WRI INDIA

Turning Ideas into Action

ANNUAL REPORT

India Resources Trust

2024-25

FOR

PEOPLE.

NATURE.

CLIMATE.

Contents

From the CEO's Desk

MADHAV PAI
CEO, WRI India

This past year has been one of meaningful engagement and renewed purpose for us at WRI India. We actively sought to broaden our reach and deepen our impact by initiating and participating in purpose-driven coalitions. We hosted the third edition of WRI India's annual convening, Uddeshya 2025, to drive gender-inclusive mobility in Indian cities. We also hosted our institutional flagship event Connect Karo, the inaugural summit of the India Forum for Nature-based Solutions, the India Just Transition Summit, the Accelerating Clean Energy (ACE) Conference and Namma Raste (Our Streets), among other major stakeholder convenings.

While the Forum is India's first national-level consortium working to mainstream nature-based solutions for resilient cities, the India Just Transition Summit,held in association with the Just Transition Research Centre at IIT Kanpur, explored strategies for a people-centered low-carbon transition, with 30 research papers presented and discussed. In Bengaluru, we looked at furthering inclusive multimodal mobility solutions in the second edition of Namma Raste 2025 — helmed by Bruhat Bengaluru Mahanagara Palike (BBMP) and supported by WRI India. The immersive three-day exhibition-convening brought together city leaders, experts and citizens and enabled holistic, data-driven conversations.

As always, supporting subnational governments remains a cornerstone of our strategy. Over the last year, we contributed to the development of the country's first-ever Climate Budget Report that integrates critical action points set in the Mumbai Climate Action Plan. In Sidhi, a resource-rich but largely impoverished district of Madhya Pradesh, our landscape restoration work is helping local farmers improve soil health and crop yield through reduced chemical fertilizer use and improved water management. Additionally, we are helping women-led self-help groups (SHGs) in the district set up *Poshan Vatikas* – nutrition gardens — to bolster nutritional security. Similarly, our clean energy efforts in Kerala are advancing meaningfully with rooftop solar panels installed across 92 panchayats, backed by robust local support.

Like every year, we reflect on our learnings and share insights through our publications. We released 37 publications, including working papers, conference proceedings, practice notes and technical notes, aimed at informing and inspiring action at multiple levels. I would like to highlight the series of publications that provide detailed modeling of the decarbonization roadmaps using the Energy Policy Simulator (EPS) for the power, transport and industry sectors. Our working paper on the transport sector, for instance, uses EPS to present an integrated assessment of decarbonization strategies ranging from electrification and fuel efficiency improvements to modal shift.

In addition to sharing research insights, we launched two illustrative guidebooks — a handbook for improved road design and infrastructure in Bengaluru, "Namma Raste Kaipidi" and a "Mapathon Guidebook" that enables citizen groups to identify open spaces for planting trees. The challenges we face today are urgent, complex and interlinked. We are most grateful to collaborate with a diverse and distinguished group of partners united by a shared commitment to building a more sustainable and equitable future. And lastly, on a personal note, it is a privilege to work with an exceptional team at WRI India, whose varied backgrounds, deep expertise and dedication continue to drive our progress toward this common goal.

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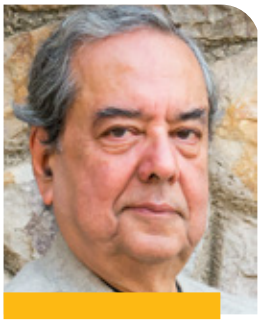
"As India accelerates efforts to meet its climate goals, it is essential that we continue to develop scalable, inclusive and context-specific solutions that work for all. WRI India remains a critical partner in this journey, combining rigorous analysis with strong collaboration to support governments, businesses, peer organizations and civil society. I greatly appreciate the work the team has delivered this year – from supporting clean energy transitions and freight electrification to charting pathways for climate action planning and addressing the complex challenges of food loss and food waste. As we move towards a just and equitable low-carbon future, that benefits people, nature and climate, I am sure WRI India's efforts will continue to translate into meaningful change – bringing tangible improvements in people's lives and livelihoods."

KIRAN PASRICHA

Former CEO, Ananta Aspen Centre; Former Deputy Director General, Confederation of Indian Industry



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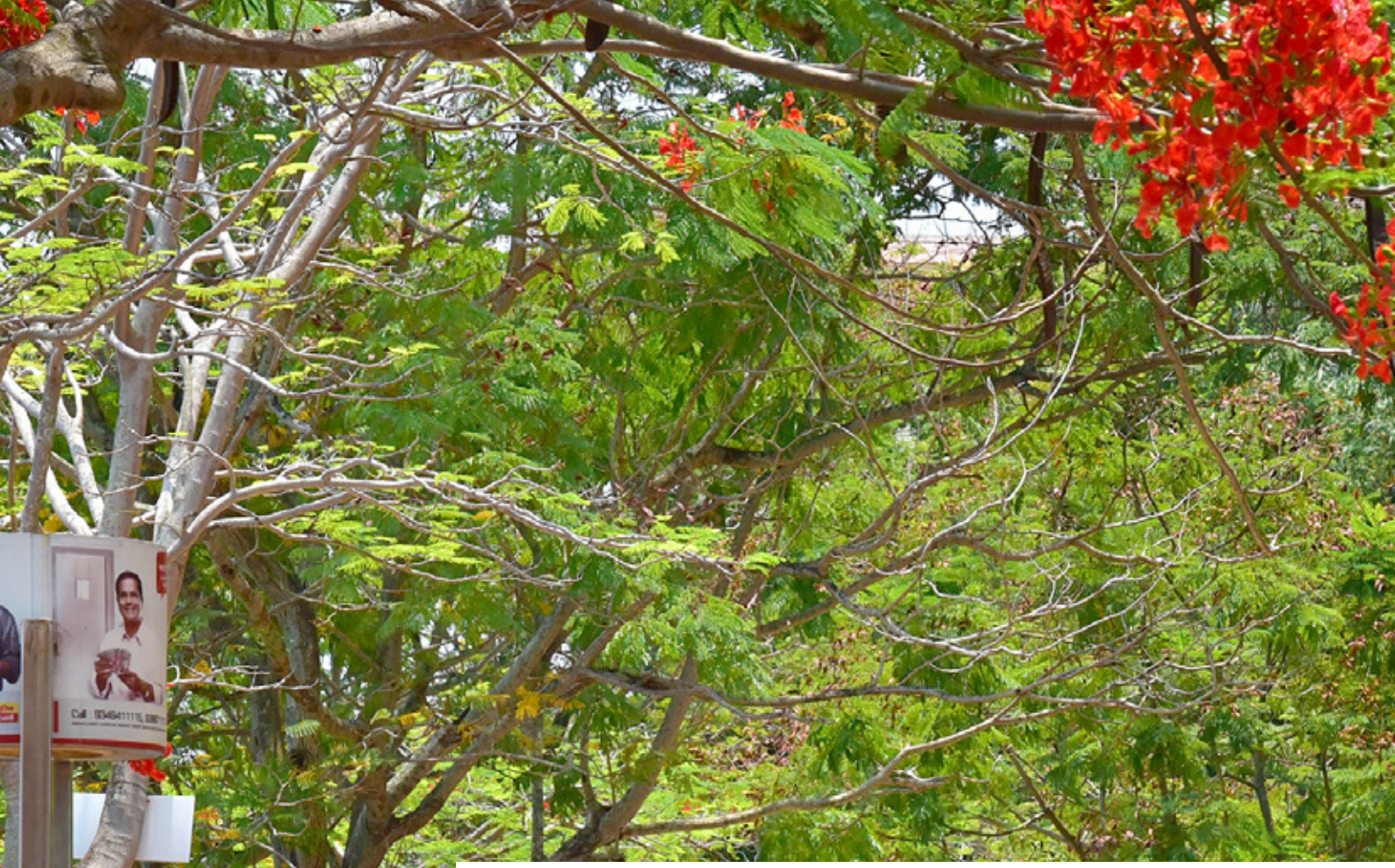
About WRI India

WRI India works to improve people's lives, protect and restore nature, and address climate change. As an independent research organization, we leverage our data and expertise to catalyze change across systems like food, land and water; energy and cities. To accelerate progress at scale, we also engage with the economic, finance and governance systems that are key to enabling this change.



OUR WORK

As India aspires to become a developed economy by its centenary year of Independence, we must work together to unlock the necessary investments to drive a new climate economy — one that meets the needs of a growing population while safeguarding its citizens, ecosystems and natural resources from climate-induced vulnerabilities.

We inform India's transition to sustainable and resilient food and land-use systems through nature-based solutions like agroforestry and sustainable agriculture. Our work supports **climate action, biodiversity conservation, resilient livelihoods and improved nutritional security.** We also develop equitable and collaborative strategies to reduce food loss and waste and advance circular food systems.

We support India's clean energy transition through scalable, inclusive and data-driven solutions. Guided by the interconnected goals of people, nature and climate, we focus on **clean energy supply, decarbonized consumption, equitable energy access and sustainable use of minerals and resources.** We partner with governments, businesses and communities to inform policies, mobilize finance and support context-specific, equitable energy transitions.

We focus on integrated solutions to urban challenges, leveraging evidence-based data, applied research, and our network of partners and experts. Designed for scale and impact, our work on **integrated mobility, urban planning, sustainable development, climate resilience and livable neighborhoods** is leveraged in partnership with local communities and urban stakeholders. The research and findings from these transformative initiatives enable us to adapt and extend our solutions across cities and states.

At WRI India, we bring a deep understanding of India's unique challenges and opportunities, translating ideas into action through robust research, analysis and recommendations, backed by our unwavering commitment to drive locally led action that is not just meaningful but also enduring.

WRI India team provides knowledge support on decentralized solar energy at Assisi Sevasadan Hospital in Nagepalli, Gadchiroli district, Maharashtra.

To augment these efforts, WRI India also works across three enabling systems

Creating **economy-wide models and analysis** at the national and state levels to inform policy pathways that support climate action, livelihoods and economic growth, while ensuring an equitable and just transition.

Strengthening state and city governance to **institutionalize climate resilience and locally led adaptation** by embedding resilience in planning, enabling climate budgeting and building capacity for climate finance.

Mainstreaming **climate action in Indian businesses** and supply chains and supporting the development of a resilient workforce for the future via tools and trainings.

STORIES OF IMPACT

FOOD, LAND AND WATER

Nutrition Gardens Transform Rural Sidhi

> “Earlier, people used to buy vegetables from the market, but that wasn’t always feasible.
>
> Now, with vegetables being grown in their backyard, their dietary diversity is enhanced, and money is also saved.”

Mamta Sahu
Community Resource Person, Sidhi

In Madhya Pradesh’s Sidhi district, where many rural households struggle to access fresh and nutritious food, Mamta Sahu is encouraging small and marginal farmers to set up *Poshan Vatikas* (nutrition gardens) in their backyards. Sahu has been part of several capacity-building activities under WRI India’s landscape restoration efforts, supported by the District Administration of Sidhi and implemented locally by Action for Social Advancement under HSBC’s Climate Solutions Partnership, to actively promote the cultivation of more than 350 leafy vegetables and over 300 spices, improving year-round access to fresh produce.

CLIMATE, ECONOMICS AND FINANCE

Skilling Women for a Just Transition

"I chose to move out of my housekeeping role because I wanted to learn new skills and grow. I approached my management and said, "I find this magnet assembly work interesting. May I try it?" They said, "Sure, go ahead," and encouraged me to learn.

Initially, the job felt daunting, and I was not sure how to do it. Magnet assembly is very different from housekeeping, so it took some time to learn. Now, I find it easy. In the beginning, I was scared. My fingers would tremble. But now, all is good."

Pechiammal A
Production Helper, Coimbatore

From housekeeping to a skilled role in an automotive manufacturing micro, small and medium enterprise (MSME), Pechiammal's story is one of resilience. WRI India, under the Resilient, Inclusive and Sustainable Enterprises (RISE) initiative, is helping women workers like Pechiammal participate in the new green economy through green skilling programs.

CITIES

Building Vibrant Safe Spaces in Ruptola Slum

“Women from our *basti* go to the civil township to work as maids in people’s houses. Earlier when they went to work, they did not have any support to take care of their young children.

Now, they leave their children with us in the library, where we take care of them and engage them.”

Jyotsna Kisan
Secretary, Ruputola Slum Dwellers Association, Rourkela

Jyotsna has helped transform an unsafe, underutilized open play space in Ruputola Slum into a haven for families as part of Nurturing Neighbourhoods Challenge, hosted by Ministry of Housing and Urban Affairs, Smart Cities Mission, in collaboration with the Van Leer Foundation and with the technical support of WRI India.

ENERGY

Improving Healthcare Through Electrification

"Before these installations, we primarily relied on grid electricity supply without a backup generator, leading to service disruptions during power outages. The facility is now likely to meet 100% of its electricity needs through a solar power plant with 6.05 kW capacity and a battery energy storage system with 21.6 kWh capacity.

Additionally, the new energy-efficient appliances and medical equipment will help us maintain lower electricity consumption compared to conventional models."

Sahaya Lilly
Administrator, Gnanamma Healthcare Centre, Meghalaya

Meghalaya's hilly terrain and susceptibility to natural disasters like landslides and flooding can complicate electricity distribution and disrupt power supply. The newly installed 6.05 kW solar plant at the Gnanamma Healthcare Centre and battery energy storage now meet up to 100% of the facility's electricity needs.

CLIMATE, ECONOMICS AND FINANCE

The Climate, Economics and Finance Program works to drive India's low-carbon transition through rigorous research, policy engagement and on-the-ground implementation. With a strong focus on low-carbon pathways, climate action planning, just transition, climate finance, carbon markets and industrial decarbonization, the program works alongside governments, businesses and civil society to inform economically sound, socially inclusive and environmentally sustainable climate strategies.

Our work under the program spans macroeconomic modeling, long-term decarbonization pathways, and integration of mitigation and adaptation in planning. It also aims to support MSMEs in adopting sustainable practices and building green skills, especially for women and marginalized groups, to drive a just and inclusive transition.

CLIMATE RESILIENCE PRACTICE

WRI India's Climate Resilience Practice Program focuses on mainstreaming adaptation/resilience at the subnational level, addressing the challenges faced by various stakeholders and aligning our efforts to help India achieve its Sustainable Development Goals and Nationally Determined Contributions. The three central pillars of our work are (i) climate-proofing district development plans (ii) empowering stakeholders, including government line department officials, through tailored training programs, and (iii) supporting state and local agencies in mobilizing resources for climate action.

INDIAN STATES ADVANCE CLIMATE ACTION THROUGH FINANCE AND STRATEGIC PLANNING

WRI India is advancing climate action in Maharashtra, Tamil Nadu and Assam — three states facing distinct but pressing climate risks. In Maharashtra, this includes mobilizing climate finance, developing a climate finance strategy, establishing a carbon credits facilitation desk and supporting cross-sectoral policy development through economy-wide modeling. In Tamil Nadu, WRI India is providing customized greenhouse gas (GHG) models, low-carbon transition roadmaps for industries and MSMEs, and support for climate finance strategies, resource mobilization and project formulation to monitor low-carbon progress. In climate-vulnerable Assam, efforts focus on integrating climate goals into development planning through GHG profiling, low-emission pathway design and capacity building for climate resilience.

Aishwarya Pradip, Program Associate, shares insights from the Maharashtra State Energy Calculator at the workshop on Economy-wide and Sectoral Modelling for Low-carbon Development of Maharashtra.

WRI India is supporting stakeholders from the government to academia in building data-driven sectoral pathways for India's low-carbon future.

SECTORAL MODELING OF LOW-CARBON PATHWAYS

Designing policies and pathways that effectively manage trade-offs between economic growth, emissions reduction and social well-being requires data-driven insights. As part of the Economics of Energy Innovation and System Transition (EEIST) research consortium, WRI India is building the capacity to develop and apply new modeling tools to inform sectoral decarbonization pathways for India, focusing on green hydrogen, green steel and heavy transport. We are also working with NITI Aayog through two working groups to assess the impacts of policy and technology choices on emissions, energy demand, economic growth, sectoral transitions, government revenue, social equity and resource use.

PATHWAYS FOR AN EQUITABLE AND INCLUSIVE EV TRANSITION IN MAHARASHTRA

Studies show that 31% of job roles in the Internal Combustion Engine Vehicle (ICEV) ecosystem will be impacted, even as new opportunities emerge in electric vehicle (EV) design, battery manufacturing and software development. WRI India's initiative aims to equip MSMEs in Maharashtra's Pune and Chhatrapati Sambhajinagar with the tools and support needed to navigate this shift. WRI India is developing resources to help MSMEs stay competitive, co-create cluster-level solutions to improve access to technology, skilling and finance, and support state policy measures for an equitable transition. It also seeks to build awareness among original equipment manufacturers (OEMs) to foster industry-wide collaboration. By 2026, this effort aims to strengthen Maharashtra's auto sector and ensure MSMEs remain central to a just and competitive EV transition.

WRI India is equipping MSMEs and their workforce for a just transition.

ENERGY

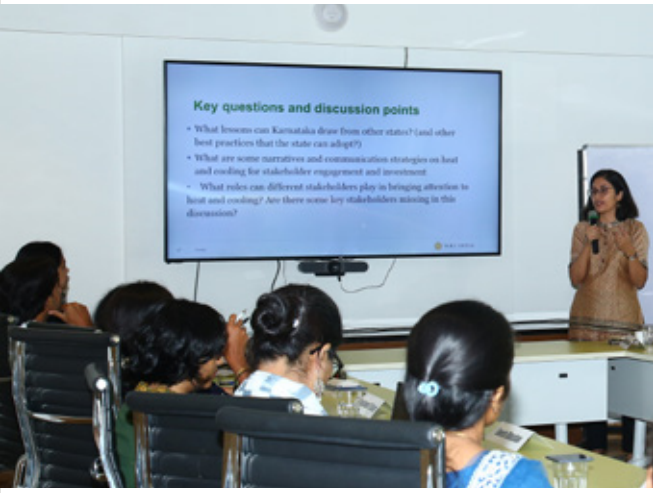
The Energy Program supports India's clean energy transition through scalable, inclusive and data-driven solutions. It promotes a clean, affordable and reliable energy future to meet the Sustainable Development Goal on energy access for all (SDG-7) while also supporting associated SDGs on health, water, economic growth, innovation, equality, consumption, climate and biodiversity. These efforts are placed at the intersection of people, nature and climate and structured around four key areas of work — Clean Energy Supply, Decarbonized Energy Consumption, Energy for Equitable Development and Energy, Minerals and Circularity.

The program operates in multiple states, driving equitable energy transitions tailored to local contexts. It emphasizes renewable energy integration, grid modernization and clean technology adoption while also supporting industrial decarbonization, energy efficiency and sustainable cooling. With a strong focus on inclusive development, the team pilots innovations and informs policies while accounting for the needs of vulnerable communities and working towards access in underserved rural areas. WRI India also works on circular economy strategies for managing renewable energy waste and securing critical minerals sustainably. It engages stakeholders at national and state levels, including governments, enterprises and communities, to support policy development, finance and participatory governance.

PARTNERED WITH STATES TO STRENGTHEN INTEGRATED RESOURCE PLANNING TOWARD SUSTAINABLE ENERGY TRANSITION

To support India's clean energy goals, WRI India is strengthening integrated resource planning (IRP) at the state level. In 2024, WRI India began collaborating with Tamil Nadu, Rajasthan and Madhya Pradesh to build the capacity of state agencies through workshops on IRP design and development. This initiative is supported by Prayas (Energy Group) and the EmLab at University of California, Santa Barbara, alongside academic partners Anna University and Maulana Azad National Institute of Technology. Seven workshops were held across the three states to train cohorts of 15-20 participants from utilities, renewable energy agencies and civil society on GridPath — an open-source production cost model. These efforts aim to help the states meet short-term energy planning goals and advance long-term clean energy transitions.

Manu Srivastava, IAS, Additional Chief Secretary, Energy and New & Renewable Energy Department, Government of Madhya Pradesh, speaks at the inaugural workshop on IRP.



Sumedha Malaviya, Program Head, Energy Program, presenting at the Karnataka Cooling Action Plan workshop.

EXPANSION OF SUSTAINABLE COOLING WORK IN ASSAM, KERALA AND KARNATAKA

WRI India is supporting the state-level implementation of the India Cooling Action Plan (ICAP). Collaborating with key institutions like the Kerala State Disaster Management Authority and the Local Self Government Department, WRI India has supported the revision of the State Heat Action Plan, provided inputs to the draft Cool Roofs Policy and plans to develop passive cooling guidelines for affordable housing. These efforts are being scaled up to other states, with recent initiatives in Assam to develop a cooling action plan for the buildings, cold chain, industry and transport sectors. Similarly, in Karnataka, WRI India is working with Karnataka Renewable Energy Development to prioritize the implementation of actions identified in the Energy Efficiency and Energy Conversation Policy.

LAUNCH OF ENERGY ACCESS EXPLORER FOR MIZORAM

The Energy Access Explorer (EAE) Mizoram was launched on September 25, 2024, to support inclusive development by integrating energy demand, supply and potential with climate vulnerability data. Inaugurated by Dr. K.C. Lalmalsawmzauva, Hon'ble Advisor to the Chief Minister, Mizoram, alongside dignitaries from various departments, the platform has undergone four training sessions for diverse stakeholders. EAE Mizoram also hosts datasets, such as solarization efforts from the Zoram Energy Development Agency (ZEDA), which are being shared for broader planning purposes.

Deepak Sriram Krishnan, Deputy Director, Energy Program, delivering the inaugural address at the launch of EAE in Mizoram.

FOOD, LAND AND WATER

The Food, Land and Water Program aims to inform India's transition towards sustainable, resilient food and land use systems through nature-based solutions like landscape restoration and sustainable agriculture. We seek to develop collaborative strategies for reducing food loss and food waste with a focus on enabling circular food systems in India. To catalyze this transition, the program works with equitable strategies that can help India achieve its climate and development goals through a systems change approach. Benefitting people, nature and climate, a land-based restoration economy can mitigate climate impacts, conserve biodiversity, provide more resilient jobs and livelihoods, and improve food and nutritional security.

SCALING LANDSCAPE RESTORATION IN CENTRAL INDIA

WRI India, along with Transform Rural India (TRI) Foundation, is focusing on addressing policy barriers, strengthening governance frameworks and fostering strategic partnerships for land-based restoration in central India. This includes setting up local restoration hubs in Kanker (Chhattisgarh), Chandrapur (Maharashtra), and Barwani (Madhya Pradesh). WRI India also co-convened "Restoration Dialogues" with the Department of Panchayat and Rural Development (DP&RD) and TRI in Raipur to scale restoration in the state. The recently concluded Sidhi landscape restoration project also demonstrated a successful pathway for landscape restoration. WRI India also strengthened restoration monitoring and data systems through innovative tools such as hydrological monitoring and measurement, reporting and verification (MRV) frameworks and trained stakeholders in remote sensing and citizen science tools. In association with World Resources Institute, the team also launched the "Restoration Launchpad Guidebook" that provides a step-by-step approach to effectively manage and implement landscape restoration projects.

Implementing restoration interventions in the pilot district of Kanker, Chhattisgarh.

FOOD LOSS AND FOOD WASTE REDUCTION

To collaboratively develop and implement evidence-based strategies to reduce food waste at the source level through recovery, redistribution and management, WRI India signed five-year MoUs with the Pune Municipal Corporation and the Indore Municipal Corporation. WRI India also collaborated with the Indian Council of Agricultural Research (ICAR) Directorate of Onion and Garlic Research (DOGR) for the development and validation of training modules on improving postharvest practices in the onion supply chain. The team is undertaking commodity-specific value chain studies to identify critical loss points and potential solutions for reducing postharvest losses in select commodities — including onion, soybean and custard apple. Through the Friends of Champions 12.3 India Network that now has 30 members, including start-ups like Wastelink and Earth Recycler, industry leaders like Zomato, and non-governmental organizations (NGOs), WRI India has been fostering knowledge sharing, innovation and collective action during its quarterly meetings and through its bi-annual newsletter titled Food Loss & Waste Digest.

MoU signing with Indore Municipal Corporation on city-level food waste reduction.

MADHYA PRADESH SUSTAINABLE AGRICULTURE PROGRAM

WRI India, in partnership with the Food and Land Use India platform and the Farmers Welfare and Agriculture Development (FW&AD) Department, Government of Madhya Pradesh, is strengthening the state's ecosystem to scale agroecology-aligned sustainable agriculture practices, improve livelihood opportunities and enhance the flow of ecosystem services. The team is developing a comprehensive roadmap suggesting pathways for scaling sustainable agricultural practices guided by evidence from robust field testing. Insights are also being drawn from multistakeholder consultations co-organized with district administrations in Chhindwara and Harda districts, as well as farmer engagements facilitated through a partnership with the Samunnati Foundation. In addition, a policy analysis is being undertaken on the impacts of national and subnational public incentives on people, nature and climate to identify opportunities and repurpose perverse or non-performing incentives to support upscaling of sustainable agriculture.

Field visit and group discussion with farmers on challenges and opportunities for scaling sustainable agriculture in Harda district, Madhya Pradesh.

SUSTAINABLE CITIES

We live in a rapidly urbanizing world, with seven out of 10 people projected to live in urban areas by 2050. Almost 90% of this projected growth will take place in the Global South, with a significant portion in India. Current estimates suggest that by 2050, India's urban population will double to 800 million. These urban areas are also highly exposed to climate risks. Between 2036 and 2060, 33 of 57 major urban locations are expected to see increased extreme rainfall and flood risks, while 24 cities may experience decreased precipitation.

Cities are at the forefront of climate change and can drive innovation in sustainable transportation and resilient, inclusive infrastructure to reduce congestion, improve air quality and enhance access to services. The WRI India Sustainable Cities Program is dedicated to shaping a future where cities truly work well for people and the planet.

Our interventions span more than 46 cities across diverse contexts and scales. Alongside on-ground efforts, we actively shape discourse through evidence-based research and scientific insights. We aim to strengthen practice and inform policy to advance sustainable and safe mobility, inclusive public spaces and resilient urban communities. This transformation is enabled by our cross-cutting focus on planning, governance and finance — critical levers for systemic and scalable impact.

We believe urban transformation can only emerge when systems of decision-making, planning and investment are aligned towards a more sustainable development path. To this end, we work closely with city administrations, government stakeholders, citizens, academia and other partners to address critical urban challenges.

NATURE-BASED SOLUTIONS TRANSFORM MAROL INTO MUMBAI'S FIRST 'WATER-SENSITIVE URBAN FOREST'

Rapid urbanization in Indian cities impacts green cover and contributes to intensifying Urban Heat Island (UHI) effect. A collaborative effort between the Brihanmumbai Municipal Corporation (BMC), Studio Piplikput and the Marol Co-operative Industrial Estate is rejuvenating an eight-acre urban forest in Mumbai's Marol locality. As the knowledge partner, WRI India has been conducting scientific assessments to integrate nature-based solutions into heat-prone industrial zones. The first phase of the project was inaugurated by the Hon'ble Minister for Information Technology, Maharashtra, Shri Ashish Shelar. The site features an eco-sewage treatment plant that recycles wastewater for irrigation. The populations of birds and butterflies in the area are on the rise while the temperature has reduced by 2-3 degrees Celsius, marking a vital step towards a cooler, greener Mumbai.

A site visit through Marol Urban Forest. WRI India is supporting BMC in integrating nature-based solutions to create a public urban forest and resilience corridor.

The kick-off meeting for the Climate Budget FY 2024-25, chaired by the Deputy Municipal Commissioner, Environment and Climate Change Department, BMC.

MAINSTREAMING CLIMATE ACTION THROUGH BUDGETING AND INSTITUTIONAL REFORM

In April 2024, Mumbai's BMC institutionalized its Environment and Climate Change (EnvCC) Department, following it up with the launch of India's first municipal climate budget report on June 5, 2024. Developed with WRI India and C40 Cities as knowledge partners, the report aligns 32.18% of BMC's capital expenditure with goals set under the Mumbai Climate Action Plan. The EnvCC Department will serve as a nodal agency, coordinating cross-departmental efforts and regulatory updates, and foster public engagement to further Mumbai's leadership in integrated urban climate governance.

CATALYZING INDIA'S EV TRANSITION

In 2024, the Ministry of Heavy Industries constituted 11 task forces to create a roadmap for EV adoption in India. WRI India led the task force set up for electric four-wheelers and organized a series of stakeholder consultations to understand industry dynamics, identify opportunities and address challenges within the ecosystem. These consultations were aimed at devising short, medium and long-term roadmaps to drive the nationwide adoption of electric four-wheelers. WRI India also supported the EV task forces on electrification plans for two-wheelers, three-wheelers, freight and buses.

A task force meeting to co-create short and medium-term roadmaps for the adoption of EVs.

INTEGRATED AIR QUALITY MANAGEMENT FOR CLEANER AIR

Launched by WRI India in 2023, the Accelerator for Clean Air Actions (ACAAS) has been providing technical assistance to 10 Indian cities — Agra, Ahmedabad, Chennai, Gorakhpur, Gurugram, Indore, Mumbai, Pune, Surat and Vadodara — in advancing their clean air goals through data-driven and multi-sectoral approaches. Over the past year, 16 capacity-building programs and consultations engaged over 1,170 government officials and other critical stakeholders. The ACAAS cities are focusing on making the transition to clean construction and cleaner fuel for bakeries, ending open burning of municipal waste, and strengthening data, research and airshed governance.

A capacity-building workshop on air pollution mitigation at construction sites in Pune, Maharashtra.

Pawan Mulukutla, Executive Program Director, Integrated Transport, Clean Air and Hydrogen, introduces the SHIFT Transport Initiative for inclusive urban mobility.

SHAPING THE FUTURE OF MOBILITY THROUGH SHIFT TRANSPORT

The SHIFT Transport initiative aims to serve as a dynamic, multi-stakeholder forum that facilitates collaboration, standardization and data-sharing to accelerate the transition to sustainable transport at the local, national and global levels. The initiative aims to serve as an open hub for informed decision-making, where urban mobility stakeholders can share insights, co-create strategies and monitor progress toward creating inclusive mobility solutions that work for all. The SHIFT Transport initiative was introduced on the sidelines of Transforming Transportation — an annual conference organized by the World Bank and WRI in Washington DC on March 10, 2025.

EMPOWERING ADOLESCENTS TO DESIGN PUBLIC SPACES

To promote adolescent voices within city planning, WRI India deployed its Public Space Assessment Framework (PSAF) across different cities, as part of the Safe, Vibrant and Healthy Public Spaces project under Fondation Botnar's Healthy Cities for Adolescents initiative. PSAF is a comprehensive, data-driven tool, shaped by insights from over 1,000 adolescents in close collaboration with communities and local governments. In the past year, PSAF has helped improve four adolescent-friendly spaces in Bhubaneswar and Jaipur, which can serve as scalable models for city authorities.

A multi-sport play zone designed by and for adolescents at Maharana Pratap Park, Jaipur.

ECO CITY-REGIONS LAUNCHES FORUM, MICROSITE AND BODOLAND WORK

The Eco City-Regions Forum and microsite connect efforts aimed at creating green, inclusive and resilient city-regions across six geographies — Delhi, Punjab, Uttar Pradesh, Jammu & Kashmir, Bodoland and Tamil Nadu. While the Forum will accelerate learnings and engagements through masterclasses, dialogues and workshops, WRI India is also engaging closely with the Bodoland Territorial Council (BTC) on the co-creation of a Regional Spatial Strategy for the Bodoland Territorial Region (BTR). We are conducting a baseline assessment of key sectoral challenges, opportunities and risks for a detailed Existing Situation Analysis (ESA) through spatial analytics and consultations with government departments and communities towards the finalization of the Regional Spatial Strategy report.

Families in Baksa District participate in the entire process of rearing silkworms, making yarn and weaving it into fabric.

Members of the Bodoland Territorial Council engage with a 3D model of the region created by the WRI India team.

The WRI India team supports the Department of Sericulture in the Bodoland Territorial Council to co-create the Regional Spatial Strategy.

02

INSTITUTIONAL HIGHLIGHTS

Over the past year, our teams have worked toward developing and contributing evidence-based solutions to address India's environmental and development challenges. We are pleased to highlight some of the key milestones and initiatives that have emerged in our ongoing efforts toward fostering equitable, resilient and sustainable development for all. Through collaboration and knowledge-sharing with a diverse set of stakeholders, we have contributed to informed decision-making that enables change on the ground. From electrification of hospitals through renewable energy initiatives to promoting landscape restoration while empowering communities and working toward climate-resilient cities and livelihoods, we are striving to build a greener, more equitable and resilient future.

HIGHLIGHTS

Tracking Food Loss and Food Waste in the Tomato Supply Chain

Food loss and food waste (FLFW) result in a considerable loss of income for small and marginal farmers, limiting their potential to diversify their agricultural livelihoods. Tomatoes, valued for their high nutritional and economic importance for consumers and farmers respectively, suffer the second highest harvest and post-harvest losses (11.6%) among major horticultural crops (NABCONS 2022). Additionally, 82% of tomato farmers are small and marginal producers who are hit particularly hard by these losses.

WRI India conducted a study to track food loss and food waste across the tomato supply chain in Madhya Pradesh. The findings of the study to were published in the working paper titled "Tomato Trail: Tracking Food Loss and Food Waste in Madhya Pradesh." The study identified critical loss points at the farm and retail levels, the key causes and drivers of FLFW, as well as the role of gender and social inclusion. It also recommended strategies for reducing FLFW. The study also found that in 2020-21, the three key tomato producing districts of Chhindwara, Dhar and Jhabua together produced 19% (55,7329 tonnes) of the state's total output of tomatoes. They incurred losses of 83,614 tonnes at the farm, 4,738 tonnes at wholesale and 56,289 tonnes at the retail level.

Beyond economic impacts, FLFW significantly impacts the environment by straining resources such as land, water and fertilizer, contributes to emissions from the improper management of discarded produce, and undermines access to food and nutritional security. This study adopts and promotes a food systems approach that looks at various stages, viz. post harvest — primary and secondary processing, distribution, consumption and disposal — to tackle food loss and food waste in the tomato supply chain. Reducing these losses offers a triple-win: economic gains for farmers, improved food and nutrition security, mitigated greenhouse gas emissions, and reduced pressure on land and water resources.

A farmer sorts tomatoes, a crop with high post-harvest losses in Jhabua district, Madhya Pradesh. WRI India's study in the state identifies where and why these losses occur, aiming to boost farmer incomes and reduce waste.

A shift to low-carbon industries and greener value chains can impact the livelihood of millions of workers engaged in the MSME sector.

HIGHLIGHTS

Equipping India's Workforce for a Low-carbon Future

Global climate goals require industries to shift toward sustainable practices, products and value chains. As India tries to balance its economic growth and climate commitments while generating employment for its growing workforce, green skilling is essential for this transition.

To support this shift, WRI India's green skilling initiatives are working toward strengthening workforce capabilities in the MSME sector, which employs over 110 million workers and contributes 30% of India's GDP.

WRI India has been collaborating with key national institutions, such as the National Skill Development Corporation, Skill Council for Green Jobs and Automotive Skills Development Council, to integrate green skills into skilling frameworks and prepare India's workforce for a low-carbon economy. With a key focus on reskilling and upskilling, especially for women workers, WRI India is helping workers transition to emerging low-carbon jobs in green sectors, build resilience and secure sustainable livelihoods.

HIGHLIGHTS

Scaling Renewable Energy through Local Governance in Kerala

The state of Kerala is aspiring to achieve 100% renewable energy by 2040. To support Kerala's energy transition goals, WRI India signed an MoU with the Nava Keralam Karmapadhathi (NKM), a state-led initiative promoting sustainable development through local-state collaboration. In partnership with the Agency for New and Renewable Energy Research and Technology (ANERT) and the Energy Management Centre (EMC Kerala), WRI India is working toward implementing clean energy projects in 92 panchayats in the state.

As part of this initiative, the team assessed rooftop solar and energy efficiency potential in panchayat-owned buildings. They also trained NKM resource personnel to conduct similar surveys in other areas. This was accompanied by the development of a project proposal template to help local governments convert assessment insights into implementable clean energy initiatives.

Through continued collaboration with ANERT and EMC, WRI India is helping design and bring scalable and replicable clean energy models for local governance to Kerala and contribute meaningfully to its renewable energy transition.

Watch our video on solarizing local bodies

Rooftop solar plant installation at the Aryad Grama Panchayat building in Kerala.

Shri D.K. Shivakumar launches Namma Raste 2025 and the Namma Raste Kaipidi (handbook).

HIGHLIGHTS

Shaping Bengaluru's Sustainable Mobility Landscape

As the city of Bengaluru continues to build on its success as an innovation hub, it needs to rapidly adapt to evolving mobility patterns, driven by new opportunities in the city. The second edition of Namma Raste (Our Streets), hosted by Bruhat Bengaluru Mahanagara Palike (BBMP), with WRI India as the knowledge partner, adopted a holistic, data-driven approach to address the city's mobility issues.

Held during February 20-22, 2025, at the BBMP Glass House, Namma Raste featured interactive exhibits, immersive city maps and over 20 panel discussions. Over 5,000 people, including policymakers, transport experts, civil society groups, students and citizens, attended the event. Sessions and exhibits explored various aspects of mobility — including street design, public transport, walkability, data innovation and inclusive infrastructure.

Shri DK Shivakumar, Hon'ble Deputy Chief Minister of Karnataka, inaugurated the event and launched the "Namma Raste Kaipidi" — a first-of-its-kind illustrated handbook aimed at making road planning, contracting and maintenance more accessible and actionable for engineers, planners and contractors.

Namma Raste brought together voices that are often left out of transport planning — journalists, local communities, drivers, people with disabilities and the youth. Civic leaders and tech entrepreneurs also debated how artificial intelligence (AI), open data and collaborative platforms could unlock scalable transport solutions.

Watch the Namma Raste 2025 video

HIGHLIGHTS

India's First Alliance for Clean Construction

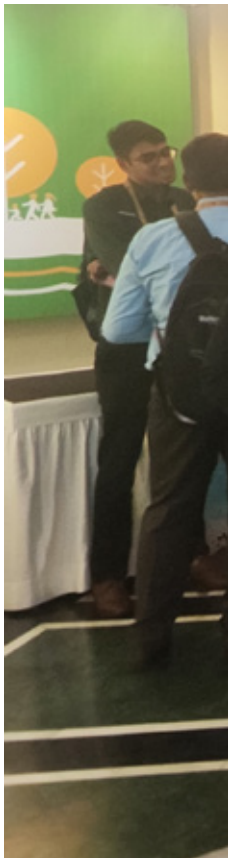
The construction sector plays a vital role in India's economy and employment landscape. However, construction-induced air pollution continues to pose a risk to human health, livelihoods and infrastructural delivery.

Given this context, WRI India is partnering with organizations from across the construction ecosystem to form the India Alliance for Clean Construction (IACC). Launched in September 2024, the alliance seeks to catalyze a sector-wide transition to clean-air-focused practices by embedding emission control at the core of planning and execution.

IACC brings together all stakeholders — builders and developer associations, government bodies, academic and research institutions, vendors of solutions, etc. — on a single platform to foster collaborative and coordinated action.

IACC is also amplifying WRI India's efforts toward air pollution mitigation through the Accelerator for Clean Air Actions (ACAAS) initiative. ACAAS, supported by Open Philanthropy, Bloomberg Philanthropies and Clean Air Fund, extends technical support to 10 Indian cities to improve their air quality management practices and accelerate the achievement of their targets as defined by the National Clean Air Programme (NCAP).

WRI India's Clean Air team comes together after the launch session.



Launch of the India Alliance for Clean Construction.

Unveiling of the IACC flyer in the presence of Amitabh Kant, G20 Sherpa, Government of India.

CSR representatives at the convening in Bengaluru to explore the potential of private finance for the city's Climate Action and Resilience Plan (BCAP).

HIGHLIGHTS

Working Toward a Climate Resilient Bengaluru

Bengaluru — one of India's fastest-growing metropolitan regions — is facing climate challenges that are projected to intensify as the population and pressure on infrastructure grow. WRI India, as a knowledge partner to BBMP and the Bengaluru Climate Action Cell, is supporting localized climate action at the ward level and launching community-led mapathons to identify potential greening sites. A "Mapathon Guidebook" was launched in December 2024, empowering citizens to organize localized mapathons. WRI India also supported the BBMP Climate Action Fellows Program, facilitated Bengaluru's first climate budgeting workshop and curated the standard operating procedure for the effective implementation of blue and green infrastructure.

WRI India also joined Sattva Consulting to support a convening of over 25 Corporate Social Responsibility (CSR) representatives in Bengaluru to explore leveraging private finance for the city's Climate Action and Resilience Plan (BCAP). Discussions focused on addressing Bengaluru's climate vulnerabilities through strategic CSR investments, developing blue-green wards and schools with climate action projects at the ward level, establishing a climate knowledge hub for community empowerment and improving last-mile connectivity with safe, low-carbon transport solutions.

HIGHLIGHTS

Accelerating Climate and Clean Air Action in Maharashtra

Maharashtra ranks among the world's 50 regions at risk of climate-related damage to its infrastructure and built environment. Nearly 75% of the state's urban population resides in 43 of its AMRUT (Atal Mission for Rejuvenation and Urban Transformation) cities that face mounting climate risks, including extreme heat, erratic monsoons and rising sea levels.

Over 40 officials from these AMRUT cities took part in a day-long workshop under the Climate Forward Maharashtra campaign. Led by the Government of Maharashtra's Department of Environment and Climate Change in collaboration with WRI India, the workshop focused on climate action planning, finance and clean air action.

Discussions centered on data-driven decision-making, identifying air pollution sources and developing climate budgets. Claudia López, former Mayor of Bogotá, Harvard 2024 ALI Fellow and Advisor to WRI, participated in the workshop and emphasized the importance of establishing low-emission zones and integrating technology, land-use planning, human capital and community engagement in urban development.

In 2022, Mumbai became the first Indian city to launch a climate action plan and went on to develop Asia's first city-level climate budget. These initiatives are already paving the way for innovative planning and financing of climate action in cities like Nashik, Solapur and Chhatrapati Sambhajinagar.

Claudia López, the former Mayor of Bogotá, delivering her special address in the presence of Sujata Saunik IAS, Chief Secretary, Government of Maharashtra.

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BMTC - Keeps Bengaluru Moving

Over 40 lakh commuters rely on BMTC buses as their primary mode of transport.

Dedicated investments in buses, prioritizing bus infrastructure to improve bus speeds, electrification & digitisation to enhance services along with creation of a robust marketplace for private players to scale operations can restore the backbone of Bengaluru's mobility.

BMTC bus network coverage & service levels

03

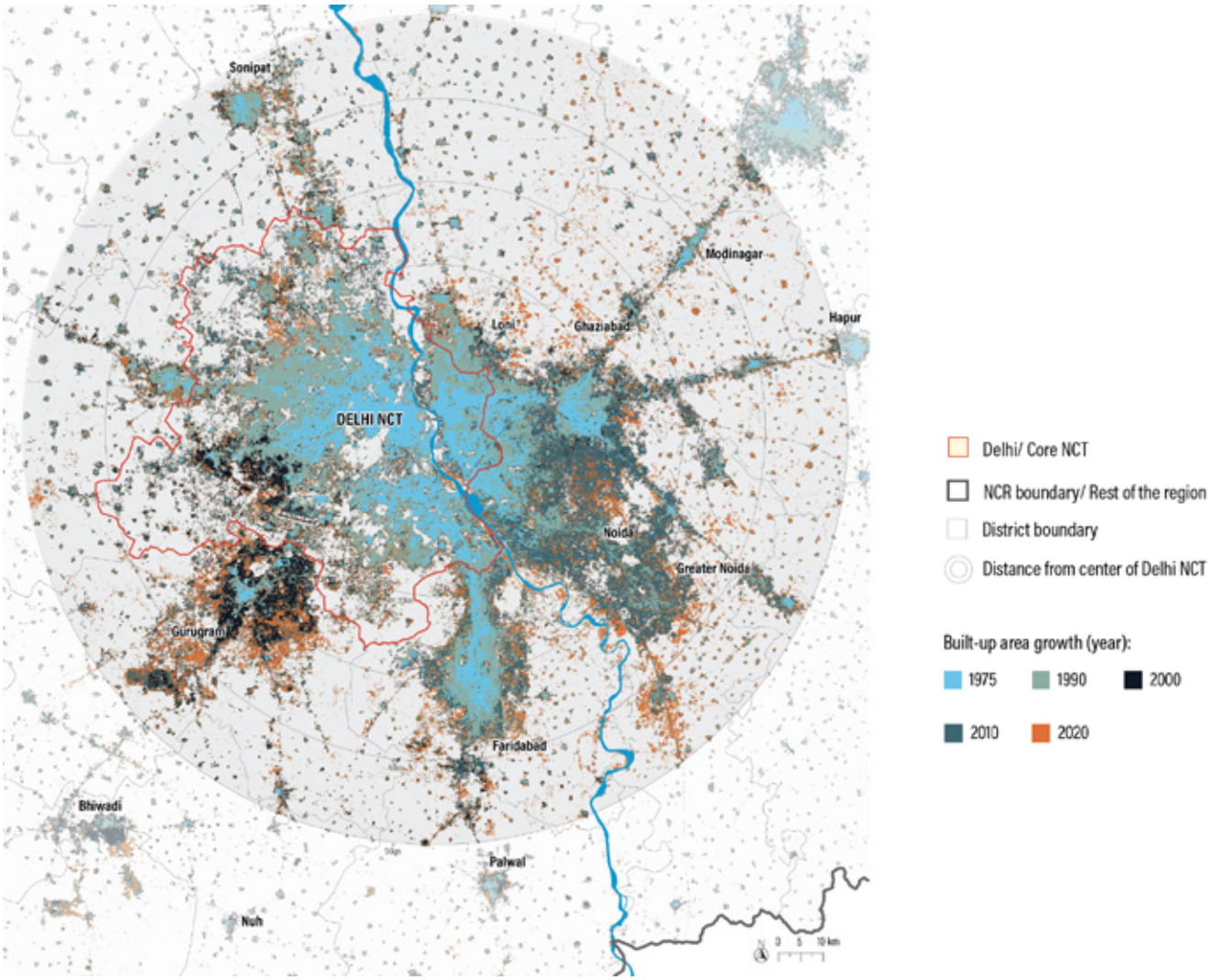
DATA

At WRI India, we believe in the potential of data-driven decision-making. Our GeoAnalytics team uses data science and technology, leveraging diverse data sources to tackle complex sustainability challenges across India. We collaborate with programs to produce geospatial data and analytical solutions – from analyzing long-term spatial and temporal trends to prioritizing targeted localized interventions. Our integrated approach provides actionable insights that equip decision-makers and stakeholders to drive transformative change.

Economic Geography

Cities and their regions drive economic growth, with mega city-regions often rivaling national economies. WRI India conducted a study titled "Morphology of Delhi National Capital Region's Economic Geography and its Implications for Planning," to assess the spatio-temporal dynamics between key economic and employment datasets with physical growth and planning, demographic, infrastructure and governance related indicators. The report discussed how the subregions within National Capital Region (NCR) underwent a unique transformation with associated demographic impacts without compromising on the economic prominence of the overall region. In Delhi NCR, urban centers and their peripheries, nodes and transport corridors have experienced maximum growth, and the increase in built expansion indicates suburbanization.

The horizontal expansion of the National Capital Territory of Delhi (NCT of Delhi) slowed after the 1990s while peripheral districts like Gurugram, Faridabad, Gautam Buddha Nagar and Ghaziabad witnessed a surge. Between 1990 and 2015, Delhi NCT's built-up area increased 1.3 times, while the peripheries grew 2.6 times.

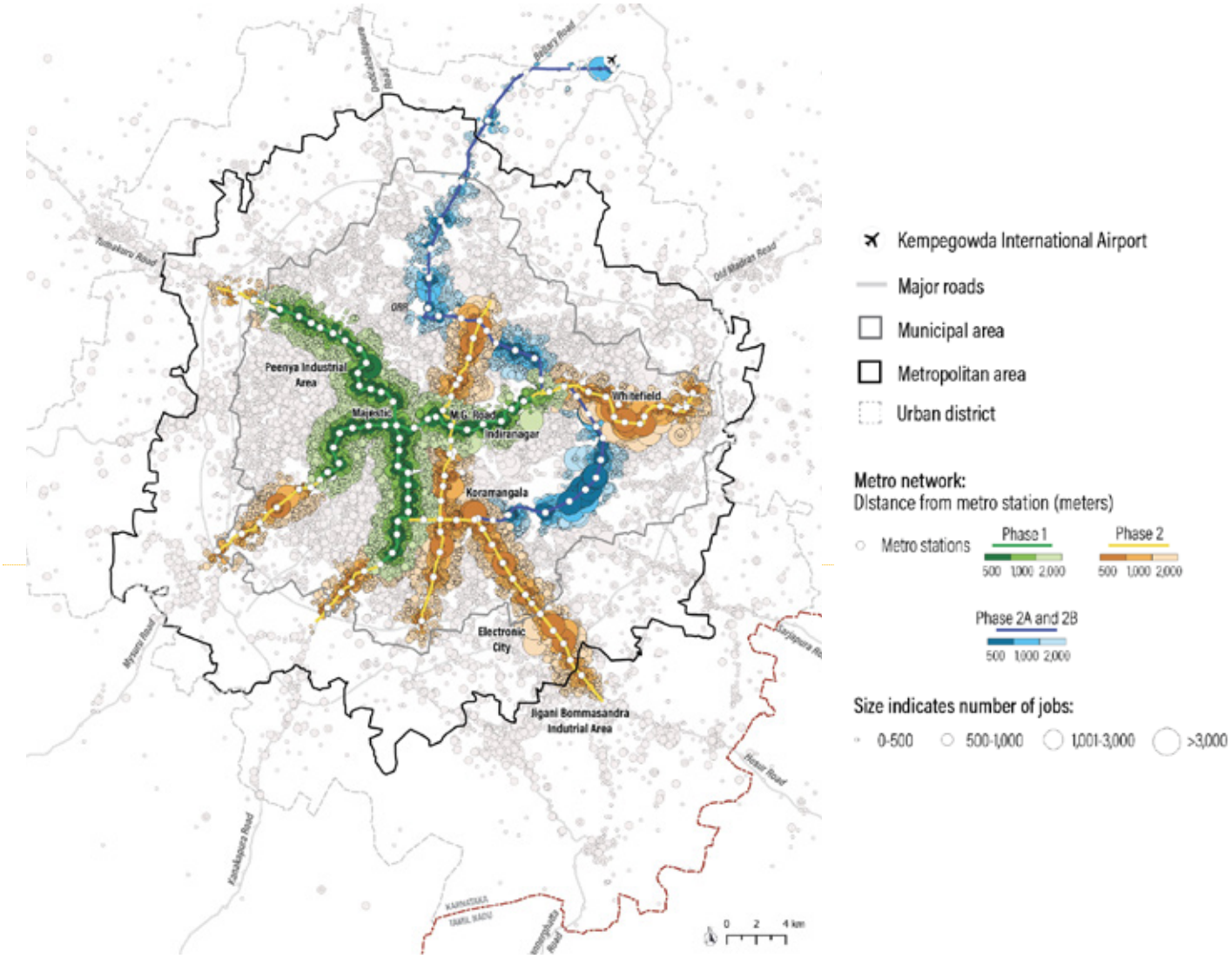


Source: Prepared for "Morphology of Delhi National Capital Region's Economic Geography and Its Implication for Planning." The Global Human Settlement Layer (EU-JRC) and OpenStreetMap (OSM) for the relevant boundaries from National Capital Region Planning Board (NCRPB), 2021.

Job Density and Transit-oriented Development

In Bengaluru, government policies and land-market dynamics have driven peripheral growth without adequate transit, leading to longer commutes, increased private vehicle usage and reduced productivity. Our study, "Jobs near metro rail transit in Bengaluru: Enabling an accessible and productive city," evaluates job distribution patterns by examining the spatial relationship between employment centres and Bengaluru's expanding metro network. The paper further highlights the role of transit-oriented development (TOD) in enhancing urban accessibility, workforce productivity and city competitiveness.

In the Bengaluru Metropolitan Area (BMA), only 28% of mapped jobs are located within the walking distance of 500 metres of a metro station. This map illustrates the spatial distribution of jobs, both density and proximity to existing and planned metro stations in Bengaluru.



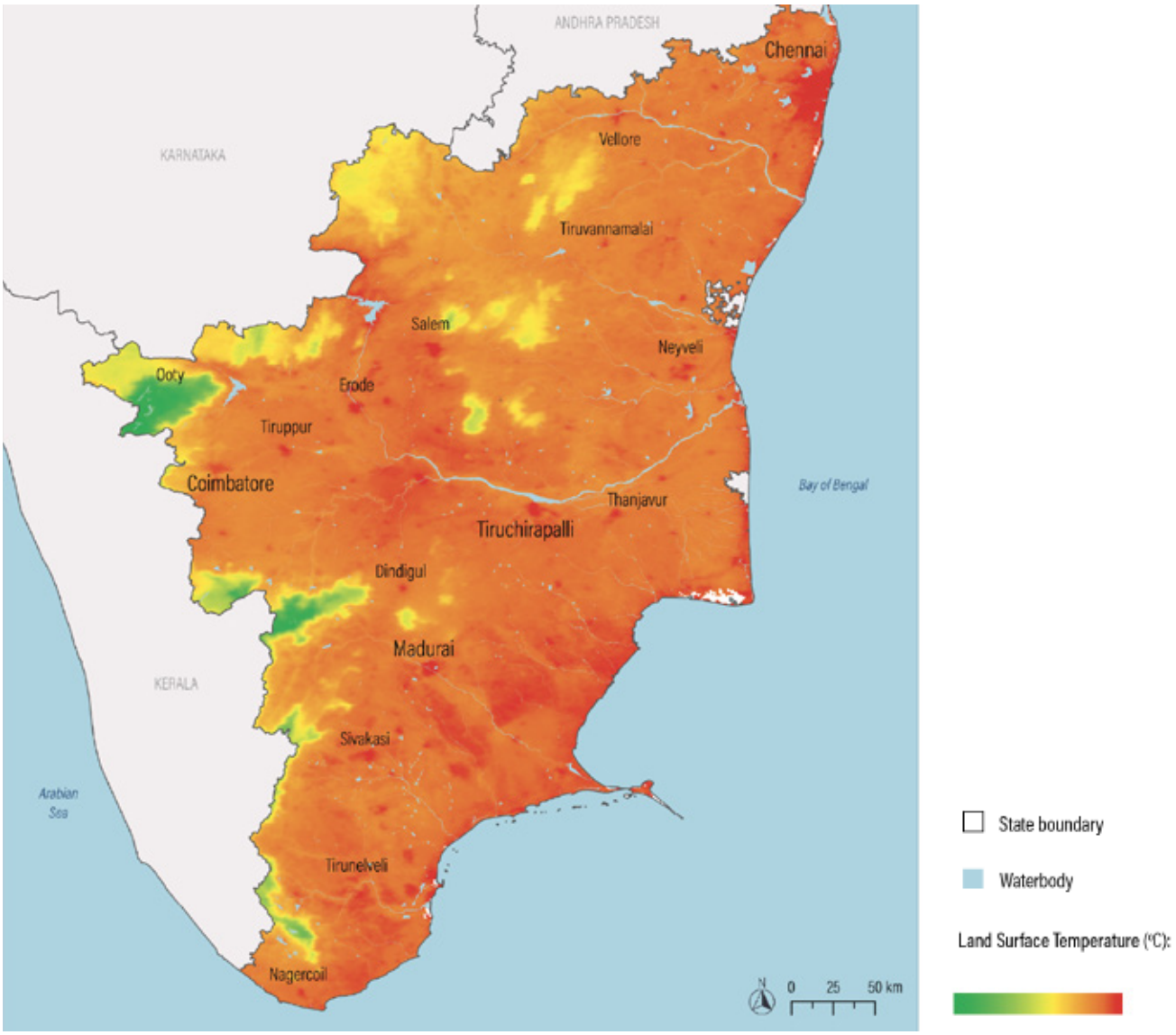
Source: Prepared for "Jobs near metro rail transit in Bengaluru: Enabling an accessible and productive city 2024 ." The map uses metro digitized using "Namma Metro" from Bangalore Metro Rail Coporation Limited (BMRCL) as in May 2023; administrative boundaries from BBMP; Bangalore Development Authority (BDA), and Karnataka State Remote Sensing Applications Center (KSRSAC) for Bengaluru Urban District (BUD) boundary; and major roads from Open Street Map (OSM) as on May 2023; and jobs data from Labour Department-Government of Karnataka as on January 2023.

Mapping Heat Challenges

Prolonged exposure to heat poses a serious threat to human health, biodiversity, agriculture and workforce productivity. Our work on the Tamil Nadu Heat Mitigation Strategy 2024 uses datasets such as day and night land surface temperature (LST), vegetation index, forest fires, heat stress and population density to assess spatial heat vulnerability across the state. The framework also considers the cascading impacts of heat–water stress, droughts, precipitation changes, sea surface temperature and environmental degradation.

The Tamil Nadu State Planning Commission introduced the Heat Mitigation Strategy as an overarching guidance to create focused solutions like cool roofs, shade policy, tree planting and nature-based solutions (NbS), heat-health impact assessments for localized heat thresholds, climate-responsive buildings, labor safety and insurance, and community resilience to heat.

All key urban centers across Tamil Nadu experience the heat island effect, and about 27% of the state's population resides in areas with higher night time land surface temperature. The map highlights regions with prolonged exposure to extreme temperatures and elevated night time LSTs.

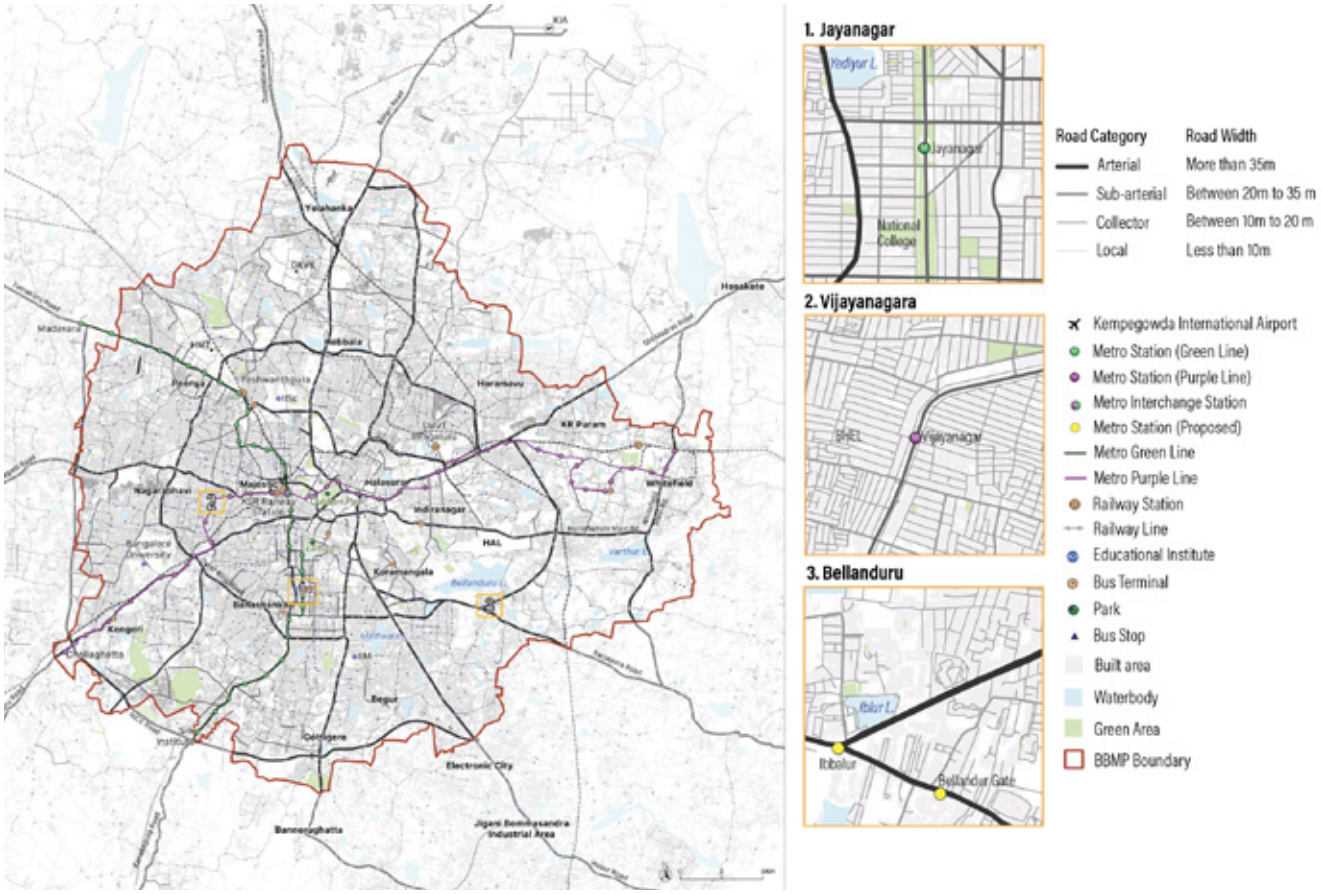


Source: Prepared for "Beating the Heat: Tamil Nadu Heat Mitigation Strategy," using MODIS Terra Land Surface Temperature and Emissivity Daily Global 1km, processed by WRI India.

Namma Raste 2025: Shaping the Future of Mobility in Bengaluru

In February 2025, the Bruhat Bengaluru Mahanagara Palike (BBMP), with WRI India as its knowledge partner, hosted the second edition of Namma Raste, a three-day exhibition-convening to advance sustainable mobility in Bengaluru. The event included an interactive exhibition that used geospatial visualizations and data-driven narratives to chart the mobility landscape and challenges in the city.

The road hierarchy map shows 12,000 km of road length illustrated based on the Right of Way (ROW) - road width information, along with existing metro network and bus infrastructure. Establishing a complete road network with clear hierarchies is essential for traffic management, facilitating non-motorized transport and aligning with TOD principles. Addressing this is critical for a city's mobility, both in existing as well as upcoming areas.



Source: Prepared for Namma Raste 2025. Road network and widths derived from Google Maps and OSM. Administrative boundaries from BBMP, metro network from BMRCL, and bus infrastructure from General Transit Feed Specification data from BMTC 2024.

04

RESEARCH

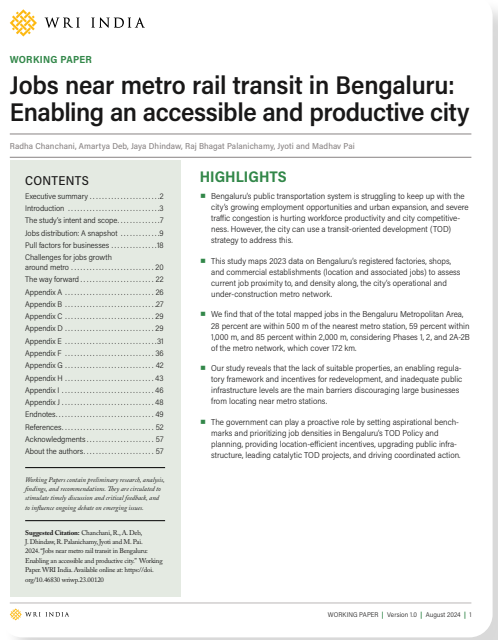
The foundation of WRI India's work is high-quality research. Our peer-reviewed publications, designed to meet academic standards of excellence for objectivity, rigor and quality, inform our work across India. We invest in talent, processes and systems for delivering robust research mentoring and publications guidance through the Research, Data and Impact (RDI) team. The RDI team supports and advises program teams in all stages of the research process, from developing research ideas and questions to research design, data collection and drafting manuscripts that meet WRI India's research standards.

WORKING PAPER

Jobs near metro rail transit in Bengaluru: Enabling an accessible and productive city

September 9, 2024

Bengaluru's public transport system has struggled to keep pace with rapid urban growth and rising employment hubs. Traffic congestion impacts productivity and competitiveness, but transit-oriented development (TOD) around metro stations could offer a way forward. Currently, limited suitable properties, weak regulatory frameworks and poor infrastructure hinder business clustering near metro stations. This study assessed job proximity to Bengaluru's operational and planned metro network and recommends that city government can drive change by integrating TOD into policy, upgrading infrastructure and setting high benchmarks.



WRI INDIA

WORKING PAPER

Jobs near metro rail transit in Bengaluru: Enabling an accessible and productive city

Radha Chanchani, Amartya Deb, Jaya Dhindaw, Raj Bhagat Palanichamy, Jyoti and Madhav Pai

CONTENTS

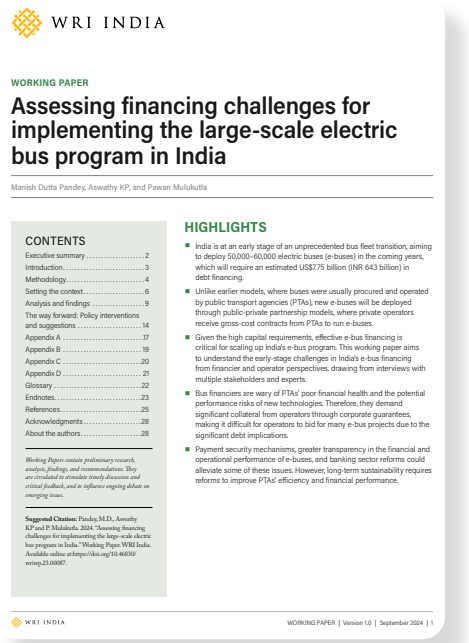
Working Papers contain preliminary research, analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback, and to influence ongoing debate on emerging issues.

Suggested Citation: Chanchani, R., A. Deb, J. Dhindaw, R. Palanichamy, Jyoti and M. Pai. 2024. "Jobs near metro rail transit in Bengaluru: Enabling an accessible and productive city." Working Paper. WRI India. Available online at: https://doi.org/10.46830/wrirep.23.00120

HIGHLIGHTS

- Bengaluru's public transportation system is struggling to keep up with the city's growing employment opportunities and urban expansion, and severe traffic congestion is hurting workforce productivity and city competitiveness. However, the city can use a transit-oriented development (TOD) strategy to address this.
- This study maps 2023 data on Bengaluru's registered factories, shops, and commercial establishments (location and associated jobs) to assess current job proximity to, and density along, the city's operational and under-construction metro network.
- We find that of the total mapped jobs in the Bengaluru Metropolitan Area, 28 percent are within 500 m of the nearest metro station, 59 percent within 1,000 m, and 85 percent within 2,000 m, considering Phases 1, 2, and 2A-2B of the metro network, which cover 172 km.
- Our study reveals that the lack of suitable properties, an enabling regulatory framework and incentives for redevelopment, and inadequate public infrastructure levels are the main barriers discouraging large businesses from locating near metro stations.
- The government can play a proactive role by setting aspirational benchmarks and prioritizing job densities in Bengaluru's TOD Policy and planning, providing location-efficient incentives, upgrading public infrastructure, leading catalytic TOD projects, and driving coordinated action.

WORKING PAPER



WRI INDIA

WORKING PAPER

Assessing financing challenges for implementing the large-scale electric bus program in India

Manish Dutta Pandey, Aswathy KP, and Pawan Mulukutla

CONTENTS

Working Papers contain preliminary research, analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback, and to influence ongoing debate on emerging issues.

Suggested Citation: Pandey, M.D., Aswathy KP and P. Mulukutla. 2024. "Assessing financing challenges for implementing the large-scale electric bus program in India." Working Paper. WRI India. Available online at:https://doi.org/10.46830/wrirep.23.00087.

HIGHLIGHTS

- India is at an early stage of an unprecedented bus fleet transition, aiming to deploy 50,000–60,000 electric buses (e-buses) in the coming years, which will require an estimated US$7.75 billion (INR 643 billion) in debt financing.
- Unlike earlier models, where buses were usually procured and operated by public transport agencies (PTAs), new e-buses will be deployed through public-private partnership models, where private operators receive gross-cost contracts from PTAs to run e-buses.
- Given the high capital requirements, effective e-bus financing is critical for scaling up India's e-bus program. This working paper aims to understand the early-stage challenges in India's e-bus financing from financier and operator perspectives, drawing from interviews with multiple stakeholders and experts.
- Bus financiers are wary of PTAs' poor financial health and the potential performance risks of new technologies. Therefore, they demand significant collateral from operators through corporate guarantees, making it difficult for operators to bid for many e-bus projects due to the significant debt implications.
- Payment security mechanisms, greater transparency in the financial and operational performance of e-buses, and banking sector reforms could alleviate some of these issues. However, long-term sustainability requires reforms to improve PTAs' efficiency and financial performance.

Assessing financing challenges for implementing the large-scale electric bus program in India

September 9, 2024

India is in the early stages of a major electric bus transition, with plans to deploy 50,000–60,000 e-buses in the coming years, which will require an estimated $7.75 billion in debt financing. Unlike traditional models where public transport agencies (PTAs) own and operate buses, the new approach relies on public-private partnerships, with private operators running e-buses under gross-cost contracts. Given the high capital requirements, effective e-bus financing is critical for scaling up India's e-bus program. This working paper explores early financing challenges from both financier and operator perspectives. Currently, lenders remain cautious due to the poor financial health of many PTAs and the perceived risks of new technologies, often demanding heavy collateral. The study suggests that strengthening payment security, improving financial transparency, and reforming the banking and public transport sectors are essential to unlocking sustainable, large-scale e-bus adoption in India.

WORKING PAPER

Tomato trail: Tracking food loss and food waste in Madhya Pradesh

September 9, 2024

In India, there is high food loss and food waste across food supply chains, especially in fruits and vegetables. Tomato incurs high postharvest losses, which leads to high economic, environmental and nutritional impacts, especially for small and marginal farmers. Most studies on the subject rely more on perception-based methods, such as interviews and surveys, instead of direct measurements. Based on our research in Madhya Pradesh, we identified farm and retail levels as critical points of food loss in the tomato supply chain. This working paper explores the potential of scaling processing at the farm and aggregator levels and adopting clean energy solutions, along with strengthening gender equity across the supply chain.

WRI INDIA

WORKING PAPER

Tomato trail: Tracking food loss and food waste in Madhya Pradesh

Shweta Lamba, Ruchika Singh, and Shaurabh Anand

CONTENTS

Working Papers contain preliminary research, analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback, and to influence ongoing debate on emerging issues.

Suggested Citation: Lamba, S., R. Singh, and S. Anand. 2024. "Tomato trail: Tracking food loss and food waste in Madhya Pradesh." Working Paper. WRI India. Available online at: https://doi.org/10.46830/wriwp.23.00020

HIGHLIGHTS

- Fruits and vegetables incur high food loss and food waste (FLFW) in India, leading to significant economic, environmental, and nutritional impacts.
- Existing literature shows a greater use of perception-based methods, such as interviews or surveys, than direct measurements of FLFW.
- We identified farm and retail levels as critical loss points in the tomato supply chain in Madhya Pradesh.
- Processing and storage of horticultural products, mainly tomatoes, are in the early stages in the region, with scope for minimizing FLFW by improving processing capacity at the farm and aggregator levels and leveraging clean energy solutions.
- The role of men and women is skewed across the supply chain, with men dominating wholesale activities, trading, and the transportation of tomatoes.
- To reduce FLFW, a food systems approach that is gender and socially inclusive should be adopted, with interventions that encourage participation from men, women, small and marginal farmers, and diverse social groups across the supply chain.

WRI INDIA WORKING PAPER | Version 1.0 | September 2024 | 1

TECHNICAL NOTE

WRI INDIA

TECHNICAL NOTE

Measuring and monitoring tree cover and plant canopy height in Pune city, India

Pulakesh Das, Sayantan Dey, Kanchana Balasubramanian, and Parth Sarathi Roy

CONTENTS

Technical notes document the research or analytical methodology underpinning a publication, interactive application, or tool.

Suggested Citation: P. Das, S. Dey, K. Balasubramanian, and P. S. Roy. 2023. "Measuring and monitoring tree cover and plant canopy height in Pune city, India." Technical Note. Washington, DC: World Resources Institute. Available online at : https://doi.org/10.46830/writn.21.00111

ABSTRACT

Trees in urban landscapes (also termed *trees outside forests* [TOF]) are perennial woody plants designed to sustain biodiversity, improve environmental quality, beautify the landscape, mitigate urban heating, provide shade, and reduce pollution. In India, the Forest Survey of India (FSI) conducts the national assessment of TOF in urban areas by employing extensive ground data. This technical note highlights the potential of the latest remote sensing data and machine learning techniques to rapidly monitor TOF and their structural attributes with limited ground data and satellite-data-derived products. The current study was conducted in the Pune Municipal Corporation (PMC) area. Publicly available Sentinel-1 microwave and Sentinel-2 optical data were used to predict tree height using Global Ecosystem Dynamics Investigation (GEDI) Light Detection and Ranging (LiDAR) data as the ground truth. The Random Forest (RF) machine learning model was applied for image classification and regression analysis. Sentinel-2 optical data were also used for land use land cover (LULC) change mapping, which shows 620 ha of tree cover loss from 2016–17 to 2019–20. The regression analysis indicated reliable tree height estimates (R^2= 0.74 and RMSE = 2.85 m). This study, with an acceptable accuracy level for many city-level uses, represents a reliable methodology for rapid TOF change and canopy height assessment using publicly available data, which can be useful for city planning in Pune. The methodology used in the current study can be scaled up to other urban landscapes.

WRI INDIA TECHNICAL NOTE | Version 1.0 | November 2023 | 1

Measuring and monitoring tree cover and plant canopy height in Pune city, India

September 18, 2024

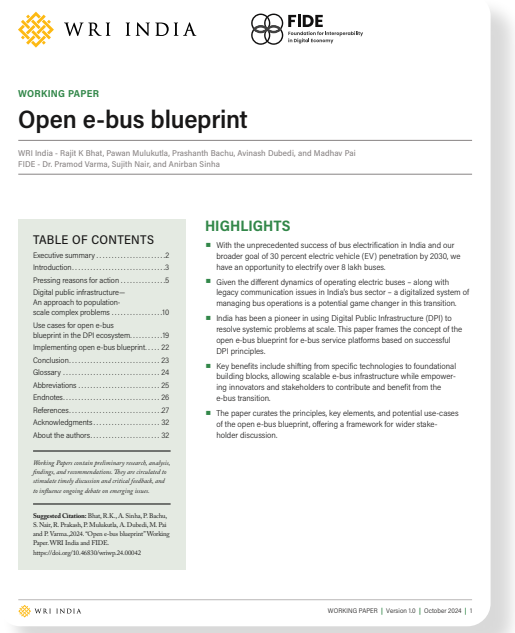
We conducted a study in Pune Municipal Corporation to demonstrate the potential of combining remote sensing and machine learning to monitor urban tree cover with limited ground data. Using publicly available Sentinel-1 and Sentinel-2 satellite data, researchers predicted tree height based on Global Ecosystem Dynamics Investigation (GEDI) Light Detection and Ranging (LiDAR) data and mapped land use changes. The analysis revealed a loss of 620 hectares of tree cover between 2016–17 and 2019–20. This cost-effective, scalable approach offers a promising tool for city planners to track and protect urban green cover across Indian cities.

WORKING PAPER

Open e-bus blueprint

October 30, 2024

India's goal of achieving 30% EV penetration by 2030 offers a unique opportunity to electrify over 8,00,000 buses. Managing e-bus operations, alongside legacy communication issues, requires a robust, foundational digital infrastructure. The paper proposes an open e-bus blueprint, rooted in the Digital Public Infrastructure (DPI) principles akin to Aadhar and UPI. This blueprint provides a sustainable approach to technology integration, emphasizing reusable digital building blocks that reduce infrastructure investment while improving efficiency and cutting costs. It outlines key elements, principles and use-cases to enable collaborative innovation among bus operators, OEMs, CPOs, financial institutions and technology providers.


WRI INDIA FIDE

WORKING PAPER

Open e-bus blueprint

WRI India - Rajit K Bhat, Pawan Mulukutla, Prashanth Bachu, Avinash Dubedi, and Madhav Pai
FIDE - Dr. Pramod Varma, Sujith Nair, and Anirban Sinha

TABLE OF CONTENTS

Working Papers contain preliminary research, analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback, and to influence ongoing debate on emerging issues.

Suggested Citation: Bhat, R.K., A. Sinha, P. Bachu, S. Nair, R. Prakash, P. Mulukutla, A. Dubedi, M. Pai and P. Verma. 2024. "Open e-bus blueprint" Working Paper. WRI India and FIDE. https://doi.org/10.46830/wriwp.24.00042

HIGHLIGHTS

- With the unprecedented success of bus electrification in India and our broader goal of 30 percent electric vehicle (EV) penetration by 2030, we have an opportunity to electrify over 8 lakh buses.
- Given the different dynamics of operating electric buses – along with legacy communication issues in India's bus sector – a digitalized system of managing bus operations is a potential game changer in this transition.
- India has been a pioneer in using Digital Public Infrastructure (DPI) to resolve systemic problems at scale. This paper frames the concept of the open e-bus blueprint for e-bus service platforms based on successful DPI principles.
- Key benefits include shifting from specific technologies to foundational building blocks, allowing scalable e-bus infrastructure while empowering innovators and stakeholders to contribute and benefit from the e-bus transition.
- The paper curates the principles, key elements, and potential use-cases of the open e-bus blueprint, offering a framework for wider stakeholder discussion.

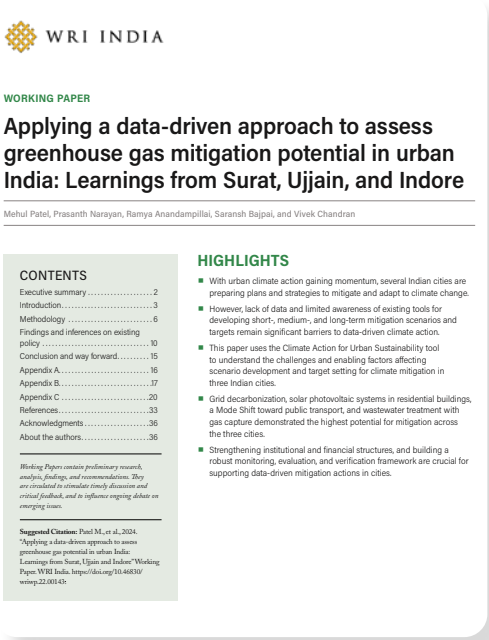
ISSUE BRIEF

Scaling up small wind turbines in India: Barriers and options for the way forward

November 7, 2024

Adoption of small wind turbines (SWTs) — a distributed renewable energy technology — has declined in India since 2017, following the discontinuation of subsidies. Due to lack of mapping studies, maintenance issues, absence of standardization, limited awareness and a preference for solar energy, SWTs haven't seen much uptake. This issue brief examines the literature on SWTs, gathers insights from stakeholder consultations and proposes solutions to scale up their usage. This includes collaboration between manufacturers and consortia formation, along with resource mapping and showcasing successful projects. The brief also finds that policies supporting grid connections and skilling initiatives are essential for improving awareness and R&D timelines for SWT deployment.

WORKING PAPER


WRI INDIA

WORKING PAPER

Applying a data-driven approach to assess greenhouse gas mitigation potential in urban India: Learnings from Surat, Ujjain, and Indore

Mehul Patel, Prasanth Narayan, Ramya Anandampillai, Saransh Bajpai, and Vivek Chandran

CONTENTS

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Suggested Citation: Patel M., et al., 2024. "Applying a data-driven approach to assess greenhouse gas potential in urban India: Learnings from Surat, Ujjain and Indore" Working Paper. WRI India. https://doi.org/10.46830/wriwp.22.00143

HIGHLIGHTS

- With urban climate action gaining momentum, several Indian cities are preparing plans and strategies to mitigate and adapt to climate change.
- However, lack of data and limited awareness of existing tools for developing short-, medium-, and long-term mitigation scenarios and targets remain significant barriers to data-driven climate action.
- This paper uses the Climate Action for Urban Sustainability tool to understand the challenges and enabling factors affecting scenario development and target setting for climate mitigation in three Indian cities.
- Grid decarbonization, solar photovoltaic systems in residential buildings, a Mode Shift toward public transport, and wastewater treatment with gas capture demonstrated the highest potential for mitigation across the three cities.
- Strengthening institutional and financial structures, and building a robust monitoring, evaluation, and verification framework are crucial for supporting data-driven mitigation actions in cities.

Applying a data-driven approach to assess greenhouse gas mitigation potential in urban India: Learnings from Surat, Ujjain, and Indore

November 7, 2024

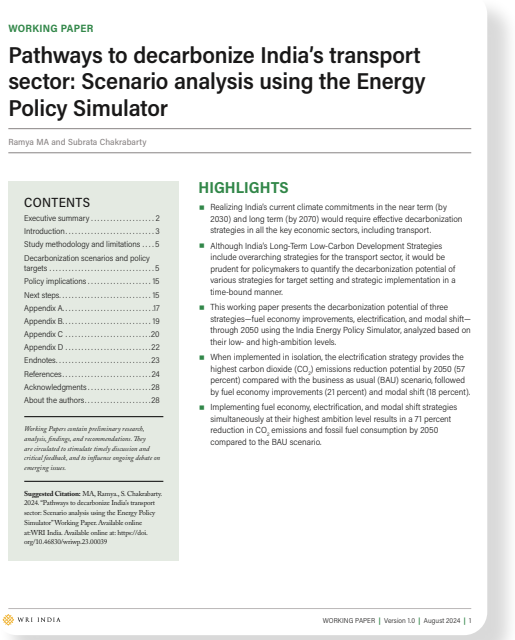
With urban climate action gaining momentum, several Indian cities are developing plans to mitigate and adapt to climate change. However, limited data and awareness about existing tools pose significant barriers to data-driven climate action. This paper uses the Climate Action for Urban Sustainability (CURB) tool — an open-source tool developed by the World Bank for setting city-level mitigation targets — to examine the challenges and enabling factors for developing scenarios and setting targets for climate mitigation in three Indian cities. Mitigation strategies such as grid decarbonization, solar photovoltaic systems in residential buildings, a shift toward public transport, and wastewater treatment with gas capture show the highest potential across the cities. The paper suggests that strengthening institutional and financial frameworks and establishing robust monitoring, evaluation and verification systems are essential for supporting data-driven mitigation actions in urban areas.

WORKING PAPER

Pathways to decarbonize India's transport sector: Scenario analysis using the Energy Policy Simulator

December 5, 2024

To meet India's climate commitments by 2030 and 2070, effective decarbonization strategies are crucial across all economic sectors, including transport. By quantifying the decarbonization potential of India's long-term low-carbon development strategies for the transport sector, policymakers can set better targets and ensure timely implementation. This working paper explores the decarbonization potential of three strategies — fuel economy improvements, electrification and modal shift — through 2050, using the India Energy Policy Simulator. The paper shows that electrification alone offers the highest carbon dioxide (CO_2) reduction potential by 2050 (57%), followed by fuel economy improvements (21%) and modal shift (18%). A combined implementation of these strategies at the highest ambition level can achieve a 71% reduction in CO_2 emissions and fossil fuel consumption by 2050 compared to a business-as-usual scenario.


WORKING PAPER

Pathways to decarbonize India's transport sector: Scenario analysis using the Energy Policy Simulator

Ramya MA and Subrata Chakrabarty

CONTENTS

Working Papers contain preliminary research, analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback, and to influence ongoing debate on emerging issues.

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HIGHLIGHTS

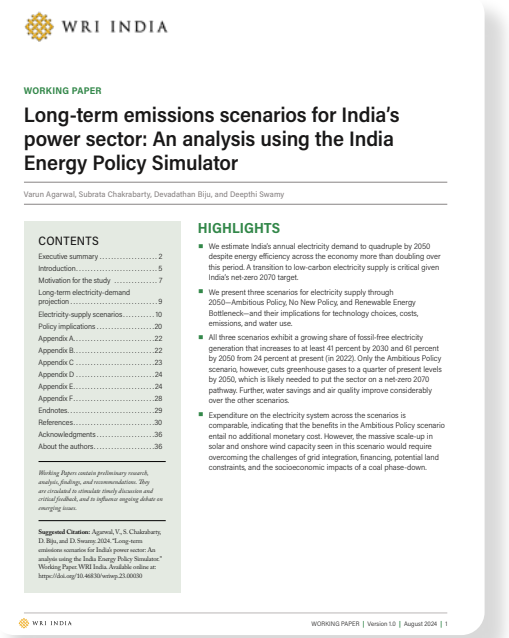
- Realizing India's current climate commitments in the near term (by 2030) and long term (by 2070) would require effective decarbonization strategies in all the key economic sectors, including transport.
- Although India's Long-Term Low-Carbon Development Strategies include overarching strategies for the transport sector, it would be prudent for policymakers to quantify the decarbonization potential of various strategies for target setting and strategic implementation in a time-bound manner.
- This working paper presents the decarbonization potential of three strategies—fuel economy improvements, electrification, and modal shift—through 2050 using the India Energy Policy Simulator, analyzed based on their low- and high-ambition levels.
- When implemented in isolation, the electrification strategy provides the highest carbon dioxide (CO_2) emissions reduction potential by 2050 (57 percent) compared with the business as usual (BAU) scenario, followed by fuel economy improvements (21 percent) and modal shift (18 percent).
- Implementing fuel economy, electrification, and modal shift strategies simultaneously at their highest ambition level results in a 71 percent reduction in CO_2 emissions and fossil fuel consumption by 2050 compared to the BAU scenario.

WORKING PAPER

Long-term emissions scenarios for India's power sector: An analysis using the India Energy Policy Simulator

January 29, 2025

India's electricity demand is projected to quadruple by 2050, making low-carbon electricity essential for the country's 2070 net zero target. This working paper explores three potential electricity supply scenarios through 2050: Ambitious Policy, No New Policy and Renewable Energy Bottleneck. All three scenarios show an increase in fossil-free electricity generation, rising from 24% in 2025 to 41% by 2030 and 61% by 2050. The Ambitious Policy scenario reduces greenhouse gases to a quarter of current levels by 2050, as needed for a net zero 2070 pathway. It also offers significant water savings and improved air quality, at no additional cost. However, the massive solar and onshore wind capacity needed for this transition faces challenges such as grid integration, financing, land constraints and the socioeconomic impacts of phasing down coal.



WRI INDIA

WORKING PAPER

Long-term emissions scenarios for India's power sector: An analysis using the India Energy Policy Simulator

Varun Agarwal, Subrata Chakrabarty, Devadathan Biju, and Deepthi Swamy

CONTENTS

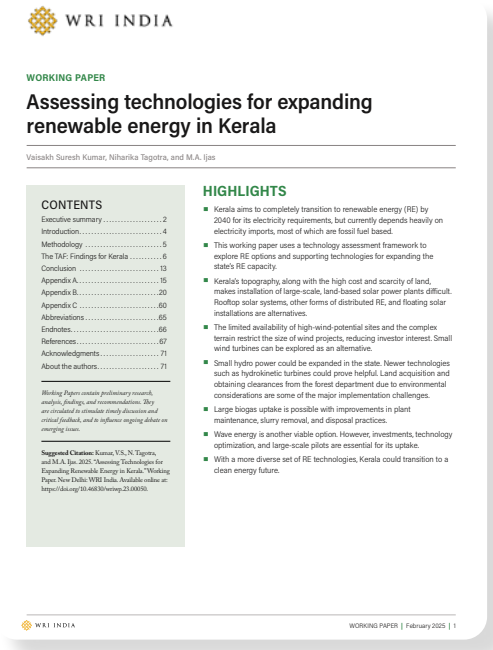
Working Papers contain preliminary research, analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback, and to influence ongoing debate on emerging issues.

Suggested Citation: Agarwal, V., S. Chakrabarty, D. Biju, and D. Swamy. 2024. "Long-term emissions scenarios for India's power sector: An analysis using the India Energy Policy Simulator." Working Paper. WRI India. Available online at: https://doi.org/10.46830/wriwp.23.00030

HIGHLIGHTS

- We estimate India's annual electricity demand to quadruple by 2050 despite energy efficiency across the economy more than doubling over this period. A transition to low-carbon electricity supply is critical given India's net-zero 2070 target.
- We present three scenarios for electricity supply through 2050—Ambitious Policy, No New Policy, and Renewable Energy Bottleneck—and their implications for technology choices, costs, emissions, and water use.
- All three scenarios exhibit a growing share of fossil-free electricity generation that increases to at least 41 percent by 2030 and 61 percent by 2050 from 24 percent at present (in 2022). Only the Ambitious Policy scenario, however, cuts greenhouse gases to a quarter of present levels by 2050, which is likely needed to put the sector on a net-zero 2070 pathway. Further, water savings and air quality improve considerably over the other scenarios.
- Expenditure on the electricity system across the scenarios is comparable, indicating that the benefits in the Ambitious Policy scenario entail no additional monetary cost. However, the massive scale-up in solar and onshore wind capacity seen in this scenario would require overcoming the challenges of grid integration, financing, potential land constraints, and the socioeconomic impacts of a coal phase-down.

WORKING PAPER



WRI INDIA

WORKING PAPER

Assessing technologies for expanding renewable energy in Kerala

Vaisakh Suresh Kumar, Niharika Tagotra, and M.A. Ijas

CONTENTS

Working Papers contain preliminary research, analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback, and to influence ongoing debate on emerging issues.

Suggested Citation: Kumar, V.S., N. Tagotra, and M.A. Ijas. 2025. "Assessing Technologies for Expanding Renewable Energy in Kerala." Working Paper. New Delhi: WRI India. Available online at: https://doi.org/10.46830/wriwp.23.00050.

HIGHLIGHTS

- Kerala aims to completely transition to renewable energy (RE) by 2040 for its electricity requirements, but currently depends heavily on electricity imports, most of which are fossil fuel based.
- This working paper uses a technology assessment framework to explore RE options and supporting technologies for expanding the state's RE capacity.
- Kerala's topography, along with the high cost and scarcity of land, makes installation of large-scale, land-based solar power plants difficult. Rooftop solar systems, other forms of distributed RE, and floating solar installations are alternatives.
- The limited availability of high-wind-potential sites and the complex terrain restrict the size of wind projects, reducing investor interest. Small wind turbines can be explored as an alternative.
- Small hydro power could be expanded in the state. Newer technologies such as hydrokinetic turbines could prove helpful. Land acquisition and obtaining clearances from the forest department due to environmental considerations are some of the major implementation challenges.
- Large biogas uptake is possible with improvements in plant maintenance, slurry removal, and disposal practices.
- Wave energy is another viable option. However, investments, technology optimization, and large-scale pilots are essential for its uptake.
- With a more diverse set of RE technologies, Kerala could transition to a clean energy future.

Assessing technologies for expanding renewable energy in Kerala

February 7, 2025

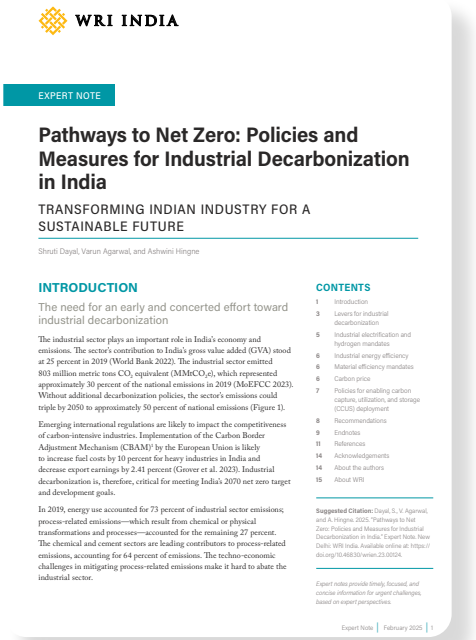
Kerala aims to meet 100% of its electricity demand with renewable energy by 2040 but currently relies heavily on fossil-fuel-based imports. This working paper assesses Kerala's renewable potential using a technology assessment framework, exploring the state's unique challenges and opportunities. Given Kerala's terrain and high land costs, large-scale, land-based solar installations face significant constraints. Rooftop and floating solar, small wind turbines and small hydro offer promising alternatives to large land-based projects. Biogas can scale with better maintenance and slurry management, while wave energy and hydrokinetic turbines need further investment and piloting. A diverse renewable energy mix tailored to Kerala's conditions, supported by targeted policy and regulatory reforms, can help the state achieve its clean energy ambitions and build a more resilient power system.

EXPERT NOTE

Pathways to net zero: Policies and measures for industrial decarbonization in India

February 12, 2025

Aligned with India's net zero 2070 target, this expert note assesses the long-term decarbonization potential of the industrial sector using the India Energy Policy Simulator. Under the modeled scenario, emissions fall 65% below baseline by 2050. Key contributors include industrial electrification and hydrogen (42% of reductions), energy efficiency improvements (16%), material efficiency (12%), carbon pricing (10%), and carbon capture, utilization and storage (CCUS). Despite progress, fossil fuels may continue to supply 50% of industrial energy by 2050, highlighting the need for CCUS to address residual emissions. The note recommends investing in green hydrogen and CCUS, implementing circular economy policies, enabling MSME decarbonization, promoting domestic manufacturing, supporting R&D and building a skilled, inclusive workforce.



WRI INDIA

EXPERT NOTE

Pathways to Net Zero: Policies and Measures for Industrial Decarbonization in India

TRANSFORMING INDIAN INDUSTRY FOR A SUSTAINABLE FUTURE

Shruti Dayal, Varun Agarwal, and Ashwini Hingne

INTRODUCTION

The need for an early and concerted effort toward industrial decarbonization

The industrial sector plays an important role in India's economy and emissions. The sector's contribution to India's gross value added (GVA) stood at 25 percent in 2019 (World Bank 2022). The industrial sector emitted 803 million metric tons CO_2 equivalent ($MtCO_2e$), which represented approximately 30 percent of the national emissions in 2019 (MoEFCC 2023). Without additional decarbonization policies, the sector's emissions could triple by 2050 to approximately 50 percent of national emissions (Figure 1).

Emerging international regulations are likely to impact the competitiveness of carbon-intensive industries. Implementation of the Carbon Border Adjustment Mechanism (CBAM)[1] by the European Union is likely to increase fuel costs by 10 percent for heavy industries in India and decrease export earnings by 2.41 percent (Grover et al. 2023). Industrial decarbonization is, therefore, critical for meeting India's 2070 net zero target and development goals.

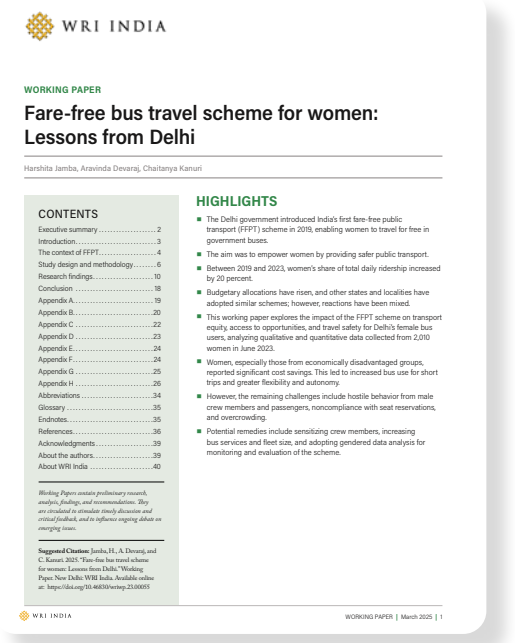
In 2019, energy use accounted for 73 percent of industrial sector emissions; process-related emissions—which result from chemical or physical transformations and processes—accounted for the remaining 27 percent. The chemical and cement sectors are leading contributors to process-related emissions, accounting for 64 percent of emissions. The techno-economic challenges in mitigating process-related emissions make it hard to abate the industrial sector.

CONTENTS

Suggested Citation: Dayal, S., V. Agarwal, and A. Hingne. 2025. "Pathways to Net Zero: Policies and Measures for Industrial Decarbonization in India." Expert Note. New Delhi: WRI India. Available online at: https://doi.org/10.46830/wrien.23.00124.

Expert notes provide timely, focused, and concise information for urgent challenges, based on expert perspectives.

WORKING PAPER



WRI INDIA

WORKING PAPER

Fare-free bus travel scheme for women: Lessons from Delhi

Harshita Jamba, Aravinda Devaraj, Chaitanya Kanuri

CONTENTS

Working Papers contain preliminary research, analysis, findings, and recommendations. They are circulated to stimulate timely discussion and critical feedback, and to influence ongoing debate on emerging issues.

Suggested Citation: Jamba, H., A. Devaraj, and C. Kanuri. 2025. "Fare-free bus travel scheme for women: Lessons from Delhi." Working Paper. New Delhi: WRI India. Available online at: https://doi.org/10.46830/wrirep.23.00055

HIGHLIGHTS

- The Delhi government introduced India's first fare-free public transport (FFPT) scheme in 2019, enabling women to travel for free in government buses.
- The aim was to empower women by providing safer public transport.
- Between 2019 and 2023, women's share of total daily ridership increased by 20 percent.
- Budgetary allocations have risen, and other states and localities have adopted similar schemes; however, reactions have been mixed.
- This working paper explores the impact of the FFPT scheme on transport equity, access to opportunities, and travel safety for Delhi's female bus users, analyzing qualitative and quantitative data collected from 2,010 women in June 2023.
- Women, especially those from economically disadvantaged groups, reported significant cost savings. This led to increased bus use for short trips and greater flexibility and autonomy.
- However, the remaining challenges include hostile behavior from male crew members and passengers, noncompliance with seat reservations, and overcrowding.
- Potential remedies include sensitizing crew members, increasing bus services and fleet size, and adopting gendered data analysis for monitoring and evaluation of the scheme.

Fare-free bus travel scheme for women: Lessons from Delhi

March 17, 2025

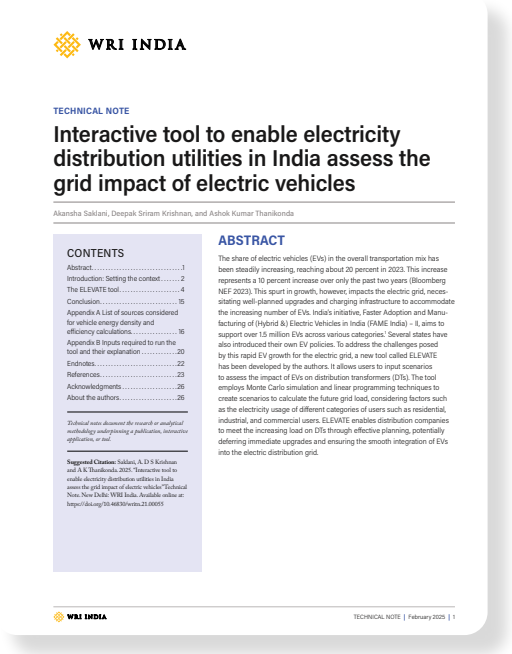
Launched in 2019, Delhi's fare-free public transport (FFPT) scheme aims to improve safety and access for women by allowing them to travel in government buses for free. By 2023, women's share of daily ridership rose by 20%. A survey of 2,010 women in June 2023 found that the scheme enhanced mobility, especially for lower-income groups, by enabling cost saving and more frequent short trips. However, reports of male crew misconduct, overcrowding and disregard for seat reservations persist. The study recommends expanding fleet capacity, training transport staff on gender sensitivity and using gender-disaggregated data for continuous monitoring and improvement.

TECHNICAL NOTE

Interactive tool to enable electricity distribution utilities in India assess the grid impact of electric vehicles

April 2, 2025

With EVs making up 20% of all vehicles in 2023 — a 10% jump in just two years — India's power grid faces growing pressure. To manage the strain on the grid, a new tool called ELEVATE (Estimate Load of Electric Vehicles and Tariff Elasticity) has been developed to help assess EV impact on distribution transformers. Using Monte Carlo simulation and linear programming, it models future grid load across user categories. ELEVATE enables utilities to plan upgrades strategically, defer immediate infrastructure expansion and ensure smoother EV integration into the electricity distribution network.


WRI INDIA

TECHNICAL NOTE

Interactive tool to enable electricity distribution utilities in India assess the grid impact of electric vehicles

Akansha Saklani, Deepak Sriram Krishnan, and Ashok Kumar Thanikonda

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Technical notes document the research or analytical methodology underpinning a publication, interactive application, or tool.

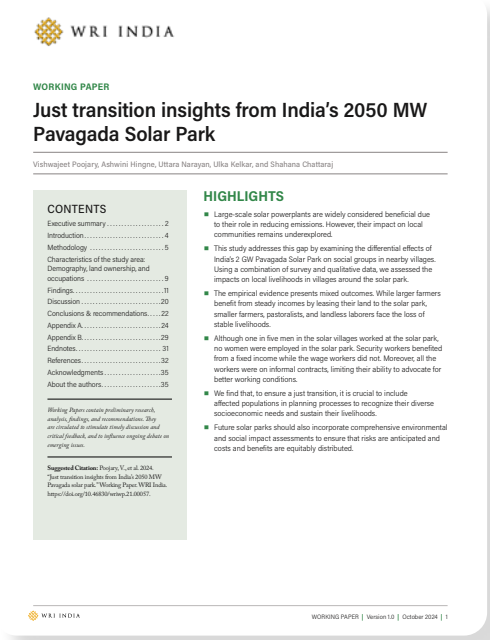
Suggested Citation: Saklani, A, D S Krishnan and A K Thanikonda. 2025. "Interactive tool to enable electricity distribution utilities in India assess the grid impact of electric vehicles"Technical Note. New Delhi: WRI India. Available online at: https://doi.org/10.46830/writn.25.00055

ABSTRACT

The share of electric vehicles (EVs) in the overall transportation mix has been steadily increasing, reaching about 20 percent in 2023. This increase represents a 10 percent increase over only the past two years (Bloomberg NEF 2023). This spurt in growth, however, impacts the electric grid, necessitating well-planned upgrades and charging infrastructure to accommodate the increasing number of EVs. India's initiative, Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles in India (FAME India) – II, aims to support over 1.5 million EVs across various categories.' Several states have also introduced their own EV policies. To address the challenges posed by this rapid EV growth for the electric grid, a new tool called ELEVATE has been developed by the authors. It allows users to input scenarios to assess the impact of EVs on distribution transformers (DTs). The tool employs Monte Carlo simulation and linear programming techniques to create scenarios to calculate the future grid load, considering factors such as the electricity usage of different categories of users such as residential, industrial, and commercial users. ELEVATE enables distribution companies to meet the increasing load on DTs through effective planning, potentially deferring immediate upgrades and ensuring the smooth integration of EVs into the electric distribution grid.

WRI INDIA TECHNICAL NOTE | February 2025 | 1

WORKING PAPER


WRI INDIA

WORKING PAPER

Just transition insights from India's 2050 MW Pavagada Solar Park

Vishwajeet Poojary, Ashwini Hingne, Uttara Narayan, Ulka Kelkar, and Shahana Chattaraj

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HIGHLIGHTS

- Large-scale solar powerplants are widely considered beneficial due to their role in reducing emissions. However, their impact on local communities remains underexplored.
- This study addresses this gap by examining the differential effects of India's 2 GW Pavagada Solar Park on social groups in nearby villages. Using a combination of survey and qualitative data, we assessed the impacts on local livelihoods in villages around the solar park.
- The empirical evidence presents mixed outcomes. While larger farmers benefit from steady incomes by leasing their land to the solar park, smaller farmers, pastoralists, and landless laborers face the loss of stable livelihoods.
- Although one in five men in the solar villages worked at the solar park, no women were employed in the solar park. Security workers benefited from a fixed income while the wage workers did not. Moreover, all the workers were on informal contracts, limiting their ability to advocate for better working conditions.
- We find that, to ensure a just transition, it is crucial to include affected populations in planning processes to recognize their diverse socioeconomic needs and sustain their livelihoods.
- Future solar parks should also incorporate comprehensive environmental and social impact assessments to ensure that risks are anticipated and costs and benefits are equitably distributed.

WRI INDIA WORKING PAPER | Version 1.0 | October 2024 | 1

Just transition insights from India's 2050 MW Pavagada Solar Park

April 24, 2025

Large-scale solar parks are key to reducing emissions, but they can affect local communities unevenly. This study examined the impact of the 2 GW Pavagada Solar Park on local livelihoods, and found mixed impacts. While large landowners had gained steady lease income, smallholders, pastoralists and landless laborers reported livelihood losses. One in five men from nearby villages work at the park, mostly as security, but none of the women are employed. All workers are on informal contracts, limiting job security. The findings highlight the need for inclusive planning, recognizing the diverse needs of affected groups, and conducting robust environmental and social impact assessments to ensure a more equitable energy transition.

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36. Just Transition Insights from India's 2050 MW Pavagada Solar Park

April 2025 | Working Paper | Vishwajeet Poojary, Ashwini Hingne, Uttara Narayan, Ulka Kelkar and Shahana Chattaraj

37. Long-term low-carbon development strategy of Madhya Pradesh

April 2025 | Conference Proceedings | Compiled by: Kshitij Singh, Prateek Barapatre and Saransh Bajpai


Shastri Park
6
NORMAL STOPPING

05

ENGAGEMENTS

For WRI India, convenings are a great way to connect with our stakeholders, donors and partner organizations. Throughout the last year, we organized numerous events while our experts and thought leaders participated in different external engagements, plenaries and multi-stakeholder consultations. These engagements, which took place across India, provided a dialogic space where our stakeholders and partners deliberated with sectoral experts, practitioners and researchers to arrive at nuanced, contextualized solutions for some of the most urgent challenges of our times.

30+
sessions

200+
speakers

1350+
attendees

250+
articles

6
publications released

CONNECT KARO 2024

for People, Nature & Climate

WRI India's flagship annual event, Connect Karo 2024, brought together more than 200 thought leaders, policymakers, financial experts, academics, social scientists and civil society members to discuss the most urgent development and environmental challenges of our times. Held at the India Habitat Centre, it hosted over 30 sessions on critical issues related to sustainable cities, clean energy, sustainable food and land-use systems, and climate action and finance.

The two-day convening saw the launch of six reports on topics ranging from decarbonizing India's transport sector and enabling access to jobs through transit-oriented development, to financial hurdles for scaling e-buses and tracking food loss and waste in the tomato supply chain. It also platformed voices from the ground, including women entrepreneurs across rural and urban areas adolescents who are helping shape their cities and homegrown entrepreneurs who are generating livelihoods while preserving their culture.

Cities as an entry point to low-carbon development took centre stage, with convening plenaries on subjects like Just Transition in India; Inclusive, Resilient and Low-carbon Pathways for Diverse and Differentiated Urbanization; and State Perspectives on Managing Urbanization.

Under the theme **"For People, Nature and Climate,"** Connect Karo 2024 offered a platform for multiple stakeholders from India and abroad to share their knowledge, perspectives and experiences as well as to collaborate toward finding meaningful responses to critical environmental and sustainability challenges.

BVR Subrahmanyam, CEO, NITI Aayog, addresses participants.

Amitabh Kant, India's G20 Sherpa, delivers his address at the event.

Madhav Pai, CEO, WRI India and BVR Subrahmanyam at an exhibition of WRI India initiatives at Connect Karo 2024.

Panelists at the launch of the working paper, "Jobs near metro rail transit in Bengaluru: Enabling an accessible and productive city."

Mamta Devi, Founder, Didi ka Papad, sharing insights on her business and the challenges she faced in scaling it, at Connect Karo 2024.

Accelerating Clean Energy

The fifth edition of WRI India's flagship energy conference, Accelerating Clean Energy (ACE), focused on enabling a just and inclusive energy transition for India. The two-day conference featured 48 speakers from 31 organizations across government, academia, industry and civil society. Experts deliberated on themes such as economy-wide decarbonization, technological advancements, and systemic approaches that integrate social and environmental priorities.

Discussions ranged from the role of new and emerging technologies in clean energy to strategies for addressing embodied and operational carbon in buildings. ACE 2024 also emphasized the interconnectedness of energy with food, land, water and transport systems, while exploring pathways to ensure equitable benefits across society.

With an inaugural address by Shri Shripad Yesso Naik, Hon'ble Union Minister of State for Power, the event also saw the release of the working paper, "Critical Minerals for India's Clean Energy Transition," which highlights the domestic vulnerabilities of India's critical minerals supply chain and recommends a way forward for the country to secure its critical minerals economy.

With India targeting 500 GW of renewable energy capacity by 2030, ACE 2024 offered key insights and actionable recommendations for managing a fair energy transition that is both inclusive and sustainable.

Left to right: Deepak Krishnan, Madhav Pai, Jennifer Layke, Mozaharul Alam, Pramod Rao, Bharath Jairaj and Shripad Yasso Naik.

Release of the working paper, "Critical Minerals for India's Clean Energy Transition" at the inaugural session of ACE 2024.

India Just Transition Summit

In October 2024, WRI India partnered with the Just Transition Research Centre (JTRC) at IIT Kanpur to co-host the first India Just Transition Summit in New Delhi, a national forum to advance people-centered approaches to climate action.

The two-day event brought together over 250 participants and more than 50 speakers, including policymakers, researchers, civil society leaders and community representatives. Panelists, including representatives from industry, MSME associations, academia and women entrepreneurs, led in-depth discussions on issues central to just transition: finance, skilling, gender and economic diversification.

The Summit also provided a platform for knowledge exchange. Over 30 research papers — selected from more than 150 abstracts submitted by academic and research institutions across the country — were presented and discussed, offering fresh insights on the diverse dimensions of a just transition in India.

The India Just Transition Summit served as a national forum to discuss challenges and scalable solutions central to a just transition.

In-depth discussions at the Summit focused on the opportunities and challenges of sectoral transition.

Restoration Policy Dialogues 2024

Restoration Policy Dialogues have served as an essential platform for bringing together policymakers, industry experts and civil society organizations (CSOs) to discuss policy barriers and explore pathways toward scaling effective restoration solutions. In September 2024, the Department of Panchayat and Rural Development (DP&RD), Government of Chhattisgarh, in collaboration with WRI India and Transform Rural India, hosted the third edition of Restoration Dialogues in Raipur.

Centered on the theme "Restoring Landscapes in Chhattisgarh for Climate and Communities," the dialogues aimed to inspire collaboration, foster innovation and design policy-aligned solutions for scaling landscape restoration through convergence of existing schemes. The event convened over 55 participants, including policymakers, civil society organizations and practitioners engaged in restoration-related initiatives across the state. Discussions underscored the need for data-driven and context-specific planning to advance restoration outcomes.

Following the dialogues, DP&RD proposed the development of a note that collates relevant data and information, which can serve as a guideline for scaling restoration efforts in Chhattisgarh. The proposed resource document, to be developed collaboratively by the policymakers and CSOs, is expected to detail degradation types, required interventions and actionable restoration plans at the local level.

Participants at the Restoration Policy Dialogues 2024 in Raipur, Chhattisgarh.

Smriti Sahu and Ashwini Soni, cluster-level federation coordinators, share their insights from training programs and village-level discussions on restoration appraches and natural resource management.

e-FAST India Summit 2024

In September 2024, the e-FAST India Summit 2024 celebrated two years of e-FAST India's growth journey, bringing together more than 300 participants. Spearheaded by NITI Aayog and supported by WRI India, the Electric Freight Accelerator for Sustainable Transport (e-FAST) is the country's first platform dedicated to accelerating zero-emission freight through collaborative action.

The Summit showcased contributions from 68 industry and 17 knowledge partners who are helping drive innovation in India's electric freight transition. With policymakers, OEMs, logistics providers, financiers and researchers in attendance, the event reinforced e-FAST India's role as a catalyst for the scale-up of sustainable transport.

Uddeshya 2025

Uddeshya 2025, WRI India's annual conference on gender and mobility, highlighted the importance of translating gender-responsive transport policies into actionable outcomes. This year's edition explored strategies for ensuring an inclusive and equitable transition to e-mobility and innovative financing mechanisms that can strengthen gender-responsive metro systems.

The event also featured a storytelling opportunity, Sutradhaar, that highlighted people's urban mobility experiences and concluded with the Uddeshya Awards, which felicitated organizations and individuals working toward furthering gender-responsive mobility across India.

Project partners from Urban Electric Mobility Initiative (UEMI), WRI India, CEPT Research and Development Foundation (CRDF), Participatory Research in Asia (PRIA) India, and EuropeAid came together to launch the official MobiliseHER website.

Insights Research Symposium 2024

WRI India's Sustainable Cities program held its inaugural research symposium in July 2024, bringing together academics, researchers and subject experts to discuss upcoming research and the potential for collaboration. The conversations focused on shaping India's cities and city regions through:

- **Urbanization, Planning and Governance:** Defining the research and policy agenda on urban planning, with an emphasis on scalable, inclusive frameworks.
- **Resilient and Healthy Cities:** Deepening the understanding of the health impacts of air pollution and integrating gender perspectives in urban planning and climate resilience.
- **Gender, Mobility and Resilient Housing:** Examining the intersection of gender with urban mobility and housing resilience, and addressing the gaps between policy and implementation.
- **Public Spaces as Catalysts for Transformation:** Exploring public spaces as levers for urban transformation and aligning road safety principles with climate-resilient infrastructure development.
- **Pathways to Inclusive, Low-carbon and Thriving Cities:** Envisioning the future of cities by integrating inclusive economic development with climate action, resilience planning and equitable urban growth.

Insights 2024 brought together academicians, researchers and subject experts to deliberate on a research agenda for thriving cities.

India Forum for Nature-based Solutions Summit

The inaugural summit of the India Forum for Nature-based Solutions (NbS), held in August 2024, fostered dialogue and knowledge-building around the critical investments and strategies to scale NbS in Indian cities.

Bringing together over 100 practitioners, academicians and financiers, with representatives from the Ministry of Housing and Urban Affairs (MoHUA), Ministry of Jal Shakti and National Disaster Management Authority, it sought to align central agencies to adopt NbS as resilient urban infrastructure.

The summit featured an exhibition, felicitated innovative NbS research and practice, and offered hands-on learning sessions. Recently, the Forum also announced its research program and launched a masterclass series.

Rahul Kapoor, Joint Secretary, MoHUA, delivering the keynote address in the opening plenary session in the presence of Dr. Debolina Kundu, Director (Additional Charge), National Institute of Urban Affairs (NIUA), Rajiv Ranjan Mishra, Chief Advisor, NIUA, Claudia Lopez, former Mayor of Bogotá and Jaya Dhindaw, Executive Program Director, Sustainable Cities and Director, WRI India Ross Center.

An attendee reading the posters displayed as part of the exhibition at the Summit.

Interactive session with attendees on addressing urban climate risks using NbS.

Nurturing Neighbourhoods 2.0 Launch

September 25, 2024

The Nurturing Neighbourhoods 2.0 (NN 2.0) was launched by Rahul Kapoor, Joint Secretary, Smart Cities Mission, MoHUA, in Delhi. The program stems from the successful Nurturing Neighbourhoods Challenge (NNC), which supported 10 cities to scale 180+ public spaces, benefitting over a million people. Led by MoHUA and Van Leer Foundation, and the technical support of WRI India, NN 2.0 will deepen efforts in selected NNC cities (Bengaluru, Indore, Jabalpur, Kochi, Kohima, Rourkela and Warangal), 2 Urban95 lighthouse cities (Pune and Udaipur), selected states and a network of other cities.

Rahul Kapoor, Joint Secretary, Smart Cities Mission, National Urban Livelihoods Mission and PM SVANidhi, Ministry of Housing and Urban Affairs, launching Nurturing Neighbourhoods 2.0.

Launch of the Battery360 Alliance.

Battery360 Alliance Launch

July 22, 2024

India's clean energy transition — targeting 425 GW of renewable energy and 30% EV sales by 2030 — relies on lithium-ion batteries, the sustainability of which calls for a circular, resource-efficient approach. On July 22, 2024, the Battery360 Alliance was launched to accelerate this shift. The platform brings together government, industry and academia to catalyze the battery sector and bridge gaps between policy and practice. The Alliance aims to reduce critical mineral dependence, localize battery manufacturing, and strengthen battery reuse and recycling for a sustainable and self-reliant battery ecosystem.

Launch of Global South Policymakers' Exchange

March 10, 2025

The Global South Policymakers' Exchange was launched on the sidelines of Transforming Transportation – a conference organized by the World Bank and WRI in Washington DC. The Exchange offers a platform for emerging economies (India, Indonesia, Brazil, Colombia, Chile, Mexico, Indonesia, South Africa, Kenya) to share learnings and inculcate best practices for implementing market-based mechanisms like supply-side regulations (SSRs) to accelerate the transition to zero-emission vehicles. It also aims to promote regional cooperation to empower policymakers to develop actionable policy frameworks and create a global peer-to-peer network of Champions of Change. The launch featured a special address by Dr. Hanif Qureshi IAS, Additional Secretary, Ministry of Heavy Industries, and remarks by Ani Dasgupta, CEO, WRI – both highlighting the need for concerted, collective action to shape the future of sustainable transport.

WRI India launched the Global South Policymakers Exchange to convene policymakers from nine emerging economies for knowledge sharing on zero-emission vehicles and create Champions of Change.

Enabling Community-led Water-sensitive Neighborhoods in Delhi
May 27, 2024

An expert panel review of the work done over three years under the Australia India Water Security Initiative (AIWASI) was convened by the Australian government's Department of Foreign Affairs and Trade in Delhi, with support from lead partner WRI India, and consortium partners Mahila Housing Trust, McGregor Coxall and the NIUA. Project partners also hosted the Delhi Water Forum (DWF) to foster interaction and collaboration with nodal government officials. The review concluded with a community visit to the two implementation sites, Bakkarwala and Mubarakpur Dabas, offering insight into residents' perspectives on water security challenges and showcasing on-ground water-sensitive design elements, such as a community park, household-level waste management and water metering.

A park in Bakkarwala co-designed with the community to be greener, accessible and playful.

Uttar Pradesh Chief Minister Shri Yogi Adityanath with the team at a workshop on Gorakhpur's roadmap to becoming a city free of open waste burning by 2027.

Gorakhpur Open Waste Burning Workshop
March 11-13, 2025

WRI India, in collaboration with Nagar Nigam Gorakhpur, organized a three-day workshop on "Gorakhpur's Roadmap to Becoming an Open Waste Burning-Free City by 2027." The event, which brought together more than 250 participants, including experts, local officials, and civic leaders, discussed innovative, data-driven strategies for reducing open waste burning. The workshop concluded with Hon'ble Chief Minister of Uttar Pradesh, Shri Yogi Adityanath, sharing his views on the need for concentrated action for cleaner air.

CLIMATE, ECONOMICS AND FINANCE

Bhopal Multistakeholder Dialogue
October 18, 2024

WRI India, in association with Environmental Planning and Co-ordination Organisation (EPCO) and the Government of Madhya Pradesh, organized a multistakeholder dialogue on the "Long-Term Low-Carbon Development Strategy of Madhya Pradesh," in Bhopal. The dialogue facilitated discussions on climate mitigation and operationalizing long-term climate actions in the state. With over 70 participants from the state government, academia and civil society, discussions focused on the role of states in contributing to India's climate goals while highlighting challenges related to data infrastructure and financing barriers. The dialogue called for stronger inter-departmental collaboration, improved data management and proactive governance to build the state's long-term low-carbon development strategy.

Manu Shrivastava, IAS, ACS, Power and Renewable Energy Department, Government of Madhya Pradesh, delivering the keynote address at the multistakeholder dialogue.

Transforming Industries: Unlocking Net Zero Pathways in Hard-to-Abate Industries
February 02, 2025

WRI India convened a closed-door roundtable on "Transforming Industries: Unlocking Net Zero Pathways in Hard-to-Abate Industries," with policymakers, industry leaders and sustainability experts. The discussion focused on scalable and economically viable solutions to accelerate industrial transformation in hard-to-abate sectors such as steel, cement and aluminum. At the event, WRI India also launched the expert note "Pathways to Net Zero: Policies and Measures for Industrial Decarbonization in India," which examines key policy actions to enable industrial decarbonization while assessing emissions reduction potential under a long-term decarbonization (LTD) scenario aligned with India's net zero by 2070 target.

WRI India launched its expert note on "Pathways to Net Zero: Policies and Measures for Industrial Decarbonization in India" at the roundtable discussion.

WRI India's booth showcasing our work under the Empower MSMEs initiative in Tamil Nadu at the Summit.

Tamil Nadu Climate Summit 3.0
February 4-5, 2025

WRI India showcased its work under the Empower MSMEs initiative in Tamil Nadu at the Tamil Nadu Climate Summit 3.0, which convened over 100 participants from research organizations, government bodies, MSMEs and NGOs to accelerate climate action in the state. Speaking at a panel discussion, Ulka Kelkar, Executive Program Director, Climate, Economics and Finance, shared insights on carbon market opportunities for the state, highlighting how industries can leverage carbon finance for low-carbon growth. Ashwini Hingne, Associate Program Director, Climate, Economics and Finance, chaired a session on low-carbon pathways for the industrial sector, which explored strategies to reduce emissions without compromising economic progress.

Gujarat Sustainability Summit
March 1, 2025

WRI India supported the Gujarat Chamber of Commerce and Industries (GCCI) in organizing the "GCCI Gujarat Sustainability Summit 2025" in Ahmedabad. Mehul Patel, Program Lead, Climate, Economics and Finance, facilitated a session on "Future-Ready MSMEs in Gujarat," at the Summit. Drawing from WRI India's ongoing efforts in the Surat textile cluster to help build future-ready, resilient and sustainable MSMEs that engage a green, inclusive workforce, Mehul highlighted the need to handhold textile MSMEs and assist them in implementing feasible solutions for greener operations and a just and inclusive low-carbon transition.

On left: Mehul Patel, Lead, Climate Program, at the GCCI Gujarat Sustainability Summit.

Developing Subnational Building Decarbonization Strategies
October 22, 2024

WRI India, in collaboration with Thiruvananthapuram Municipal Corporation (TMC), Energy Management Centre-Kerala (EMC-K) and Indian Green Building Council (IGBC), conducted a stakeholder consultation to develop a city action plan for Net Zero Carbon and Resilient Buildings (NZCRB) in Thiruvananthapuram. A focus group meeting was held with IGBC in Nashik on February 20, 2025, to align NZCRB efforts with the Nashik Climate Action Plan and discuss private sector interventions. On April 15, 2025, the working group met in Thiruvananthapuram to refine transformative actions and identify an implementation roadmap for the NZCRB Action Plan for the city.

Stakeholder consultation workshop on "Developing a City Action Plan for Net Zero Carbon and Resilient Buildings (NZCRB)," for Thiruvananthapuram City.

Participants at the working group discussion in Thiruvananthapuram.

Deepak Tiwari, Research Fellow, Energy Program, presenting at the ETPI session at IEFK.

India Energy Festival of Kerala
February 8-9, 2025

In collaboration with the Energy Management Centre, Kerala, WRI India hosted two sessions focused on accelerating Kerala's energy transition at the India Energy Festival of Kerala (IEFK). The first session, "Driving Change," highlighted emerging clean energy technologies and included the release of WRI India's working paper "Assessing Technologies for Expanding Renewable Energy in Kerala." The second session featured the Energy Transition Preparedness Initiative (ETPI), a joint effort with Prayas (Energy Group) and Sustainable Futures Collaborative, discussing sectoral developments and cross-cutting themes across electricity, buildings and transport in 10 states.

Dialogues in Madhya Pradesh to Reduce Food Loss and Food Waste

December 13, 2024 - February 5, 2025

Mobilizing action on food loss and food waste (FLFW) across the state, WRI India co-organized a series of dialogues on city-level strategies to reduce FLFW in collaboration with the Environmental Planning & Coordination Organisation (EPCO), Government of Madhya Pradesh. Held in Bhopal, Jabalpur, Gwalior and Indore, these workshops have been crucial in creating awareness among the government and non-government stakeholders involved in managing a city's FLFW. The workshops focused on discussing the causes, scale and impact of FLFW and mapped city-level practices and challenges. They also showcased best practices and developed actionable strategies to address food loss and waste.

Glimpses from the Jabalpur Dialogue, organized in collaboration with EPCO, Madhya Pradesh — a city-level conversation focused on reducing food loss and waste.

Sessions on Building Sustainable Food and Land-use Systems

September 12, 2024

The Food, Land and Water Program hosted a series of curated sessions on enabling sustainable and resilient food and land-use systems in India at WRI India's flagship event, Connect Karo 2024. A high-level plenary explored strategies, financing opportunities and innovative models for enabling sustainable and resilient food and land-use systems in India. A working paper on food loss and food waste in the tomato supply chain was also launched at one of the sessions, followed by a high-level panel discussion. An insightful fireside chat was held with city representatives to explore innovative food waste management strategies and models of citizen engagement. Sessions also focused on overcoming barriers to financing, capacity building and collectivizing action to nurture a restoration economy.

Glimpses from Food, Land and Water sessions at WRI India's Connect Karo 2024.

Capacity-building Workshops for Strengthening Restoration Efforts
February 10 - 11, 2025
December 20, 2024

A series of workshops were organized in Madhya Pradesh's Sidhi district with support from district administration and local partners to empower Gram Panchayats in planning climate-resilient, community-led restoration efforts. These sessions focused on enhancing natural resource management (NRM) activities under Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) and promoting restoration strategies, such as soil and water conservation, climate-resilient agriculture, and value chain development for bamboo, jackfruit and mahua. WRI India's team held a two-day training on the Restoration Opportunity Assessment Methodology (ROAM) in February 2025 to emphasize the integration of scientific tools with traditional knowledge. MGNREGS functionaries from across the state were provided assistance in preparing village-level restoration plans and development project reports using GIS at the Gram Panchayat level. A two-day orientation on gender sensitization and landscape restoration also focused on the integrated landscape approach, with an aim to scale NRM investments under MGNREGS, thereby promoting sustainable livelihoods.

Capacity-building workshops on climate-resilient panchayats in Madhya Pradesh's Sidhi district and a two-day session on gender sensitization and landscape restoration.

Multistakeholder consultation on sustainable agriculture practices held in Chhindwara, Madhya Pradesh.

District-level Consultations Under Madhya Pradesh Sustainable Agriculture Program
January 23, 2025 - April 23, 2025

As part of the Madhya Pradesh Sustainable Agriculture Program (MPSAP) initiative, WRI India co-organized a series of consultations with scientists and technical experts in collaboration with the district administration offices of Harda, Chhindwara, Indore, Mandsaur and other partners. Discussions focused on region-specific agricultural practices and challenges and the pathways to accelerate the adoption of sustainable agriculture. Stakeholders at the consultations included government representatives, civil society organizations, farmer producer organizations, self-help groups, champion farmers, scientists, researchers, academicians and market facilitators.

LIFE AT WRI INDIA

At WRI India, our commitment to diversity, equity and inclusion shapes a vibrant, welcoming workplace where everyone can thrive. We celebrate the unique experiences and perspectives our team brings, fostering collaboration, learning and shared growth. Here's a glimpse into life at WRI India — where work, learning and celebration go hand in hand.

Learn more about our diversity commitments here.

CPR training at the Mumbai office. Similar training was also conducted in Delhi, Bengaluru and Chennai.

Celebrating birthdays and work anniversaries in the Bengaluru office, WRI India style.

Season's Greetings! — Christmas celebrations at the Delhi office.

Lighting up the office with colors, culture and camaraderie on Diwali.

Tradition, enjoyment and fun — ethnic day at the Delhi office.

Taking work-life balance outdoors — picnic in Bengaluru and Delhi.

WRI India team spirit at the annual all-staff retreat.

FINANCIAL SUMMARY

WRI India ended 2024-25 in good financial and operational health. Even as we deliver high-impact programmatic results, we continue to steward the growth of the organization with sound financial management. We recognize the vision and generosity of our donors, without whom our work would not be possible. The financial results depicted are derived from WRI India's audited financial statements.

View the copies of the complete audited financial statements on our website: wri-india.org

Women-led self-help group members displaying Moonj baskets. As part of Uttar Pradesh's Aspirational Cities Programme, WRI India is documenting local crafts and practices.

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DESIGN

Karthikeyan Shanmugam

CURATION AND PRODUCTION

Rama Thoopal and Karthikeyan Shanmugam

EDITING AND PROOFREADING

Aditi Sundan, Anya George and Chandni Nair

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WRI INDIA

Lower Ground Floor, AADI 2,
Babir Saxena Marg, Hauz Khas,
New Delhi, 110016