharashtra Water Resources Regulatory Authority Water Entitlement Transfer (WET) and Wastewater Reuse Certificates (WRC) Platform Regulations, 2019 6) Maharashtra State Water Policy, 2019 7) Jaluyukt Shivar Abhiyaan Maharashtra 8) Water Resources Development and Management Plans (WRDMPs) 9) Integrated State Water Plan (ISWP) | <ol style="list-style-type: none"> 1) Water Resources Department, GoM 2) Water Supply & Sanitation Department, GoM 3) MPCB 4) Maharashtra Water Resources Regulatory Authority 5) All ULBs 6) All Gram Panchayats | <ol style="list-style-type: none"> 1) Proposed District Level Climate Change and Environment Committee 2) NMRDA 3) Urban Development Department, GoM 4) Rural Development and Panchayat Raj Department, GoM 5) Directorate of Industries, GoM 6) MIDC |

Recommendations for phasing out coal mines in Nagpur district¹⁰

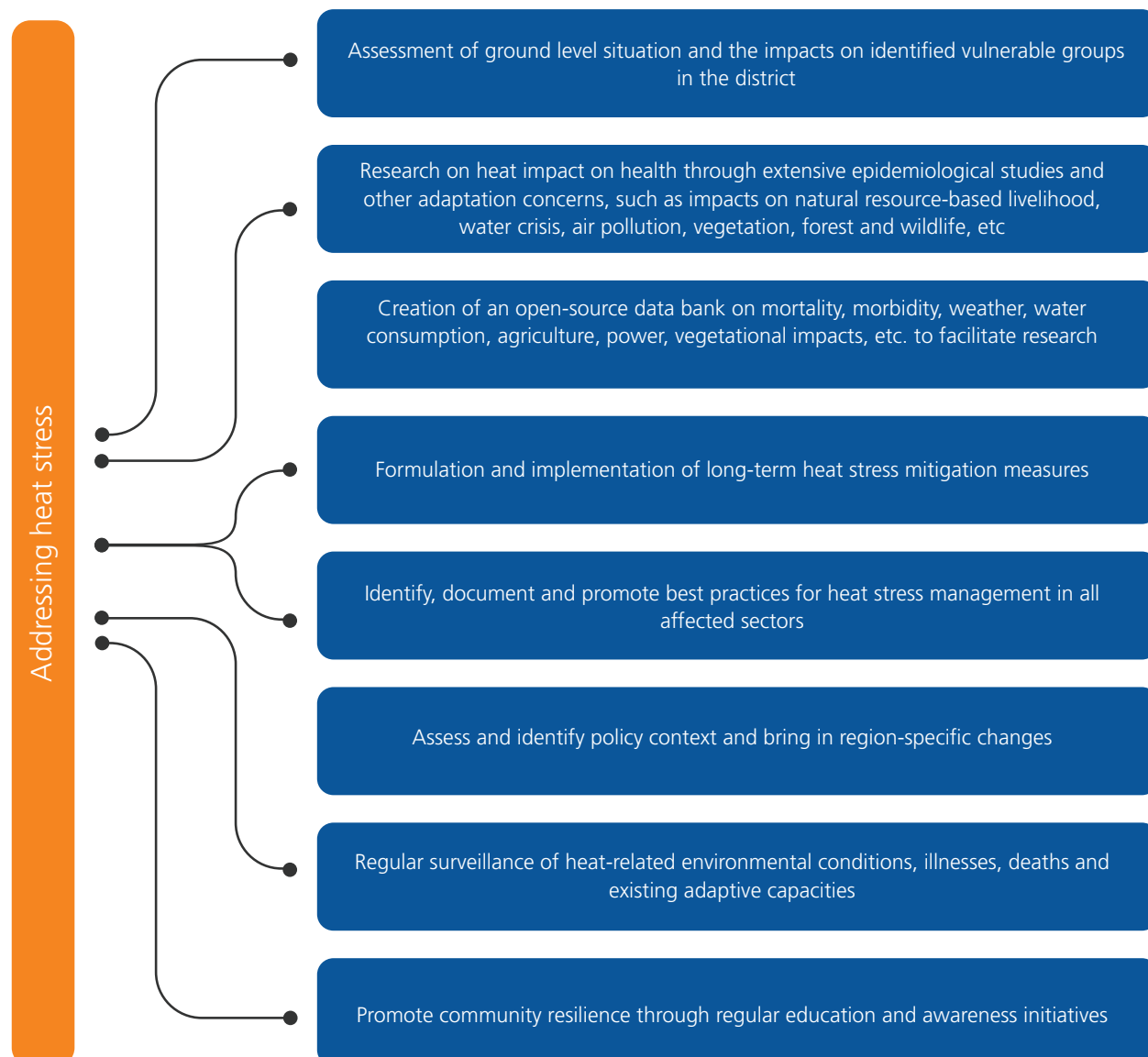
Besides the emissions from coal powered thermal plants, coal mining activities itself lead to GHG emissions in the form of fugitive emissions that occur during mining, transportation and processing. Nagpur district emitted around 3,98,000 tonnes of CO₂e. emissions due to coal mining in 2018.

In order to align with India's latest climate commitments under the UNFCCC Paris Agreement and to complement Maharashtra's State Action Plan on Climate Change (SAPCC), Nagpur district must plan to phase out the coal mining. Recommendations to work towards this aspect are as under:

- Prepare a viable coal phase-out roadmap with defined targets, timelines and proper monitoring and evaluation framework.
- Encourage a just and feasible transition for coal mining workers. Facilitate reskilling, provide platforms to access decent work and quality jobs. As well as ensure regional economic development, while at the same time limiting adverse impacts on consumers and energy-intensive industries.
- Discourage/ prevent new coal-fired power plants from being built in the district, and enhancing the capacity of RE (detailed recommendations given in sections 6.1.1 and 6.3).
- Devise cost-efficient alternatives, such as including carbon pricing or industry-internal schemes whereby remaining power stations pay out plants that are retiring ahead of their end of economic life.
- Ensure mine reclamation and rehabilitation:
 - ◀ Provisions related to environmental impact mitigation, mine closure, resettlement for locals and employment,
 - ◀ Open legal avenues for local communities and indigenous people affected by mining,
 - ◀ Ensure back-filling of pits regularly or in intervals to restore the land to its original state as far as possible,
 - ◀ Cover toxic wastes, barren waste rocks, tailings or any inhibition to vegetation with the previously stored top soil,
 - ◀ Effectively carry out tillage (provides aeration, mix fertilisers and mulches into the soil to reduce compaction in the soil and facilitate moisture infiltration,
 - ◀ Installation of effective drainage and sediment control system,
 - ◀ Devise suitable plans for rehabilitation of people.
- **Sand and other minor mineral mining**
 - ◀ Carry out effective river audits and develop detailed reports of all mining areas available in public domain.
 - ◀ Prevent ground water pollution by prohibiting sand mining on fissures, as it works as filter prior to ground water recharge.
 - ◀ Promote alternatives i.e., manufactured sand, artificial sand and alternative technologies in construction materials processing to reduce the dependence on naturally occurring sand and gravel.
 - ◀ Develop local supplier capacity, strengthen local value chains and integrate them into core business.
- **Environmental legislation with reference to mining in India**
 - ◀ Mineral Conservation and Development Rules, 2017
 - ◀ The Environment Impact Assessment (EIA) Notification, 2006
 - ◀ Provisions for mining operations under Forest (Conservation) Act, 1980 and the rules made in 1981
 - ◀ National Mineral Policy, 2019








¹⁰ District scenario for mining in Nagpur is given in Chapter-1






Recommendations for managing heat stress in Nagpur district¹¹







¹¹ The district scenario is given in Chapter 2









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 |
|---|---|---|---|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| 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. |    | Short to medium-term | Policy framework and targets exist (section 6.4.1) | <p>The AT&C losses of MSEDCL for FY 2018-19 are 16.9%, well over the international standard range of 6% to 8%, there is a clear scope of improvement.</p> <p>MSEDCL needs to upgrade its infrastructure, introduce smart metering, smart billing, etc. to increase its efficiency.</p> <p>Case 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 a 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). Similar pilot projects can be introduced in Nagpur by MSEDCL.</p> |
| HABITAT: Provide subsidies/tax rebates to builders/building owners to encourage adoption of ECBC or IGBC (eg. property tax/water cess/IT rebate). |  | Medium to long-term | Policy framework exists (section 6.4.1), but targets need to be set Needs inter-departmental collaboration | ECBC buildings deliver 20% to 25% energy savings, in different climates, when compared with the conventional buildings (BEE, 2017). |
| HABITAT: Energy efficient vertical urban development should be promoted instead of horizontal development to conserve green cover. |    | Medium to long-term | Policy level intervention required | Vertical urban growth facilitates more housing for the population, and contributes towards the environment. It averts the loss of agricultural land and open spaces and makes the transport mechanism much more efficient. |

| Recommendations that could be pursued by the district collector/state-level committee | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|--|---|--|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| <u>TRANSPORT:</u> Energy efficiency of infrastructure in railways can be enhanced through the following measures: a) Installing solar panels along electrified tracks and on railway station rooftops, b) Installing optimal light control systems and appliances, smart sensors and building management systems at station buildings, c) Ensuring regeneration of energy (through rolling stock) parallel to the grid. |   | Medium-term | Needs inter-departmental collaboration | Rail Land Development Authority and National Building Construction Corporation have signed an MoU for the redevelopment of 10 railway stations across India as 'smart railway stations'. Railway stations in the district can also be developed along similar lines. |
| <u>TRANSPORT:</u> Use fiscal instruments to discourage the use of personal vehicles by: a) Increasing charges on registration of internal combustion engine (ICE) vehicles, b) levying congestion charges and other green tax, c) phasing out of older, more polluting vehicles. |   | Short-term and continuous | Proper policy backing based on research and inter-departmental cooperation is needed | In January 2021, the Ministry of Road Transport and Highways announced additional taxes on old vehicles that are unfit for roads as 'green taxes'. |
| <u>TRANSPORT:</u> Identify and shift key commercial / business centres from all the ULBs to outside city limits to reduce traffic load. | | Long-term | Needs proper policy, based on research and inter-departmental cooperation | Need for the development of areas outside NMC limits to accommodate the shifting of industries, business centres, IT parks etc. |
| <u>TRANSPORT:</u> While gradually rolling out EV infrastructure, district authorities can recommend (to state and national governments) standardised EV cables and infrastructures. This would help put in place large-scale smart charging infrastructure that is easier to integrate and interoperable. |  | Medium to long-term | Needs policy intervention | |

| Recommendations that could be pursued by the district collector/state-level committee | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|--|---|--|---|---|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| INDUSTRY: a) Ensure regular PAT compliance of DISCOMs and other designated consumers (DCs) in the district. b) Increase the number of DCs for the PAT scheme in the district, and ensure the compliance of targets. |  | a) Short-term and continuous b) Medium to long-term | Policy framework exists (section 6.4.1), but targets need to be revised gradually Ensure M&E Collaboration required | Until PAT Cycle VI (2020-21) only eight DCs have volunteered under the scheme in Nagpur district. ¹² Over the years, various DCs from the district have helped avoid around 2,11,009 tCO ₂ e emission by improving their systemic energy efficiency under the PAT scheme. |
| INDUSTRY/ENERGY: Ensure compliance to renewable purchase obligations (RPOs) while gradually increasing the RPO targets. |  | Medium to long-term | Policy framework exists (section 6.4.1) | For FY 2021-22, the RPO target for industries is 17.5% in the state, as set by MERC. |
| AGRICULTURE: Encourage millet cultivation (requires less water to grow, shows good productivity under extreme climate conditions and is rich in nutrition). |  | Medium to long-term | Needs creation of appropriate financial mechanisms to encourage farmers to grow millets Requires research collaboration This would also enable achievement of targets of SDG#2 (Zero Hunger): 2.1, 2.3, 2.4 | The production of <i>jowar</i> decreased in Nagpur from 80,000 tonnes (2017-18) to 68,110 tonnes (2019-20). |
| 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. |  | Medium to long-term | Needs research collaboration and capital investment This would also enable achievement of the following targets of SDG#2 (Zero Hunger): 2.1, 2.3, 2.4, 2.a. | Area under wheat cultivation in the district has decreased from 1.8 lakh ha (2017-18) to 1.56 lakh ha (2019-20) leading to decreased production from 3.02 lakh tonnes (2017-18) to 2.03 lakh tonnes (2019-20). The yield has reduced by 21.8%. In order to meet the food demand in the future, climate-smart agriculture is the key to reduce crop failures. |

12 Names of designated consumers: Morarjee Textiles Ltd, Spentex Industries Ltd, Sunflag Iron and steel Co, Topworth Urja and Metal Ltd, Khaparkheda TPP, Koradi TPP, Mouda TPP, Butibori TPP

| Recommendations that could be pursued by the district collector/state-level committee | Cross-cutting with | Qualifying priority | | District scenario/case examples |
|---|---|---|--|--|
| | | Timeframe for the action to be accomplished | Framework for implementation | |
| AGRICULTURE: For overall reduction in electricity and water consumption in agriculture, subsidies need to be reduced in a phased manner. |    | Medium to long-term | Policy intervention needed Requires awareness generation and collaboration with the farming communities | Agricultural tariff in Maharashtra is only around 50% of the average cost of supply (ACoS). In addition, GoM is providing a substantial subsidy against even this lower tariff under Section 65 of the Electricity Act, 2003. ¹³ The approved tariff has decreased by 6% and 1% for high tension-agriculture and low tension-agriculture meters, respectively, for FY 2020-21. |
| 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 percent of their profit for greening of open spaces in the district. |    | Long-term | Needs strengthening of the existing policy framework Needs stakeholder collaboration | Green belt on the boundaries of industries help in maintaining the green cover of the area. Moreover, it absorbs the pollution emitted from the industries (i.e., helps in carbon sequestration). |
| E-WASTE: Adopting 'green marketing' by: a) Promoting green products, b) displaying product lifespan on e-products labels to influence purchase decisions, thereby using the labels as behavioural intervention. |   | 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 | 1) Maharashtra State Energy Conservation Policy, 2017 2) National Smart Grid Mission 3) Smart Metering National Programme 4) Integrated Power Development Scheme (IPDS) 5) Restructured Accelerated Power Development and Reforms Programme (R-APDRP) 6) UDAY Scheme, 2015 7) National Mission on Energy Efficiency, specifically PAT (Perform, Achieve and Trade) Scheme 8) Maharashtra State Renewable Energy Policy, 2020 9) Policy for Decentralized Renewable projects, 2016 10) Standards and Labelling Programme | 1) Industries, Energy and Labour Department, GoM 2) MSEDCL, GoM 3) MEDA, GoM 4) BEE (EESL) | 1) Department of Environment and Climate Change, GoM 2) Central Railways – Nagpur Division 3) Proposed District Level Climate Change and Environment Committee |

¹³ <https://www.mahadiscom.in/consumer/wp-content/uploads/2020/03/Order-322-of-2019.pdf>


| Sub-sectors | Policies and programmes that can push forward the recommendation | Primary departments/agencies | Supporting departments/agencies |
|-------------|--|--|---|
| Habitat | 1) ECBC, 2017 | 1) Urban Development Department, GoM 2) MEDA, GoM 3) All ULBs 4) Nagpur Smart and Sustainable City Development Corporation Limited (NSSCDCL). | 1) Proposed District Level Climate Change and Environment Committee 2) MSEDCL |
| Transport | 1) ECBC 2) JNNURM 3) Smart Cities Mission 4) AMRUT | 1) Department of Motor Vehicles, GoM 2) All RTOs 3) All ULBs | 1) MSRTC 2) MEDA 3) MSEDCL 4) Nagpur Smart and Sustainable City Development Corporation Limited 5) Central Railways: Nagpur Division |
| Industry | 1) PAT Scheme 2) Industrial Promotion Policy, 2014 3) BEE-SME Program | 1) Industry, Energy and Labour Department, GoM | 1) District Industries Centre 2) Proposed District Level Climate Change and Environment Committee |
| AFOLU | 1) National Mission on Food Security 2) Rashtriya Krishi Vikas Yojana: RAFTAAR 3) National Mission for Sustainable Agriculture 4) Price Support Scheme 5) National Afforestation Programme (NAP) 6) Green India Mission 7) CSR Act, 2013 | 1) Department of Agriculture, GoM 2) Maharashtra Forest Department, GoM | 1) APMCs 2) MIDC 3) Energy Department, GoM 4) Maharashtra Agro Industries Development Corporation 5) Directorate of Geology and Mining, GoM 6) Maharashtra State Agriculture Marketing Board 7) Proposed District level Committee on Climate Change and Environment |
| Waste | 1) E-waste Management Rules, 2016 | 1) Directorate of Information Technology, GoM | 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; water |
| 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 the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment | AFOLU (agriculture), mining |
| | Target 2.4: By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality | AFOLU (agriculture), mining |
| | Target 2.a: Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research | AFOLU (agriculture), mining |
| | Target 2.a; Article 10.3.e: Development of sustainable irrigation programmes for both crops and livestock. | AFOLU (agriculture and livestock) |
| 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 | Water pollution; co-benefits from waste (through cleaner neighbourhood, better access to sanitation) |
| | Target 3.4: Reduce by one third premature mortality from non-communicable diseases through prevention | Co-benefits from waste (by reducing pollution and providing better hygiene) |
| | Target 3.9: Substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination | Waste; water scarcity and pollution; air pollution |
| SDG 6: Clean Water & Sanitation  | Target 6.1: Achieve universal and equitable access to drinking water | Water scarcity and water pollution |
| | 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 | Waste; energy (industry); water pollution; mining; thermal power plants |
| | Target 6.4: Substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals | Energy (habitat: demand side management, industry); AFOLU (agriculture and green spaces); water scarcity; mining; thermal power plants |
| | Target 6.5: Implement integrated water resources management at all levels | AFOLU (agriculture and green spaces/forestry); water scarcity and pollution, thermal power plants (TPP) |
| | Target 6.8: Support and strengthen the participation of local communities | Waste; AFOLU; transport; mining |
| | 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; mining |

| SDGs | Targets | Sector (sub-sectors) addressing the recommendation |
|--|---|---|
| SDG 7: Affordable & Clean Energy  | Target 7.1: Ensure universal access to affordable, reliable and modern energy services | Energy (power, habitat); AFOLU (agriculture); TPP |
| | Target 7.2: Increase share of renewable energy in energy mix | Energy (power, transport, habitat: energy efficiency in building and bye-laws for new construction, industry); mining |
| | Target 7.3: Double the global rate of improvement in energy efficiency | Energy (power, habitat, industry); TPP |
| | 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); mining; TPP |
| | 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); AFOLU; TPP; mining |
| 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); mining |
| | 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; mining |
| | Target 8.9: Devise and implement policies to promote sustainable tourism | AFOLU (forestry/green spaces) |
| SDG 9: Industry, Innovation and Infrastructure  | Target 9.1: Develop quality, reliable, sustainable and resilient infrastructure | Energy (habitat: energy efficiency in building, transport); waste; mining |
| | 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); water scarcity |
| | 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); waste; mining; |
| | Target 9.b: Research and innovation in developing countries, including by ensuring a conducive policy environment | Waste; energy (power, industry); air pollution; mining |

| SDGs | Targets | Sector (sub-sectors) addressing the recommendation |
|--|---|--|
| 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; water |
| | 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, habitat: energy efficient building); |
| | Target 11.4: Strengthen efforts to protect and safeguard the world's cultural and natural heritage | AFOLU (forestry); water scarcity |
| | 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, transport, industry); air pollution; mining; TPP |
| | 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, 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 |
| 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; water pollution; mining |
| | 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 and water pollution; mining |
| | Target 12.5: Substantially reduce waste generation through prevention, reduction, recycling and reuse | Waste; energy (habitat and industry); mining |
| | 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); mining |
| | 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 and sub-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) |

| SDGs | Targets | Sector (sub-sectors) addressing the recommendation |
|---|---|--|
| 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; water pollution; mining |
| | 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 | AFOLU (forestry); water pollution; mining |
| | Target 15.9: Integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies | AFOLU; water scarcity; mining |
| | 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 and water scarcity |
| 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; BCC; individual action |
| | 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 it 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, and install window shades, shutters, screens, etc. on windows for an extra layer of insulation and to prevent cooling loss.
- 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



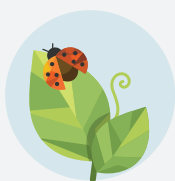
Other climate-conscious precepts



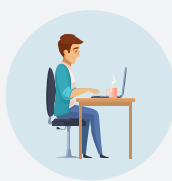
Be mindful of water consumption. Use bucket instead of shower. Use bucket instead of hose for cleaning cars/ porch/back-yard. Opt for dual-flush toilets. Close the tap while brushing. Reuse RO reject water.



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.



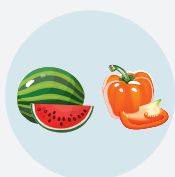
If possible, opt for work from home option for a few days in a week.



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



1

Purchase BEE star-rated energy efficient appliances



2

Shift consumption to off-peak hours (i.e. other than 10 am to 8 pm)



3

Replace electric water heater with a solar water heater, if feasible



4

Unplug idle devices/appliances.



5

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



6

Proper maintenance of air conditioners helps to increase efficiency



7

Do not overload the refrigerator



8

Set the AC thermostat at 25°C to 26°C, for optimum cooling

Transport



1

Choose direct flights to reduce carbon footprint



2

Travel light to reduce carbon emissions



3

Strictly abide by pollution norms



4

Put on your shoes for short trips



5

Ensure regular maintenance of vehicles



6

Choose inter-modal transport (private + public)



7

Reduce demand for vehicle travel by expanding personal mobility choices such as car-sharing and bike-sharing



8

Shift to clean, non-petroleum fuels such as electricity (through RE) to power vehicles



9

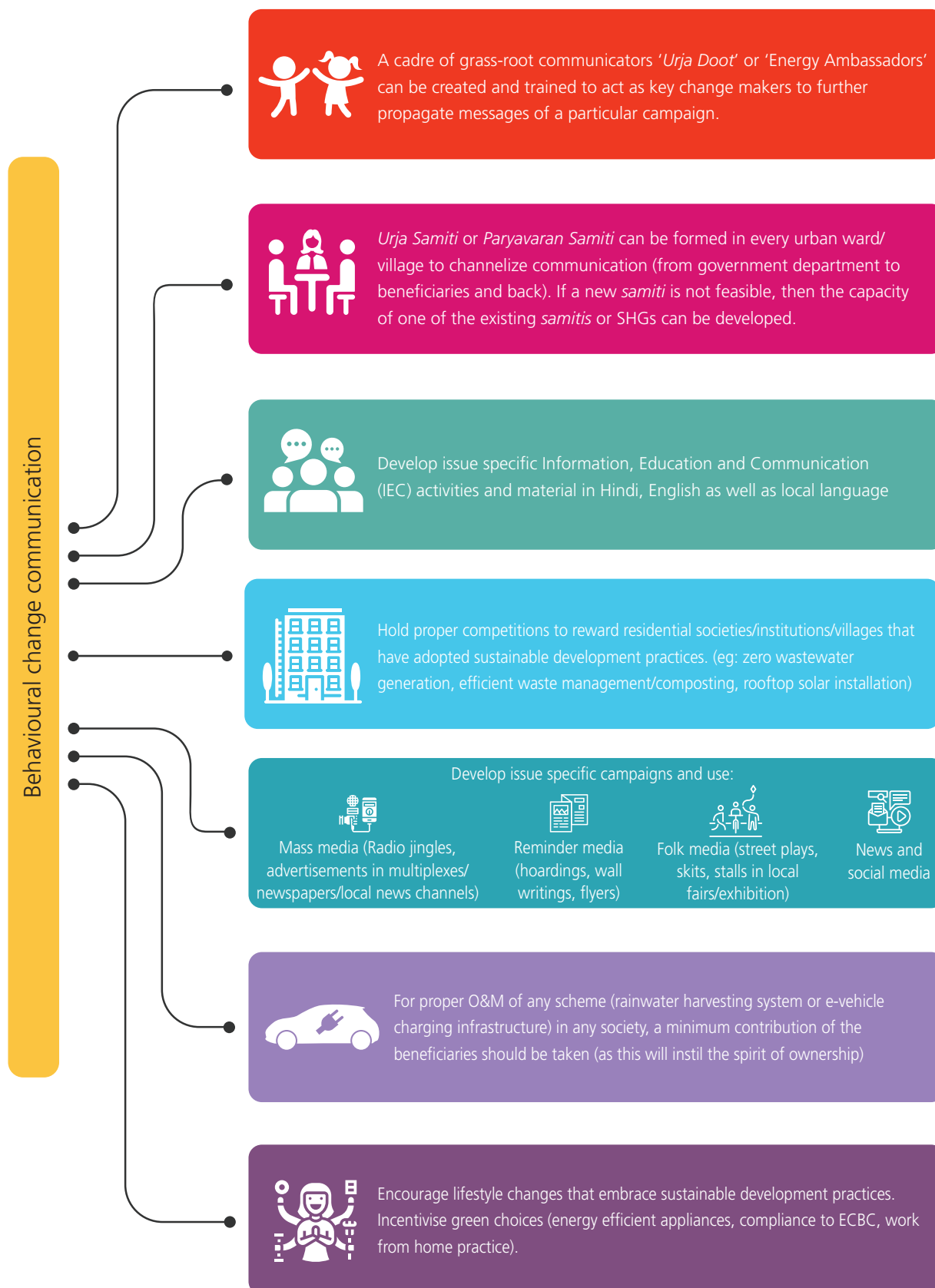
Car pool to work, Use bicycles park and ride



10

Switch off the ignition at traffic signals

6.7. Behavioural Change Communication (BCC) techniques



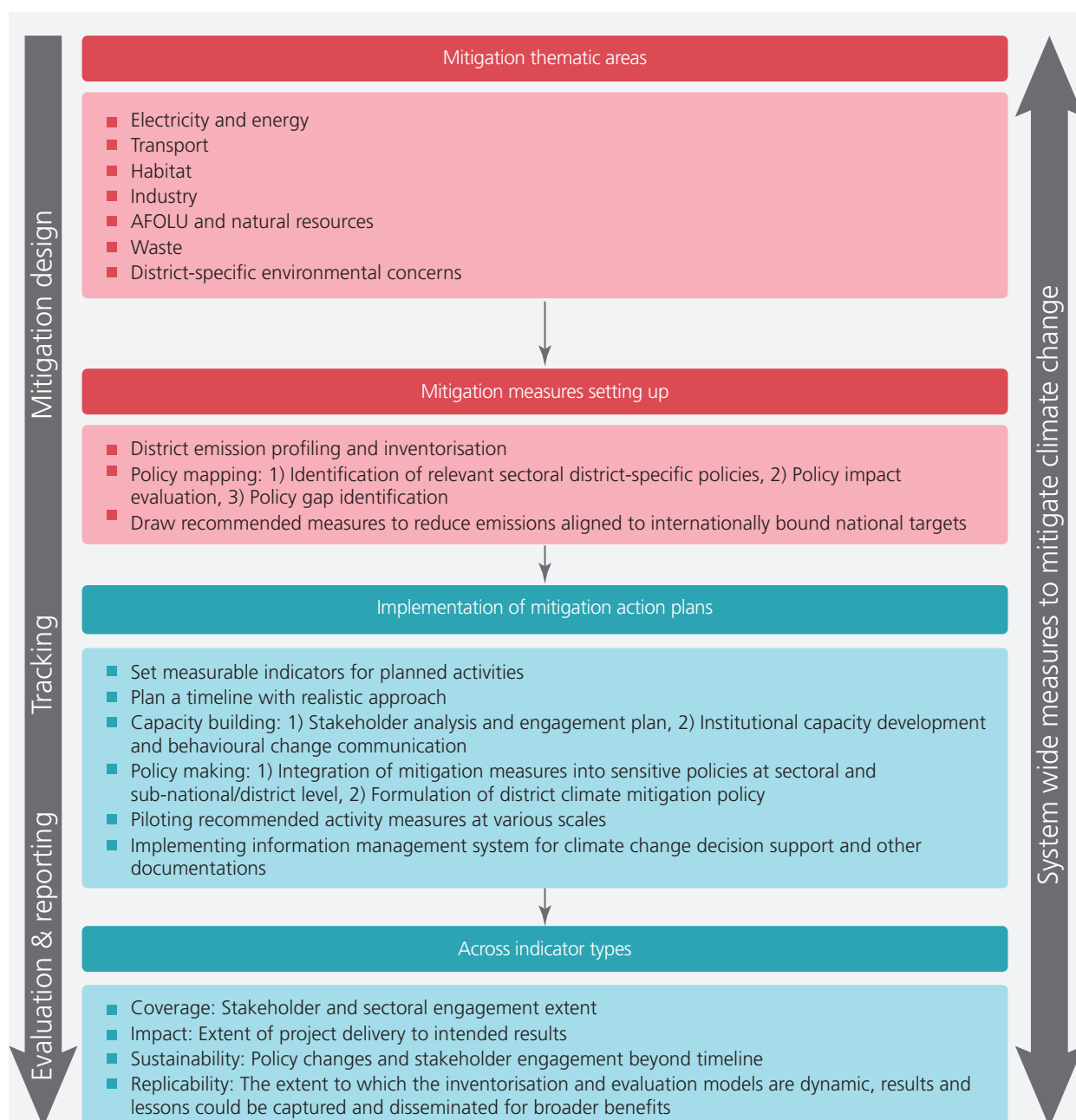
MONITORING AND EVALUATION PLAN



7. MONITORING AND EVALUATION PLAN

7.1. Framework for monitoring and evaluation

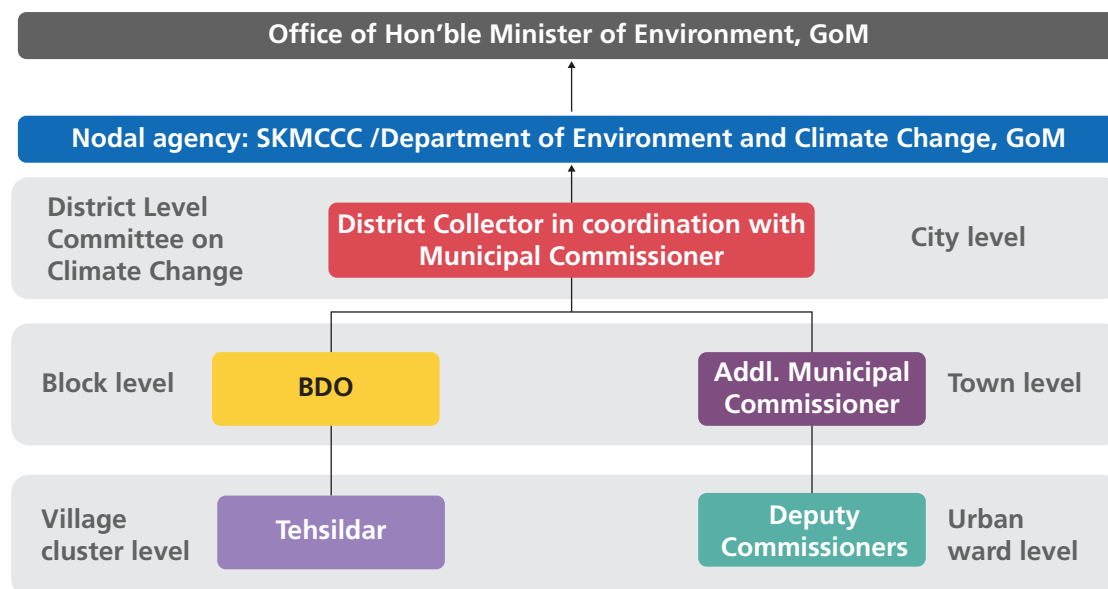
This section describes the planning for monitoring and evaluation (M&E) of the climate change mitigation measures that the district may adopt for sectors identified in the report. M&E is crucial to realise the achievement and track the effectiveness of results envisaged, in order to compliment the national endeavours to attain nationally determined contributions. The framework proposes to incorporate a) district-level mitigation profiling, b) planning for mitigation measures, c) tracking of implementation and integration to the national mitigation response, and d) evaluation of relevance and effectivity.¹⁴



¹⁴ Activities that are already covered in the current CCEAP for Nagpur District are in red colour. Activities that are: 1) to be based on the CCEAP findings and recommendations or, 2) potentially mapped out through the CCEAP report, like the stakeholder mapping or behavioural change communication plan, etc. are given in the blue colour.

7.2. Proposed institutional set-up

As a central authority or body to steer the wheels of climate mitigation, it is recommended to formulate a district climate cell/committee or include the perspective of climate change in the existing District Environment Committee.¹⁵ The committee shall assign tasks according to stakeholder analysis and engagement as outlined in the following model. This monitoring and evaluation committee shall comprise of representatives from concerned administrative bodies, sectoral experts, civil society organisations and civic/other associations (as applicable) and shall similarly be formed at the block, ULB, cluster and ward level. The committee shall oversee implementation of deliverables, following the prescribed recommendations/framework and the outputs. A proposed set-up of the committee at each of the levels is as follows:



District level committee

Chairman: District Collector

Members: Municipal Corporation Commissioner, District Development Officer (DDO), District Planning Officer (DPO), District Agriculture Officer (DAO), Superintendent of Police, Deputy Collector, district-level officers/representatives of: Pollution Control Board, MSMEs, Agriculture & Animal Husbandry, Department of Statistics and Planning, District Urban Development Agency, Industry Department, Urban Development Department (UDD), Water Supply, RDD, Health Care Department, Regional Transport Officer (RTO), etc.

Block level

Members: Representatives of the departments at the Block level.

Town level

Members: Rural Development Department, Department of Irrigation, Water Supply Department, Agriculture & Animal Husbandry and other departments mentioned in the district committee

Tehsil level

Members: Sarpanch and other PRI members, Self-help group members, head of women committee, Village water sanitation committee (VWSC), grassroots communicators

Urban ward level

Members: Department representatives, president of RWAs, grassroots communicators, civil societies

¹⁵ As per the Hon'ble NGT order in OA No. 710/713/2017 dated 15.07.2015



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IMPACT OF COVID-19 VIS-À-VIS CLIMATE ACTION



Empty roads during lockdown and an operational thermal power plant can be seen in the background

8. IMPACT OF COVID-19 VIS-À-VIS CLIMATE ACTION

8.1. Introduction

The ongoing COVID-19 pandemic has gravely affected the country. Nagpur reported a total of 4,93,445 cases as of Sep 30, 2021, making up for 7.5 percent of the state's total case load (Covid19India, 2021). This has affected the management of climate crisis.

Positive impacts: Lockdowns have had several positive impacts on the environment. For the first time in nearly four decades, India has seen a reduction in CO₂ emissions by 30 million tonnes CO₂ in FY2019-20 due to a slowdown in economic activity and restrictions (Lauri & Dahiya, 2020). In April 2020, aerosol levels were at a 20-year low for that time of the year in north India, one of the most polluted regions in the world (NASA, 2020). Improved water quality and biodiversity sightings were also reported from different parts of the country during mid-March to June, 2020 (Goswami, 2020).

However, the economic and social (both direct and indirect) costs of the pandemic are likely to take priority over climate goals and commitments. The following are some likely impacts of COVID-19 vis-à-vis climate action, inferred from observations across the country and drawn for the district of Nagpur.

8.2. Energy consumption

8.2.1 Electricity demand

Coal-based power generation reduced by 26 percent in just two weeks after the lockdown, a significantly larger drop as compared to 6 percent globally (Pillay, 2020). India's power consumption shrank by 22.75 percent in April, 2020 and increased by 14.16 percent in May, 2020 with relaxations in lockdown norms (The Economic Times, 2020). At the national level, while fuel consumption took a dip of around 70 percent, as compared to pre-COVID levels, electricity demand fell by 20 to 25 percent during the strict lockdown.

The total energy demand reduced largely due to decreased demand from services and industry sectors (IEA, 2020). Maharashtra's electricity consumption declined by 13 percent in the first eight months of 2020. In the long run, India's electricity demand is projected to be 7 to 17 percent lower by 2025 due to the downward revision of its GDP growth, partly due to the COVID-19 economic shock (Spencer, 2020).¹⁶

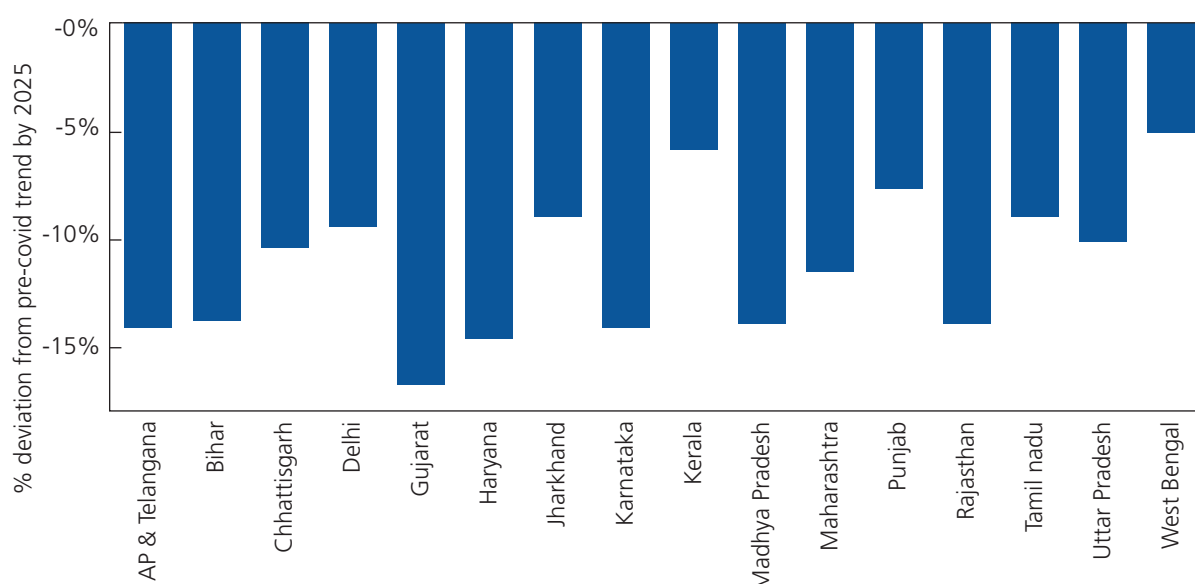


Figure 46: 2025 deviation of electricity demand from pre-COVID trends projected from major Indian states

¹⁶ However, as per Central Electricity Authority's Power Supply Report, the national energy requirement in August, 2021 was 1,28,519 MU, recording a 14 percent rise in comparison to the same month in 2019.

Outlook for Nagpur

Due to lower demand, some states have reduced coal power generation. Contribution of coal in total power generation in India reduced from an average of 72.5 percent in March, 2020 to 65.6 percent in April, 2020. This can be attributed to the fact that renewable energy sources have a 'must run' status, and the running cost of renewable power plants is lower as compared to thermal power plants (Surya, 2020). This only underscores the need to increase focus on renewable energy and strengthen its integration into the grid. Nagpur district needs to increase RE generation by encouraging projects such as solar rooftops, biogas, and solar pumps for agriculture.

8.2.2 Electricity generation in Nagpur district

Nagpur district has six coal-fired thermal power plants (TPP), namely: Mauda thermal power station (TPS), Koradi TPS, Khaparkheda TPS, Mihan TPS, Butibori TPP, and Bela TPS. Butibori TPP has been non-functional since February 2019, while Mihan TPS and Bela TPS have been non-functional for the whole of 2019 and 2020.

In order to determine the impact of lockdowns and reduced demand (due to COVID-19) on electricity generation, a month-on-month comparison was drawn on the total electricity generated by the TPPs in the district from January, 2019 till December, 2020.

This exercise shows that electricity generation took a hit post March 2020. A stark difference in electricity generation is visible in the months of April 2020 (69.37 percent decrease), May 2020 (61.94 percent decrease) and June 2020 (63.68 percent decrease), with respect to 2019. The findings are presented in Figure 47.

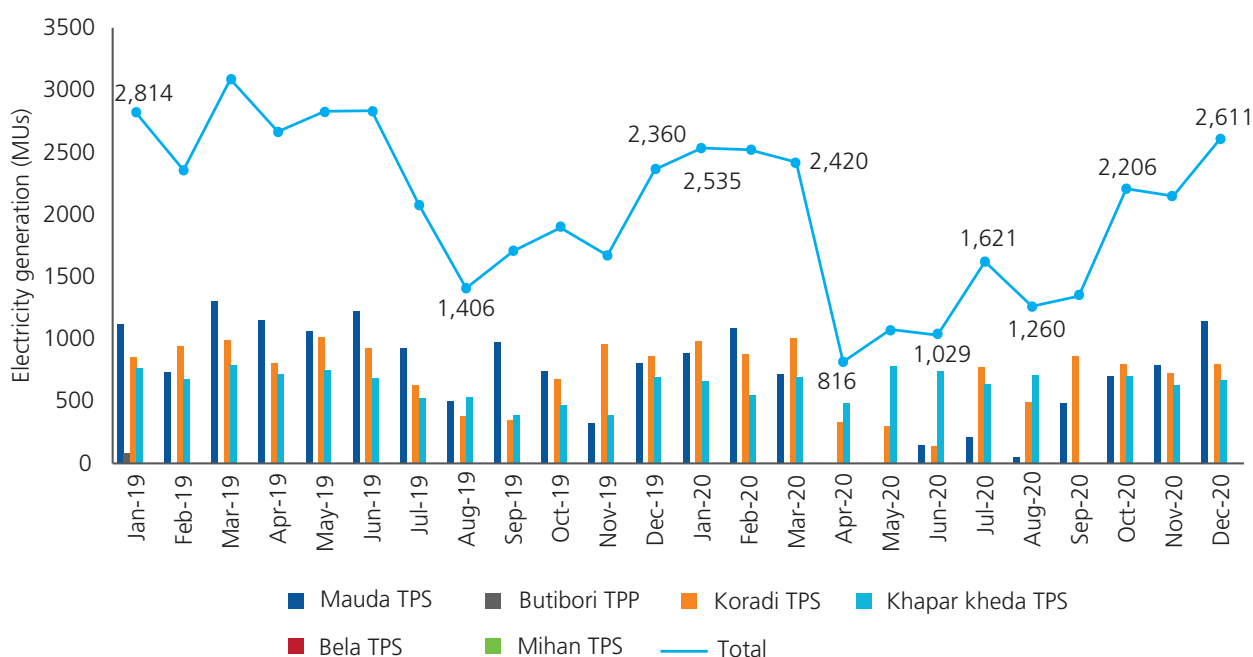


Figure 47: Monthly total electricity generated (Jan 2019 till Dec 2020) from the TPPs in Nagpur district.

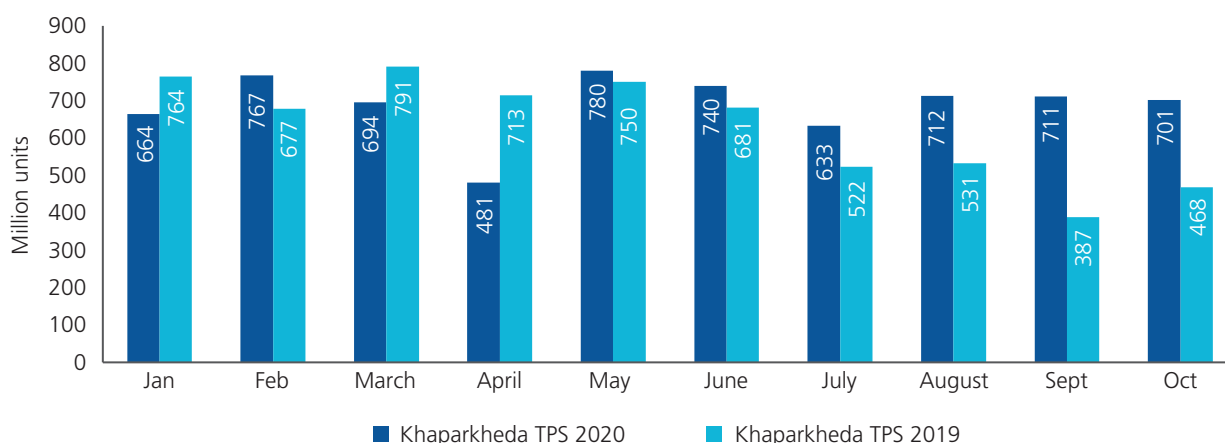


Figure 48: Monthly comparison of electricity generated at Khaparkheda TPS (Jan to Oct, 2019 and 2020)

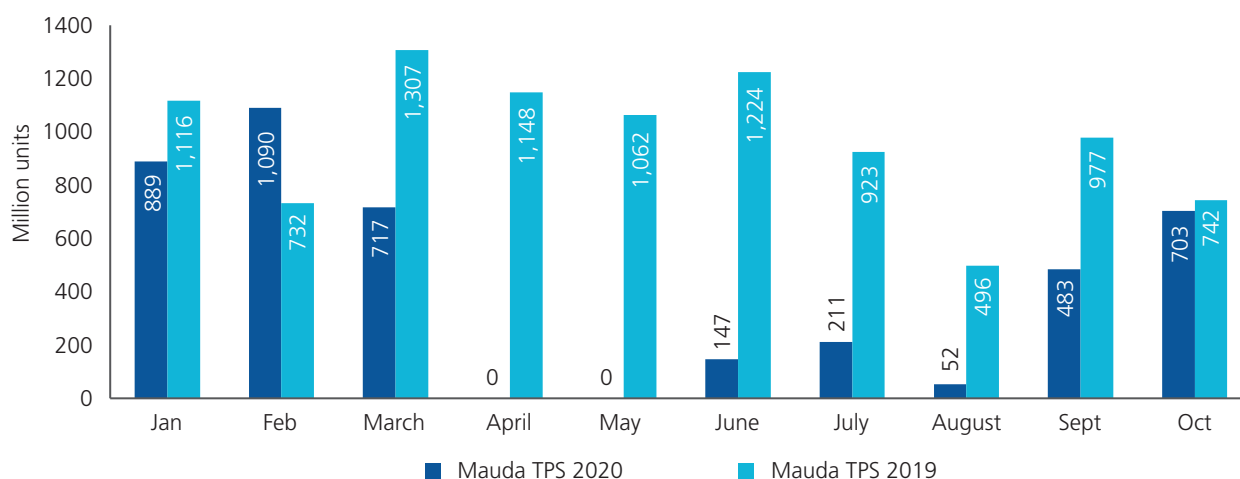


Figure 49: Monthly comparison of electricity generated at Mauda TPS (Jan to Oct, 2019 and 2020)

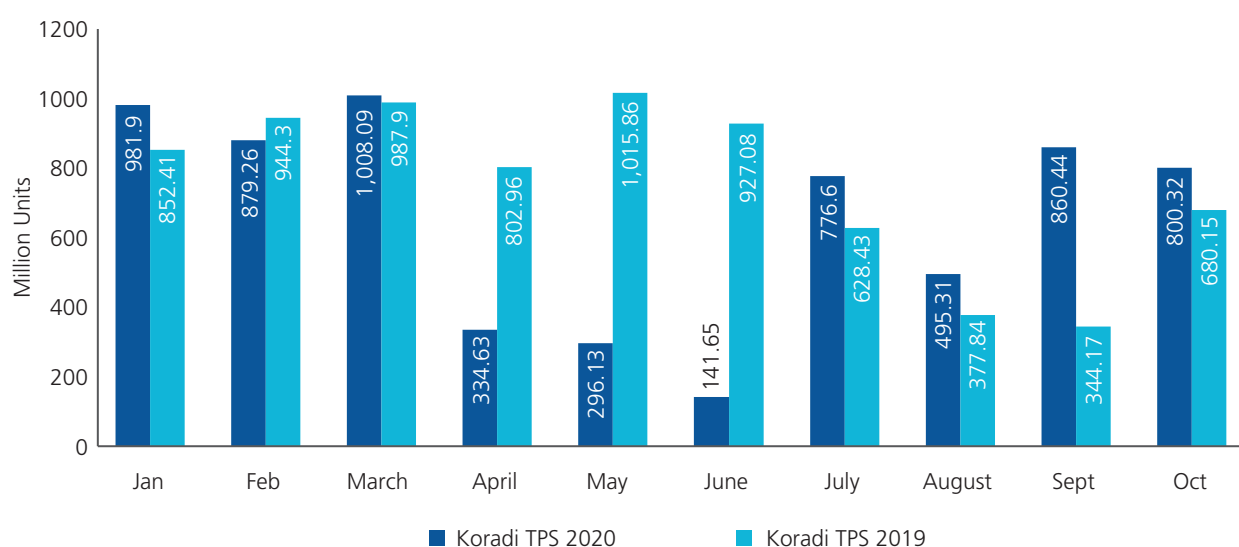


Figure 50: Monthly comparison of electricity generated at Koradi TPS (Jan to Oct, 2019 and 2020)

8.2.3 Fuel consumption

India's fuel consumption fell by 45.8 percent to 9.93 million tonnes in April, down from 18.32 million tonnes of fuel consumed in the same month a year back (Business Standard, 2020). The only fuel that showed growth was LPG as the government dole of free cooking gas cylinders to poor households fired up consumption by 12.2 percent to 2.13 million tonnes in April 2020.

Outlook for Nagpur

As of September 2020, the sale of petrol and diesel was 70 percent of the pre-COVID levels. This was due to reduced movement of private vehicles since most people were staying home to prevent the spread of the disease (The Times of India, 2020). During this time, the reliance on fossil fuels was clearly decreasing. This provides an opportunity to bring about a paradigm shift in the transport system towards e-mobility. The district needs to take up planning and phase-wise implementation of e-mobility infrastructure and incentives on a priority basis.

8.3. Agriculture

COVID-19 caused disruption to agriculture and supply chains. Inability to hire harvester and other machinery interrupted harvesting activities for wheat and pulses (during *rabi* season). The closure of hotels, restaurants, sweet shops, and tea shops during the lockdown caused a depression in milk sales. Shortage of staff at cold storage and food processing units also impacted the supply chain for milk and milk products. Meanwhile, poultry farmers were also badly hit due to misinformation on social media.

While the lockdown impacted the availability of seeds, machinery and irrigation equipment, however, reverse migration proved beneficial for kharif (monsoon) crops. As of July 2020, total kharif crops have been sown on 691.86 lakh ha area against 570.86 lakh ha area during the corresponding period of last year, an increase of 21.20 percent (WBCSD, 2020) (PIB, 2020).

Outlook for Nagpur

In order to prevent loss of yield, the district administration must ensure availability of irrigation facilities, composts, seeds, and farming machines during sowing and harvesting periods and provide support where necessary, in consultation with farmer bodies. Small farmers must be prioritised while provisioning facilities. Further, the prices paid to farmers must be regulated to ensure steady income.

8.4. Migration

India witnessed a national migrant crisis resulting from the nationwide lockdown, leading to widespread job loss, particularly for daily wage labourers. The huge migrant exodus from cities to villages added pressure on energy, food and water resources in rural areas, thereby increasing the waste footprint. Post the commencement of the lockdown, the Madhya Pradesh-Maharashtra border saw a massive movement of migrants. Nagpur district faced a massive outflux of migrants during the lockdown period.

Outlook for Nagpur

With unlocking and renewed opportunities of employment, some migrants may return to the city. The district administration must understand the migration pattern in Nagpur and plan allocation and management of resources accordingly. Agriculture sector schemes, MGNREGS and state employment guarantee programmes can be used to fast-track incorporation of these migrants into the state roll to open employment opportunities for them. To ensure safety of immigrants, they should continue rapid testing and have adequate isolation centres.

8.5. Waste management

The pandemic has had a tremendous impact on the waste sector. Grappled with an already burdened healthcare and municipal waste management system, Indian states and district-level administrations are going to face serious environmental governance challenges leading to the risk of higher emission from this sector. Here are some challenges confronting administrations:

- Increase in the use of disposable PPEs, masks, single-use plastic containers for sanitisers, online shopping packaging waste and double-layered bags (two bags) for collection of COVID-19 waste in the hospitals, etc. is leading to huge amount of additional waste. This not only changes the composition, but also the density of both municipal solid waste and hospital waste.
- All COVID-19 medical waste from hospitals treating COVID-19 patients is categorised as yellow waste, which is to be incinerated as per the Bio-medical Waste Management Rules, 2016. Similarly biomedical waste generated from quarantine camps, centres and homes is to be treated as 'domestic hazardous waste' under the Solid Waste Management Rules, 2016. This increases emissions from waste incineration manifold (CPCB, 2020).
- The CPCB guideline mandates immediate disposal of COVID-19 bio-medical waste and permits operation of incineration facilities for extra hours at the CBWTF, if required, causing further increase in emission.
- For rural areas not having CBWTF facilities, COVID-19 waste shall be disposed of in the existing captive facilities, which would have more emission potential (equal to landfilling) than that of incineration. It is to be noted that most of rural India is not connected to CBWTFs and is already impacted by COVID-19.
- The use of hazardous waste treatment facilities (TSDF) for incinerating COVID-19 waste from solid waste stream leads to increased emissions from TSDFs.
- Unsafe and unsustainable disposal would lead to infectious spread, landfill burden and increased landfill emissions.

8.6. Air pollution¹⁷

The term “PM” refers to particulate matter i.e., tiny particles suspended in air in the form of either solid or liquid droplets. They comprise of various organic and inorganic components including acids, ammonia, black carbon, water, mineral dust, etc. The major sources of particulate matter are vehicular, industrial, domestic fuel burning, construction, natural sources including soil dust (re-suspended) and other anthropogenic sources. PM can be primary – mechanically generated including carbonaceous fly-ash particles produced from high temperature combustion of fossil fuels in coal power plants, and secondary - formed in the atmosphere through reactions of primary gaseous pollutants (NO_2 , NH_3 , SO_2 , non-methane volatile organic compounds). The size of these particles is critical in defining their potential for causing health problems. Particles less than $10\text{ }\mu\text{m}$ in diameter penetrate deep into the lungs causing serious health concerns and reduce visibility (cause haze). Of this, particles having diameter less than $2.5\text{ }\mu\text{m}$ ($\text{PM}_{2.5}$) pose greater risk to respiratory and cardiovascular mobility and mortality over the long term.

Comparisons of 24-hour average of $\text{PM}_{2.5}$ over Nagpur district between Jan to May for the years 2019 and 2020 show that $\text{PM}_{2.5}$ concentration has reduced significantly during the lockdown months (Figure 51 and 52) and the air quality remained in the good category ($0\text{--}30$ and $30\text{--}60\text{ }\mu\text{g}/\text{m}^3$) according to Indian standards. A similar reduction in PM_{10} concentration was observed during the lockdown months in India in comparison to the previous year. Except for the months of winter i.e., January and February, the PM_{10} concentration remained under $0\text{--}100\text{ }\mu\text{g}/\text{m}^3$ range (Figure 53 and 54).

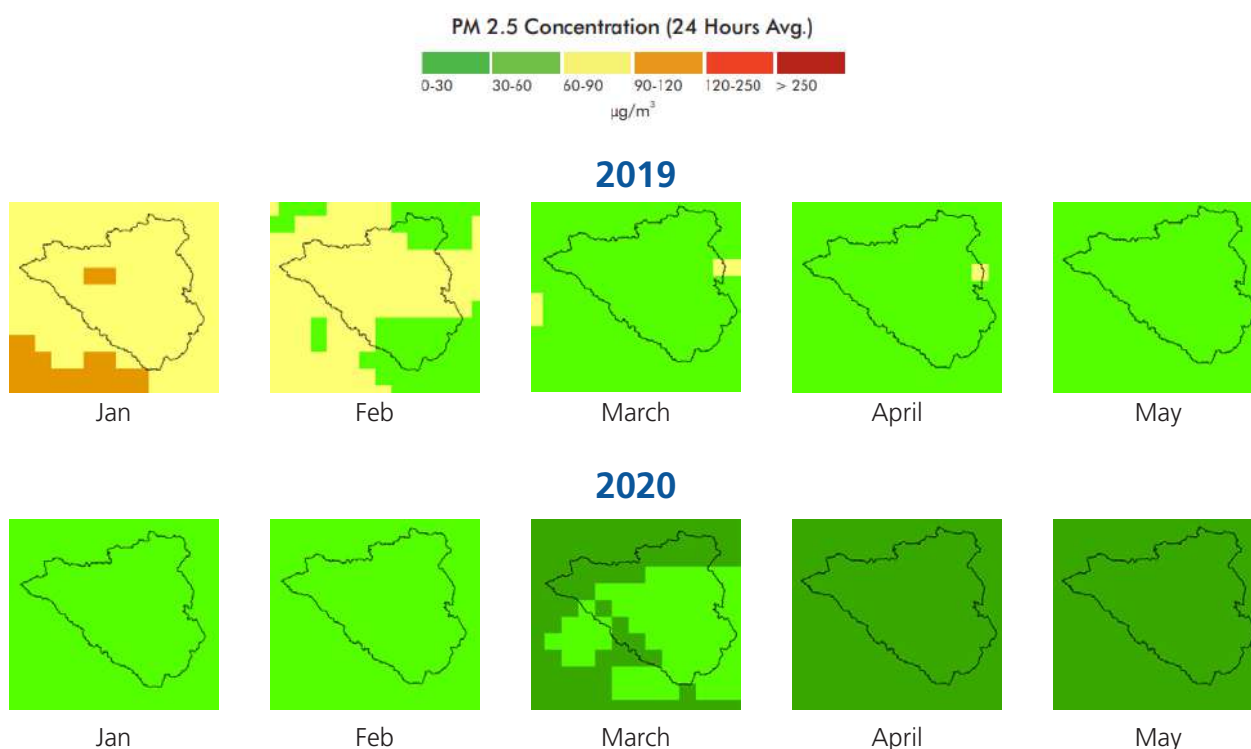


Figure 51: $\text{PM}_{2.5}$ concentration in Nagpur for January to May, 2019 vs. 2020

¹⁷ The $\text{PM}_{2.5}$ and PM_{10} modal forecast data obtained from European Centre for Medium-Range Weather Forecasts (ECMWF) and analysed at GIS platform for mapping of monthly mean values.

The data can be accessed from <https://apps.ecmwf.int/datasets/data/cams-nrealtime/levtype=sfc/>

For the mapping of NO_2 and SO_2 the data were obtained from following URLs. https://developers.google.com/earth-engine/datasets/catalog/COPERNICUS_S5P_OFFL_L3_NO2

https://developers.google.com/earth-engine/datasets/catalog/COPERNICUS_S5P_OFFL_L3_SO2

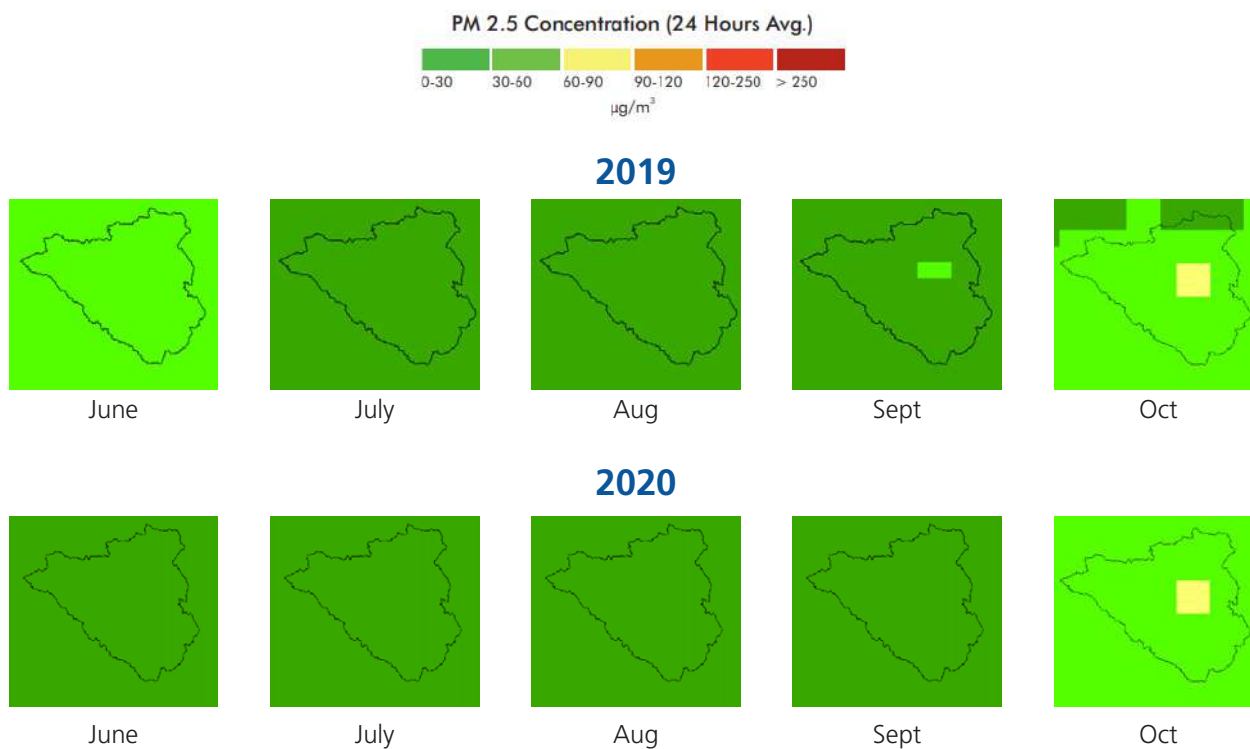


Figure 52: PM_{2.5} concentration in Nagpur for June to October, 2019 vs. 2020

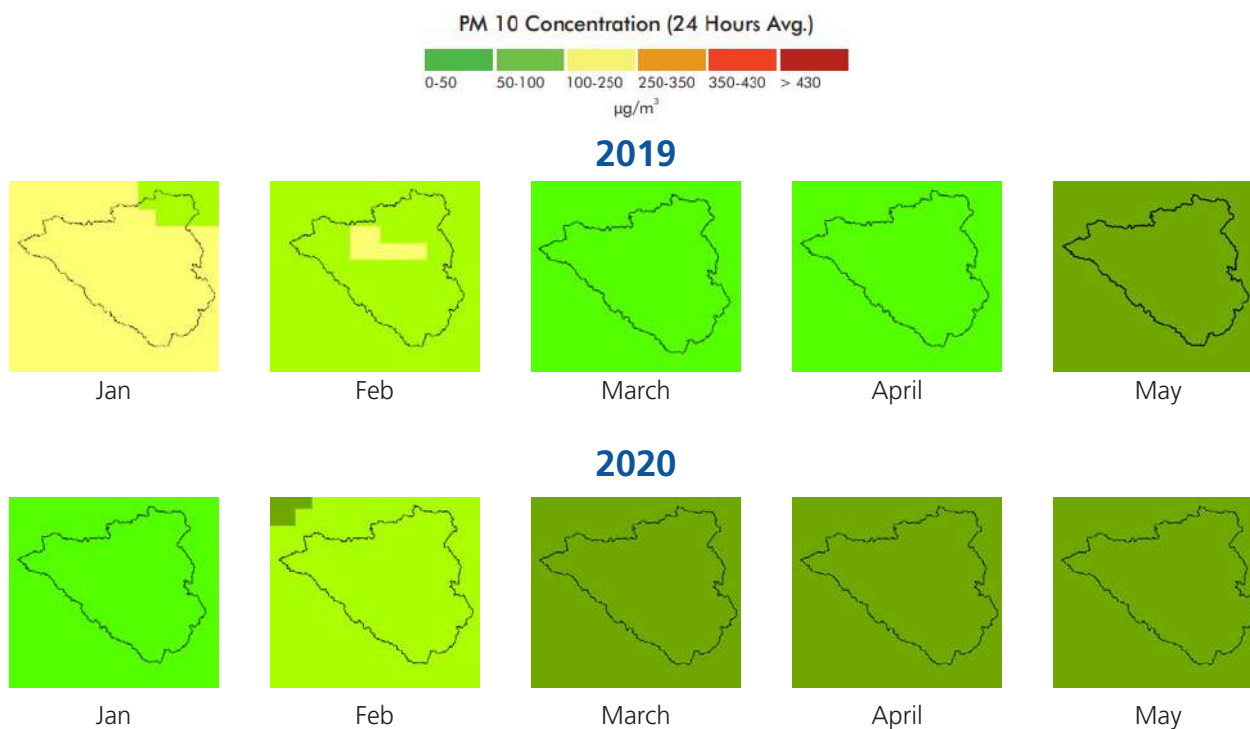


Figure 53: PM₁₀ concentration in Nagpur for the months of January to May 2019 vs. 2020

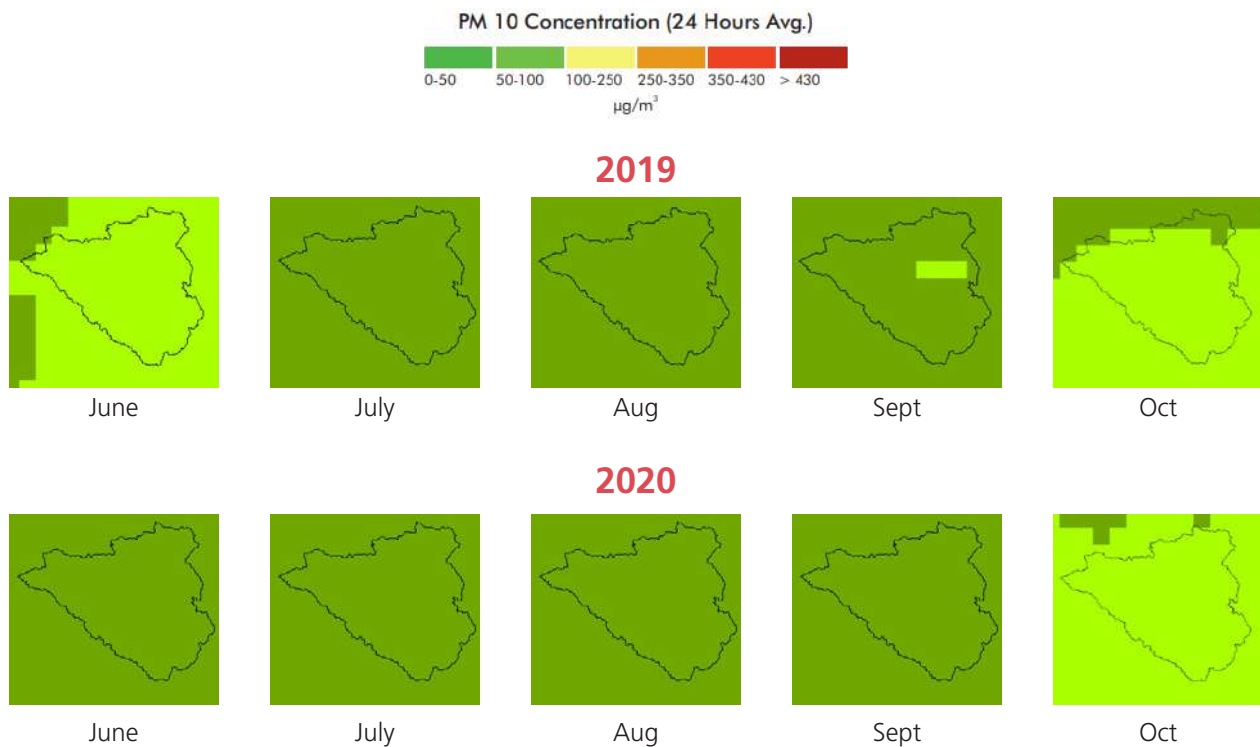


Figure 54: PM₁₀ concentration in Nagpur for the months of June to October 2019 vs. 2020

During the lockdown, most anthropogenic activities were at a standstill or were limited. Therefore, the concentration of nitrogen dioxide over Nagpur city (upper region) reduced significantly in comparison to 2019, (especially from March to September). From a range of 172-200 $\mu\text{mole}/\text{m}^2$ in 2019, the concentration decreased to the range of 57-85 $\mu\text{mole}/\text{m}^2$ in 2020 (Figure 55).

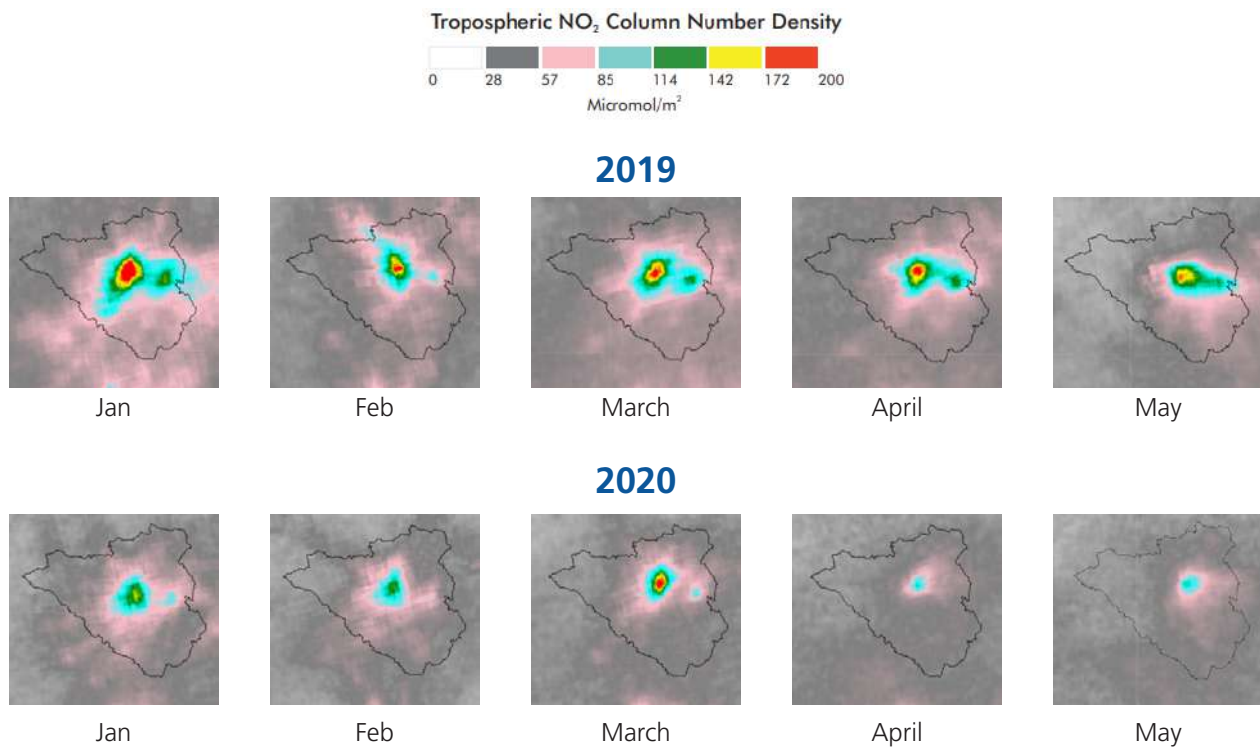


Figure 55: NO₂ concentration in Nagpur during January to May 2019 vs. 2020

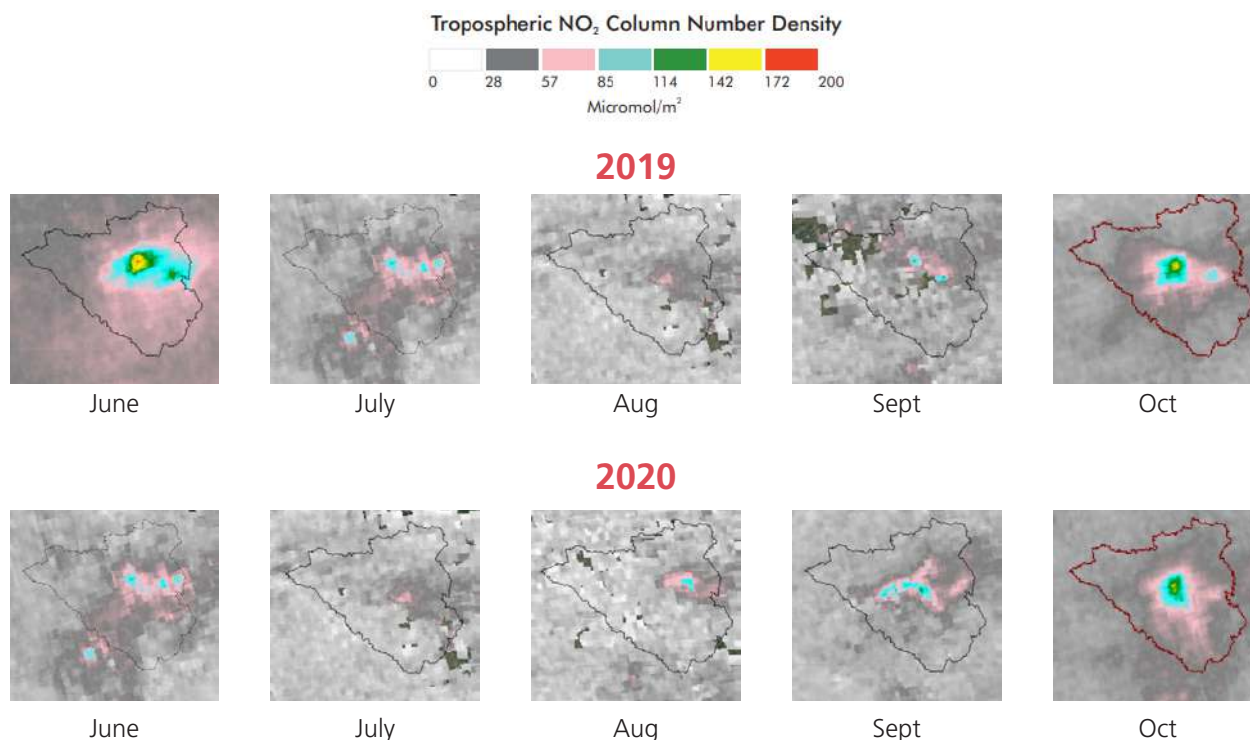


Figure 56: NO₂ concentration in Nagpur during June to October 2019 vs. 2020

Similar effect was observed on the SO₂ concentration over Nagpur with a sharp decline in April and May 2020 from its usual high 500-420 $\mu\text{mole}/\text{m}^2$ to 0-140 $\mu\text{mole}/\text{m}^2$ (Figure 57). Patches of SO₂ were observed over the entire district and were particularly dense near urban agglomerations (Figures 57 and 58).

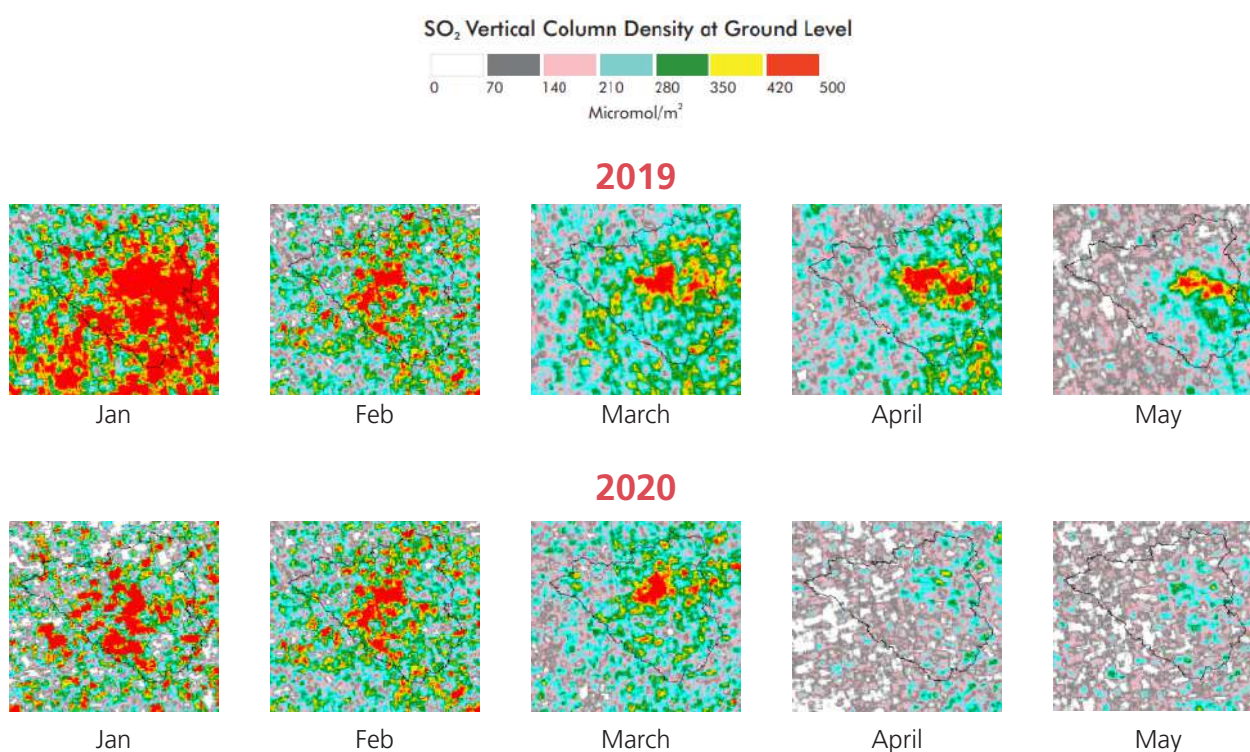


Figure 57: SO₂ concentration in Nagpur during January to May 2019 vs. 2020

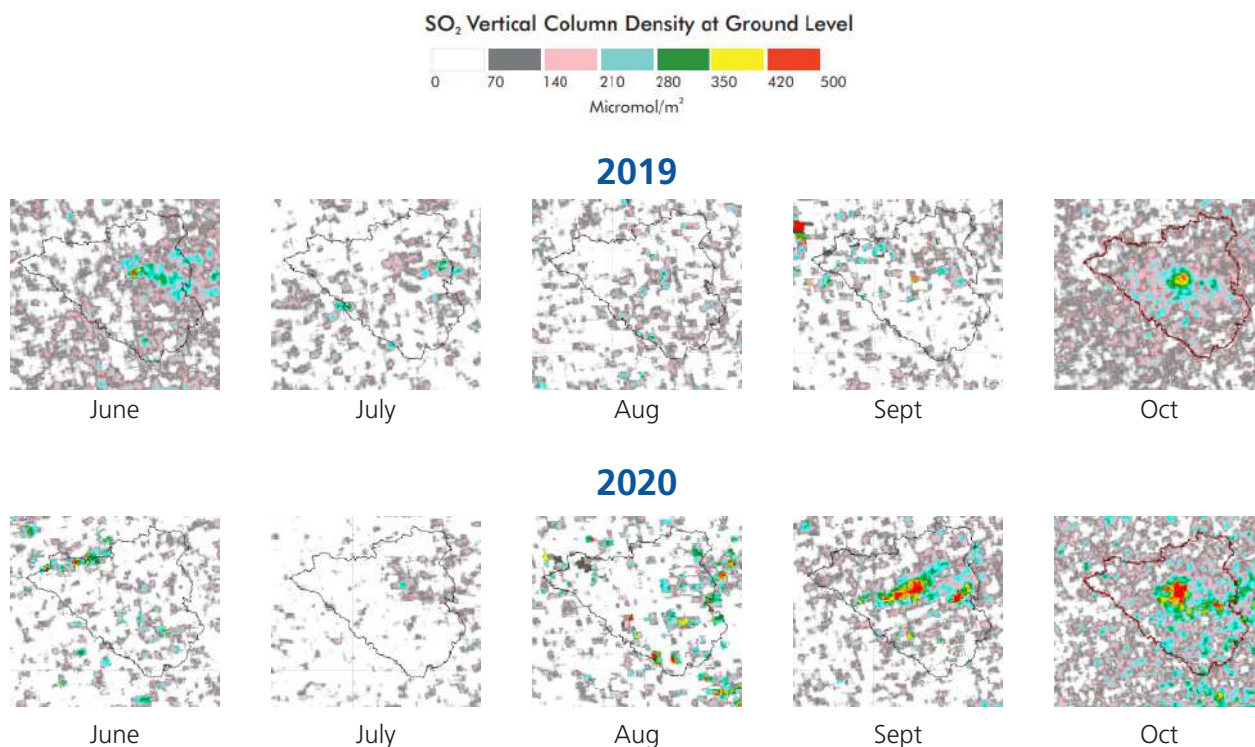


Figure 58: SO₂ concentration in Nagpur during June to October 2019 vs. 2020

Outlook for Nagpur

The COVID-19 lockdown provided a temporary relief from air pollution in most Indian cities. However, with the unlock process, air pollution levels increased gradually, reaching pre-Covid levels post-October 2020, when normal life resumed. Source apportionment studies can help identify air pollution hotspots in the district. Authorities in Nagpur can focus on measures to minimise and/or optimise industrial processes in order to reduce emissions. Further, authorities must work towards decreasing and distributing traffic during peak hours and encourage the use of public transport to minimise vehicular emissions.

THE WAY FORWARD



THE WAY FORWARD

India has set a target to meet its 50% of energy demand through RE by 2030, at COP26/Glasgow, 2021. It is important to break this goal into smaller action plans for each district and involve various stakeholders to work towards meeting the targets.

Nagpur district has displayed its commitment towards mitigating climate change. The district has been a pioneer in undertaking several measures to address climate change. For instance, Nagpur was one of the first cities in India to introduce electric vehicle charging stations among other sustainable transport interventions in the past, such as biofuel buses. Together with the Nagpur Metro (which was launched in March 2019) and improvement in last-mile connectivity, the district has the potential to emerge as a leader in public transport connectivity in India. In terms of promoting e-mobility, the Maharashtra EV Policy, 2021 provides multiple incentives including subsidies, ease of parking, exemption from taxes, etc. to promote and fast track EV integration into the modal share. In July 2021, Nagpur was one of the winners in India Cycles4Change Challenge, this feat can act as a precursor to promote NMT in the district. Nagpur is also one of the first cities in India to introduce a heat action plan that strengthens response towards heat stress conditions in the city.

The district can select recommendations from the comprehensive list provided in Chapter 6 of this action plan, and develop a detailed implementation plan for pilot projects that can be rolled out in the short-, medium- and the long-term.

The analysis of district-level policy and scheme-wise budgetary allocation with respect to climate action can help in understanding the available avenues for financing climate action by streamlining existing policies and programmes.

However, this must be treated as a dynamic document and the action plan can be updated regularly with the latest emissions profile and mitigation potential of the district. Organising periodic stakeholder consultations would help strengthen the action plan, as per the changing requirements of the district.



Citizen participation in Cycles4Change Challenge, an initiative by Smart Cities Mission, MoHUA, GoI Source: smartnet.niua.org

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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”.



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