THE ENERGY AND RESOURCES INSTITUTE

Creating Innovative Solutions for a Sustainable Future

Strategic Document

Vision: 2025-30

CONTENTS

EXECUTIVE SUMMARY

India stands at a tipping point. The decisions we take and the choices we make between 2025 and 2030 will determine if we are able to fuel a billion lives with clean energy, take back our air and water, and create cities that prosper rather than suffocate.

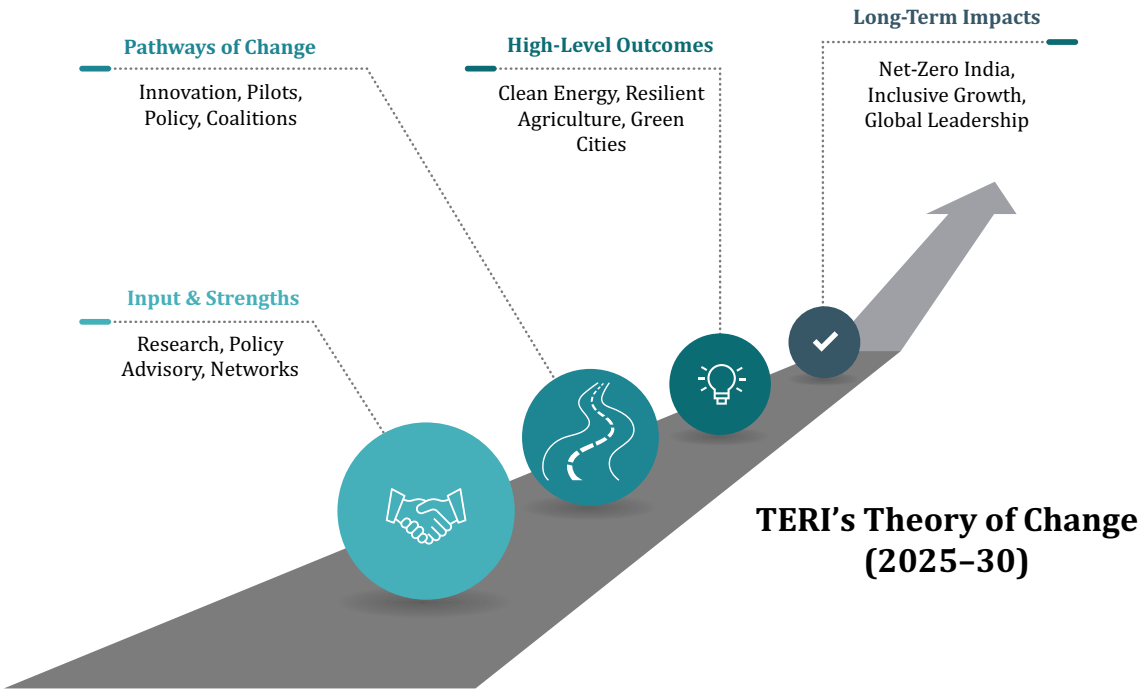
The Energy and Resources Institute is convinced we can – and we should. The critical years between 2025 and 2030 will decide whether we lead the world towards a net-zero, resilient future– or lock ourselves into crisis. TERI is determined to tip the balance. By connecting science, society, and systems, TERI will catalyse India's leap to a net-zero, resilient, and inclusive future.

TERI's *Strategic Document Vision: 2025–30* lays out a road map across multiple domains, including climate resilience, clean energy, industrial biotechnology, waste management, sustainable agriculture, sustainable development, and social transformation. The document highlights TERI's past achievements, innovative solutions developed, and future priorities aimed at driving systemic change towards a more sustainable and resilient future following sustainability focused national missions.

This document emphasizes TERI's mission in sustainable infrastructure development, integrating energy transition using green energy solutions, promoting green policy innovations, carbon finance & modelling, and enhancing transport and shipping efficiency to reduce carbon footprints. TERI believes that waste and water treatment and circular economy initiatives will play a crucial role in minimizing environmental impact, while responsible forestry practices will support ecological balance. Additionally, corporate social responsibility (CSR) efforts will focus on community engagement, environmental stewardship, thereby fostering long-term business sustainability goals aligned with national and global frameworks. Moreover, the awareness and consciousness about sustainability among all stakeholders, especially youth cannot be ignored.

TERI's Theory of Change (2025–30)

TERI's approach is based on a firm conviction: change occurs when research becomes innovation, innovation informs policy, and policy triggers large-scale adoption that changes lives and landscapes. TERI's role is to be the catalyst: testing solutions, shaping policy, and building capacity so that clean energy, sustainable agriculture, and green infrastructure become the norm. By 2030, this ripple effect will drive India – and the Global South – towards net-zero prosperity. The diagram below illustrates TERI's Theory of Change, showing how inputs and strengths flow through pathways of change to create high-level outcomes and long-term impacts.



TERI's Theory of Change (2025–30)

We will act where impact is greatest:

- ✓ **Inputs and Strengths:** world-class research, policy advice, ground-level outreach, international networks.
- ✓ **Pathways of Change:** innovation and pilots, evidence-based policy making, capacity development, multi-stakeholder alliances.
- ✓ **High-Level Outcomes:** scaled uptake of clean energy, climate-resilient agriculture, green infrastructure, and circular economies.
- ✓ **Long-Term Impacts:** a net-zero India that is resource-efficient, socially inclusive, and globally competitive in sustainability.

Our Strategic Priorities

We shall act with courage in four impact clusters that hold out the maximum change:

1. **Energy Transitions for Net Zero**
   - » Accelerate renewables, storage, green hydrogen, and energy efficiency.
   - » Reimagine shipping and transport for carbon-free futures.
   - » Shape pathways to phase out fossil fuel dependence across industries and cities.
2. **Resilient People and Ecosystems**
   - » Build climate-proof communities and early warning systems.
   - » Scale circular economy models for waste, water, and forestry.
   - » Revive rivers, soils, and biodiversity for resilience in the long term.

3. **Innovation for Green Growth**
    - » Support industrial biotechnology, bio-plastics, and zero-waste production breakthroughs.
    - » Open up carbon markets and green finance to support systemic change.
    - » Make India a hub for sustainable technology and business.
4. **Inclusive Communities and Just Transitions**
    - » Enable farmers to have climate-smart agriculture and regenerative practices, including the use of nanofertilizers to boost crop productivity sustainably.
    - » Nature-based solutions for improving soil health.
    - » Develop green livelihoods and skills for women and youth.
    - » Enable partnerships between policymakers, industry, and civil society for common prosperity.

How We Deliver

TERI's strategy is ambitious yet practical. We test concepts on the ground, co-design solutions with partners, influence enabling policies, and replicate impact at the national and international levels. Through its regional hubs, TERI will make innovation locally grounded yet internationally applicable – capturing the mantra of *Think Global, Act Regional*.

The Future We Aim to Create

By the year 2030, TERI foresees:

- ✓ Every home and business powered by clean energy.
- ✓ Resilient, mobile, and livable cities.
- ✓ Regenerating landscapes through farms while maintaining food security.
- ✓ Industries operating in circular, low-carbon systems.
- ✓ Green skills and opportunities that enable communities to prosper.

WHERE WE ARE

With its inception in 1974 as a hub of knowledge, TERI ignited a movement at the local level with a global focus. From its cradle, the Institute nurtured ground-breaking research, aimed at tackling the intertwined challenges of climate change, environmental degradation, energy scarcity, and the urgent need for sustainable development.

Over five decades, TERI's influence has only grown leaps and bounds in sustainability domains visible through setting up of multiple numbers of Centres of Excellence, the latest being the Institute of Energy Transition and the Centre for Himalayan Studies. With a strong physical presence across multiple locations in India, including its headquarters in New Delhi and regional centres in Bengaluru, Goa, Guwahati, Hyderabad, Mukteshwar, and Mumbai, TERI has established itself as a national and global thought leader. It has partnered with governments, shaping policies that steered the nation towards energy efficiency and climate action.

Deeply rooted in communities, its research has empowered small and medium enterprises (SMEs) with innovative energy-saving solutions. In the past, TERI has reached millions across India and the Global South, to revolutionize clean energy-based lighting and cooking, illuminating lives, and fostering healthier communities through Lighting a Billion Lives (LaBL) campaign, which was launched in 2008. The Institute is working on launching LaBL 2.0, which will focus not just on illuminating homes, but on enabling better health, education, and income-generation through decentralized clean energy solutions. By harnessing the power of nature, TERI has driven innovation in agriculture, energy, and biotechnology—advancing sustainable practices across sectors. Its research and ground-level impact continues to shape resilient communities and green transitions across the world.

Over the past half-a-century, TERI has established itself as a leading institution, spearheading transformative efforts in sustainable energy, environmental conservation, climate action, and beyond. With pioneering research, innovative technologies, and impactful policy interventions, TERI continues to drive meaningful change. This *Strategic Document Vision: 2025–30* showcases the recent accomplishments of our programmes and special initiatives while outlining their short-term and long-term priorities for the future.

In the short term, TERI's strategic focus lies in piloting innovative technologies, advancing regulatory frameworks, enhancing capacity building, and fostering community-centric sustainable practices. Programmes are geared towards supporting policy design, driving behaviour change, expanding stakeholder training, and demonstrating on-ground models across sectors such as clean energy, sustainable agriculture, water and waste management, climate resilience, and social transformation. In the long term, TERI envisions scaling up these interventions through transformative research, large-scale deployment of clean technologies, development of integrated sustainability frameworks, and strengthening international partnerships. Emphasis will be on enabling systemic decarbonization, promoting circular economy solutions, mainstreaming climate-smart infrastructure, and accelerating the transition towards a net-zero, resource-efficient, and inclusive development trajectory by 2030.

OUR REGIONAL CENTRES

TERI's regional centres are not just physical extensions of its headquarters but are strategic hubs that drive cutting-edge research, foster stakeholder collaboration, and deliver region-specific solutions aligned with the institute's broader sustainability goals. Spread across diverse geographics—Bengaluru, Goa, Guwahati, Hyderabad, Mukteshwar, and Mumbai—these centres exemplify TERI's commitment to contextual relevance, community-led solutions, and impactful nationwide engagement.

Each centre plays a responsible role in translating global knowledge into locally actionable strategies. By leveraging regional strengths, resources, and partnerships, they address unique regional environmental and socio-economic challenges, reinforcing TERI's vision of inclusive and locally grounded sustainable development.

What sets our centres apart?

- **Locally relevant solutions:** Grounded in regional priorities, our work reflects the environmental, cultural, and economic uniqueness of each area.
- **Collaborative ecosystems:** Strong partnerships with governments, academia, industry, and civil society ensure lasting impact.
- **Strategic focus:** Each centre sharpens its expertise in core sustainability themes to drive meaningful change on the ground.

Regional focus areas

- **Bengaluru:** Specializes in decarbonization, renewable energy, and sustainable building technologies.
- **Goa:** Focuses on marine ecology, ecotourism, sustainable aquaculture, and climate vulnerability.
- **Guwahati:** Works extensively on agriculture, forestry, biodiversity conservation, natural resource management, medicinal plants, waste management, water quality improvement, and community development across Northeast India. Recently, a decision was made to set up a Centre for Himalayan Studies in Guwahati–a proposed collaborative initiative for climate change adaptation and resilience with Gauhati University, Balipara Foundation, and the International Centre for Integrated Mountain Development (ICIMOD).
- **Hyderabad:** The TERI Institute of Energy Transition (TIoET) has been set up in Hyderabad, Telangana with support from the Ministry of Power and the Ministry of New & Renewable Energy (MNRE), Government of India. The TIoET aims to pioneer scalable solutions for decarbonization, energy efficiency, and achieving net-zero emissions.
- **Mukteshwar:** Emphasizes Himalayan ecology, mountain ecotourism, sustainable agriculture, and microgrid development.
- **Mumbai:** Positioned in India's financial capital, the centre leads efforts in marine plastic waste management, nutrition security, and environmental reporting.

The regional centres are increasingly being recognized as vital platforms for advancing TERI's growth and influence across state and national agendas. They are important for fostering partnerships with governments, academia, industry, and civil society both locally and internationally. They also work on addressing problems faced by the various regions.

A decentralized model for national impact

As TERI continues to expand its footprint nationally and globally, its regional centres remain central to a decentralized yet cohesive growth strategy. By aligning local action with national and global sustainability agendas, these centres exemplify TERI's philosophy of 'Think Global, Act Regional'. As we grow, these centres remain fundamental to our decentralized, impactful model of change.

OUR PROGRAMMES

CLIMATE CHANGE AND AIR QUALITY

BRIDGING SCIENCE, POLICY, AND PRACTICE

CLIMATE CHANGE AND AIR QUALITY

For over three decades, the Climate Change and Air Quality Programme, has been at the forefront of research on critical global and local environmental challenges across both developed and developing nations. Adopting an interdisciplinary approach, it conducts pioneering research in climate change and air quality, utilizing a combination of instrumentation, model-based assessments, and stakeholder engagement.

Thrust Areas

- Climate risk assessments
- Mitigation
- Adaptation
- Climate policy developments
- Air quality research
- Environment and health research
- Climate resilience
- Sustainable cooling

Vision

To lead the pursuit of equitable low carbon climate-resilient development and better air quality.

Mission

To deliver science, policy, and practice-based solutions in climate change and air quality through advanced data analytics, innovative research, and the development of decision-support tools that empower policymakers and stakeholders with actionable guidance.

Achievements

TERI has been a pioneer in climate change and air quality research, shaping global and national policies through groundbreaking studies and strategic interventions.
We:

- Hosted the first climate change workshop in a developing country (1989) and established a dedicated research facility.
- Played an active role in climate negotiations, contributing to the development of the Framework Convention on Climate Change (FCCC) and Kyoto Protocol.
- Instrumental in designing the Clean Development Mechanism (CDM) architecture.

- Developed India's first Vulnerability Assessment for the Agriculture Sector (2003) at the district level.
- Contributed to the IPCC Working Groups 2 and 3 since the 1990s.
- Established state-of-the-art facilities for climate risk assessments (CRAs).
- Advanced research in air quality, covering both outdoor and indoor pollution and its health impacts.
- Contributed to the development of the India Cooling Action Plan (ICAP)—the first-of-its-kind—globally.
- Served as a member of the Steering Committee for both the India Cooling Action Plan and the Mobile Air Conditioning Sub-Group, shaping national strategies for sustainable cooling.
- Actively engaged in international and national collaborative platforms as a member of the United Nations Environment Programme (UNEP)-led Cool Coalition and a founding member of the India Cooling Coalition, advancing the agenda of climate-smart cooling solutions.

Aligning Actions with National and International Commitments

TERI's work aligns with evolving national and global policy frameworks, ensuring research and interventions contribute to sustainable development and climate resilience.

- **Nationally Determined Contributions (NDCs)**
  - » Tracking non-quantifiable NDCs, transition finance flows, transparency reporting.
  - » Decarbonization strategies for steel, cement, and sustainable habitat sectors.
  - » National and subnational climate action, just transition pathways.
- **Long-term Low-emission Development Strategy (LT-LEDS)**
  - » Aligning transition finance with India's LT-LEDS.
  - » Financing pathways for micro, small, and medium enterprises' (MSME) energy transition and decarbonizing shipping.
  - » International climate finance flows and financial instruments for transition.
- **Sustainable Development Goals (SDGs)**
  - » Contributions to SDG 6 (Water), SDG 7 (Energy), SDG 13 (Climate), SDG 15 (Land), and SDG 17 (Partnerships).
- **Mission LiFE (Lifestyle for Environment)**
  - » Driving behavioural change for sustainable consumption.
  - » Engaging youth and building capacity on water, sanitation, and hygiene (WASH) linkages.

- **Panchamrit**
  - » Developing low-carbon pathways for hard-to-abate sectors.
  - » Strategies for financing decarbonization and technology road maps.
  - » Supporting a just transition through research and policy recommendations.
- **National Clean Air Programme (NCAP)**
  - » Technical assistance for effective implementation of the NCAP.
  - » Alignment of air quality research in alignment with advancements in scientific understanding on airshed-based air quality management.
- **India Cooling Action Plan (ICAP)**
  - » Contributed to the ICAP by authoring the dedicated chapter on mobile air conditioning.
  - » Working on implementation of ICAP by working on different fronts of sustainable cooling including space cooling, transport/mobile air conditioning (MAC), refrigeration and cold chains, district cooling systems, refrigerant transition, passive cooling, and skilling service technicians.
  - » Designing and developing a quarterly newsletter with Ozone Cell, Ministry of Environment, Forest, and Climate Change (MoEFCC) dedicated to the refrigeration and air-conditioning service sector.
  - » Working on exploring feasibility of innovative cooling solutions.

THE WAY FORWARD

The thrust of TERI's Climate Change and Air Quality Programme in the next five years will be to strengthen equitable global, national, sub-national, local-scale action on climate, with the aim to reduce the concentrations of GHGs and limit overall rise in temperatures to 1.5°C. The objective is to reduce the overall impacts of climate change and support opportunities for driving local actions for a cleaner and greener environment. The key activities in alignment to our Vision 2030 are as follows:

Long-term priorities		Short-term priorities	
1.	Contribute to global, national, sub-national climate policy and its developments, air quality management	1.1	Provide policy support and regulatory recommendations for climate action
		1.2	Contribute to key agendas of discussion on the Climate Finance, Global Goal on Adaptation, Loss and Damage Fund, Enhanced Transparency Framework, the NDCs and ambitions, Article 6 developments, Just Transition Work Programme (JTWP)
		1.3	Contribute to India's *Biennial Transparency Report* (BTR) and NDC Revision Process
		1.4	Contribute to national, subnational, city plans on climate
		1.5	Engage with contributions to the LT-LCDS and India's NAP process
		1.6	Focus on Short-Lived Climate Pollutants (SLCPs) and co-benefits
		1.7	Engage in India's Cooling Action Plan, discussions and development with reference to the Kigali Amendment and phasing out of Ozone-Depleting Substances (ODS)
		1.8	Support National Clean Air Plan Phase 2 and Commission for Air Quality Management (CAQM) engagements
2.	Contribute to large-scale data collation, analytics for understanding the climate change and air quality challenges leading to the development of appropriate tools	2.1	Undertake climate risk assessments for different scales, location-specific studies, real-time source apportionment studies
		2.2	Contribute to source apportionment studies for non-attainment cities, Air Quality Modelling including pollution dispersal and load assessments, Advancing Research on Black Carbon and Aerosol Monitoring
		2.3	Development of inventories, GHG profiling and air quality inventorization at different scales based on requirements
		2.4	Contribute to banking sector reforms integrating physical and transition risks into bank portfolios and customer profiles
		2.5	Enhance monitoring and surveillance of various diseases
		2.6	Develop AI-based TERI Climate Tool and contribute to hydropower generation and generation of optimization tool
		2.7	Use of Artificial Intelligence and Machine Learning (AI/ML) for air quality management
		2.8	Develop data collection tools and apps for collection of granular data on environmental health impacts in different geographies
		2.9	Undertake exposure assessment studies to airborne nanoparticles

Long-term priorities	Short-term priorities
3. Conduct analytical studies	3.1 Develop a comprehensive plan and road map for various States and their Emission profiles from different sectors including agriculture, waste, use of firewood etc., This includes development of State Action Plan on Climate Change (SAPCC), SLCP State Reports and State Clean Air Action Plans 3.2 Contribute to studies on market-based approaches, under the Article 6 of the Paris Agreement, and for the shipping sector under the International Maritime Organization 3.3 Understand climate change impacts with focus on agriculture, water, health and infrastructure 3.4 Study the geo-political context and its implications on climate actions including trade, Market-Based Mechanisms (MBMs), Carbon Border Adjustment Mechanism (CBAM), etc. 3.5 Focus on Just Transition pathways and processes including dimensions of capacity and inclusivity 3.6 Produce reports on pathways for climate resilience, net-zero, reductions in air quality emissions 3.7 Analyze cost/benefits of interventions 3.8 Frame the adaptation context and finance 3.9 Generation of evidence on environment and human health linkages through historical data and attribution studies based on primary data collection
4. Contribute to global climate action and improvement in air quality for cleaner urban environments	4.1 Identification of strategies to reduce the overall impacts of climate and decline in air quality 4.2 Technical inputs on delineation and understanding of risks and restructuring and redesigning of infrastructure 4.3 Pilots, experiments, demonstrations of technologies, practices for climate resilience, reduction of GHG emissions, air quality management that can be scaled up 4.4 Assessment of policies and their contributions to climate actions and co-benefits 4.5 Focus on active cooling technologies in urban contexts and the rural cooling landscape 4.6 Support adoption of suitable technologies including adoption of super-efficient technologies accelerating transitions from low to zero Global Warming Potential (GWP) and natural refrigerants 4.7 Advance low GWP in electric vehicles 4.8 Nudge consumer behaviour and raise awareness to enhance contributions from stakeholders 4.9 Establishment of a knowledge centre on airshed-based management to enable regional scale air quality interventions 4.10 Support clinical interventions with focus on health 4.11 AI-enabled simulations, strategization, maintenance and implementation 4.12 Develop business models and scale up action

Long-term priorities	Short-term priorities
5. Foster collaboration and partnerships on climate change and air quality studies and implementation	5.1 Engage with key stakeholders and promote collaborative research on climate change and air quality 5.2 Strike partnerships – strategic or otherwise for spearheading work in related areas
6. Stakeholder engagements and capacity building	6.1 Conduct trainings, workshops on focal areas of research in the Programme 6.2 Engage stakeholders for inclusivity in inputs and participatory approaches 6.3 Build capacities at national, sub-national, local scales of all relevant actors
7. Expand services on climate and air quality to other developing countries	7.1 Expand services in other developing countries including South Asia and SE Asia

ENERGY

DRIVING INNOVATION FOR A CLEAN ENERGY FUTURE

ENERGY

The Energy Programme is committed to accelerating India's transition to a sustainable, low-carbon energy system. Through its work, TERI influences policy, empowers industries, and supports India's ambitious clean energy goals.

Thrust Areas

- Industrial energy efficiency
- Electricity and renewables
- Energy assessment and modelling

Vision

To lead the transition towards a sustainable, low-carbon future by pioneering innovative energy solutions and practices through applied and analytical research, consultancy and collaboration to foster clean, affordable energy for all.

Mission

- To conduct high-impact research, modelling, and strategic studies that shape. India's energy future, ensuring reliable, affordable, and sustainable energy for all.
- To pioneer renewable energy integration, smart grid development, and energy storage solutions for a more resilient and efficient power system.
- To drive decarbonization across key industrial sectors, including steel and cement, through strategic road maps, supporting cleaner technologies, and best operating practices.
- To build capacity and empower stakeholders in the energy sector through knowledge-sharing, training, and policy support.
- To collaborate with national and international partners in achieving India's energy security, efficiency, and net-zero commitments.

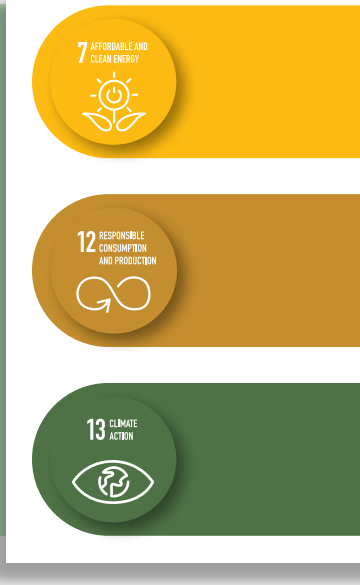
Achievements

- Conducted national-level integrated electricity demand and supply studies for 2030 & 2050, bringing out the level of renewable energy which can be integrated with the grid and its cost implications.
- Undertaken a detailed study on a net-zero energy emission energy system for India.
- Assessed the floating solar potential in India (280 GW, which can lead to saving ~4.5 lakh hectares of land).
- Analyzed and estimated the potential role of hydrogen in India.
- Developed a road map for net-zero steel sector in India.
- Conducted energy audits across 40+ countries.
- Pilot implementation of battery energy storage system in distribution companies' (DISCOMs) licence areas for various applications.

- Capacity building of hundreds of personnel in various DISCOMs on demand-side management.
- Supported the Ministry of New and Renewable Energy (MNRE) on the PM Surya Ghar Yojana.
- Supported a World Bank project benefiting around 350 micro, small, medium enterprises (MSME) units:
  - » Provided support to the Government of Guyana by setting up the first photovoltaic (PV) solar plant (300 kW grid connected) at Port Mourant Water Treatment Facility in Guyana.

Aligning Actions with National and International Commitments

The Energy Programme actively supports India's national and international commitments, including Atmanirbhar Bharat, Enhanced Nationally Determined Contributions (NDCs), the Net Zero 2070 goal, Mission LiFE (Lifestyle for Environment), and other key sustainability initiatives.



THE WAY FORWARD

The Energy Programme is accelerating the transition to a sustainable, low-carbon energy system. The key activities that would be undertaken in alignment to our Vision 2030 are bifurcated into short-term and long-term priorities:

Long-term priorities	Short-term priorities
1. Conduct integrated sectoral analysis for Indian electricity sector and give implementation support at national/ state/utility levels.	1.1 Research reports/discussion papers on macro-assessment of solar potential, re-powering of wind turbines, nuclear power and support to states like Gujarat, Odisha, and West Bengal in the electricity sector. 1.2 Providing policy support and regulatory recommendations in the electricity sector. 1.3 Revisiting State Resource Adequacy studies as required.
2. Facilitate integration of renewables with the grid, by addressing issues, challenges, market designs, and policy and regulatory aspects, including focus on storage solutions.	2.1 Assessing the feasibility of behind-the-meter (BTM) storage with rooftop solar PV in Assam and Bihar. 2.2 Conducting training programmes for various stakeholders under the PM Surya Ghar Yojana. 2.3 Pilots implementation and capacity building on energy storage systems (ESS) at the distribution level.

Long-term priorities	Short-term priorities
3. Enable establishment of performance benchmarking and quality standards for renewable energy technologies (RETs).	3.1 Performance audits of established solar PV projects. 3.2 Random testing of used and new panels acquired through market/original equipment manufacturers (OEMs). 3.3 Quality awareness training for balance of system (BoS) and best practices for installations for solar installers/ engineering, procurement, and construction (EPG) contractors.
4. Foster research partnerships and programmes with industry and academia on clean energy solutions.	4.1 Collaborative research projects on low-carbon technological solutions. 4.2 Support Industry 4.0 and advanced energy management systems in selected sectors.
5. Undertake analytical studies and develop net-zero pathways for various sectors including hard-to-abate industry sectors like steel, cement, shipping, etc.	5.1 Developing a comprehensive plan and road map to achieve 60% renewable energy by 2030 for ports identified by the Ministry of Ports and Waterways. 5.2 Low-energy consumption port studies for selected ports 5.3 Studies related to promotion of best available technologies (BAT) in steel sector. 5.4 Studies related to accelerating material efficiency, circularity, and green hydrogen use in steel sector. 5.5 Financial assessment of deep decarbonization technologies for steel sector. 5.6 Support project developers to reach final investment decisions (FID) in hard-to-abate sectors. 5.7 Net-zero road map for cement sector as well as other industry sectors.
6. Develop and implement innovative solutions for various applications/ technologies, including those appropriate for MSME sectors/ clusters.	6.1 Energy audits and technical assistance to SMEs in selected states. 6.2 Exploring alternative clean energy solutions like biomass, solar thermal, direct electrification, etc. 6.3 Strengthening financial support to MSMEs. 6.4 Capacity building and awareness generation.
7. Expand energy audit services through in-depth analysis and newer sectors, including support for implementation.	7.1 Expanding services for new clients in India, including under the proposed carbon capture, transport, and storage (CCTS) of Government of India. 7.2 Supporting industries in implementing best available technologies (BATs) and balance of plants (BoPs).
8. Energy modelling, demand supply integration and end-use demand estimation of energy consuming sectors.	8.1 Examine role of energy consumption, efficiency and decarbonization potential due to technical and behavioural actions across sectors. 8.2 Integrate socio-economic dynamics with energy system dynamics for energy transition. 8.3 Dissemination of analytical tools and capacity building across stakeholders towards green transition.

Long-term priorities	Short-term priorities
9. Integrated assessment modelling covering land, water, energy, economy, and climate linkages.	9.1 Evaluate macro-economic implication of climate change and green transition at national and sectoral levels. 9.2 Evaluate resource constraints towards transitioning to a green economy. 9.3 Integrate climate risk analysis in green transition pathways. 9.4 Evaluate the developmental implication on non-CO_2 GHGs and its reduction potential.
10. Assessment of alternative energy development and decarbonization pathways and its implications on the economy and environment.	10.1 Examine India's need for carbon space for balancing Viksit Bharat and green transition. 10.2 Examine role of alternative technologies for sustainable development transition. 10.3 Analyze costs-benefits of new and emerging technologies. 10.4 Examine the cost of adaptation and its implication on development trajectory.
11. Demonstration of people-centric transition and economic diversification models, socio-economic, macro-economic and geo-political impact assessment and co-benefit analysis for decarbonization.	11.1 Socio-economic impact assessment of energy transition policies in sectors such as coal mining. 11.2 Examining ways to upscale climate actions at specific communities, sub-sectors and local levels. 11.3 Study the impact of geo-political dynamics and trade measures (like carbon market/carbon border adjustment mechanism or CBAM). 11.4 Evaluating sectoral transition road maps. 11.5 Evaluate strategies for enhancing resilience for vulnerable groups/sectors and regions. 11.6 People-centric transition in coal mining regions through holistic development of a coal-rich district. 11.7 Develop a tangible and scalable framework for socially responsible land acquisition in utility-scale renewable energy (RE) projects. 11.8 Exploring the framework required to effectively mainstream equitable practice in the utility-scale RE deployment in India through secondary and primary research and engagement with industry and policymakers.
12. Promote demand-side management and expand activities around new and innovative solutions like agricultural photovoltaics (AgriPV), building-integrated photovoltaics (BIPV) floating solar, concentrated solar power (CSP) electrification of thermal processes, green hydrogen, smart grids, agrivoltaics, etc.	12.1 Developing baseline reports on pilots, detailed project report (DPR) framework; exploring grid-integration challenges and recommendations, farmer engagement. 12.2 Developing guidebooks on BIPV. 12.3 Capacity building and awareness on new and innovative. solar applications. 12.4 Development of framework for estimation of floating solar photovoltaics (FSPV) potential.
13. Expand services on clean energy solutions to other developing countries.	13.1 Expanding services in Guyana, Fiji, Indonesia, and other developing countries.

GREEN SHIPPING, ADVANCED BIOFUELS, AND BIOCHEMICALS

PIONEERING SUSTAINABLE MARITIME AND ENERGY SOLUTIONS

GREEN SHIPPING, ADVANCED BIOFUELS, AND BIOCHEMICALS

The Green Shipping, Advanced Biofuels, and Biochemicals Programme demonstrates TERI's research capabilities in supporting sustainable utilization of resources across key sectors including ports, shipping, and waterways. The Programme hosts the National Centre of Excellence in Green Ports and Shipping (NCoEGPS) to support the Ministry of Ports Shipping and Waterways (MoPSW) and key stakeholders in fostering carbon neutrality and circular economy in India's maritime sector in line with changing global and national regulatory landscape. The Programme actively engages in industry advisory services on various environmental, social, and governance (ESG) dimensions. It undertakes cutting-edge scientific and policy research in promoting commercially viable and sustainable solutions derived from bio-based routes, anchored on the principles of circularity, towards greening India's maritime sector and beyond.

Thrust Areas

- Developing sustainable and cleaner technologies (through biochemical and thermochemical routes) for producing bioenergy, green fuels, biochemicals, and bio-commodities using 1st-, 2nd-, and 3rd-generation feedstocks.
- Using life cycle tools for evaluating sustainability benefits of various resource-efficient pathways in fast-moving consumer goods (FMCG) consumer durables, defence, and transport sectors.
- Actively engaging in policy advocacy and industry advisory services based on scientific research and data-driven evidence to support net-zero transition.
- Providing learning, training, and capacity development for stakeholders to strengthen awareness on imperative of green transition in maritime sector and beyond.
- Focus on promoting sustainable consumption and production to ensure efficient and responsible use of natural resources in alignment with SDGs 8.4 and 12.

Vision

To lead the transformation of India's maritime sector through cutting-edge research, policy innovation, and foster industry collaboration for carbon neutrality and circular economy.

Mission

Undertake cutting-edge research in promoting commercially viable and sustainable solutions anchored on the principles of circularity and energy efficiency, for supporting green transition in India's maritime sector and beyond.

Achievements

- The NCoEGPS, developed the first-of-its-kind outcome document on 'green port and shipping initiatives', under the Neel Arth Vision Implementation (NAVIC Cell 3)
  - » Tracking progress on Harit Sagar Guidelines and Maritime India Vision (MIV) 2030.

- » Identifying challenges faced by ports in green initiatives implementation.
- » Developing a strategic action plan with timelines.
- » Exploring green financing opportunities.
- » Strategies for capacity building and skill development in the green maritime sector.

- **NCoEGPS portal launch and updates**
  - » Officially launched on 27 February 2025 by Hon'ble Union Cabinet Minister Shri Sarbananda Sonowal.
  - » Over 1000+ resources available, including books, articles, reports, policies, standards, and research papers.
  - » Close to 10,000 hits recorded as on date.
- **Resource efficiency governance**
  - » TERI, in association with Shakti Sustainable Energy Foundation and the Council of Energy, Environment, and Water (CEEW) provided the knowledge support to developing India's National Critical Mineral Mission approved by the Cabinet in January 2025.
  - » Developing a green credit methodology for adoption of biogas and biofertilizers in India.
  - » Unlocking economic and environmental benefits of green training for Indian Armed Forces.
- **Microbial biofuels and biochemicals**
  - » Established state-of-the-art large laboratory infrastructure facility for production of value-added biochemicals from first- and next-generation feedstocks (lignocellulose biomass).
  - » Demonstrated pilot-scale production of industry platform biochemicals, 2,3 butane diol, bioethanol, from first-, next-generation feedstocks (patent filed).
  - » Demonstrated pilot-scale biohydrogen production from second-generation biomass at technology-readiness level 6 (TRL-6) (patent filled).
  - » Demonstrated large-scale biohydrogen production from sugar industry spent matter (molasses and distillery effluent) at technology readiness level 7 (TRL-7) (patent filed).
  - » Developed high-rate biomethane production process from livestock waste and agriculture residue biomass, through microbial interventions.
  - » Demonstrated large-scale outdoor marine algae cultivation for generating third-generation biomass for biofuel and bio-commodity production.
  - » Developed bioprocess for cleaner production of valuable organic acid short-chain organic acids and enzymes (lipase).
  - » Developed bioprocess for cleaner production of bio-commodities.
  - » Hosted first-of-its kind G20 research leaders meet, Sixth Research and Development 20 (RD20) international conference on clean energy technologies in India (outside Japan), (in association with the Ministry of New and Renewable energy).
  - » Hosted joint India–Netherlands Innovation Mission workshop on biofuels, biochemical, and bio-commodities.
- **Pyrolytic biofuels, biochar, and green chemicals**
  - » Hosted the Indo–German bilateral workshop—Future Energy Carriers: Advancing Bio-Circular Economy for Clean Energy.

- Pyrolysis research (patented technology TRL 5): Developed a gas-fired auger pyrolyzer unit with dual-mode heating (gas and electricity) and a catalytic bio-oil upgrading system for converting various biomass feedstocks and agro-industrial residues into biofuel and biochar.
- Biodiesel production (technology TRL 4): Developed a two-stage, in-house ionic liquid-catalyzed process for biodiesel production from used cooking oil (UCO) and marine algal lipids, achieving over 95% conversion efficiency.
- Collaboration with Indian Oil Corporation Limited and Centre for High Technology (MoPNG) for pilot-scale development of pyrolysis oil from multi-feed (biomass, plastic, tire) and its co-processing in refineries.

Aligning Actions with National and International Commitments

The Green Shipping, Advanced Biofuels, and Biochemicals Programme aims at transitioning towards sustainable future through development of clean and green technologies for production of biomaterials from bio-based renewable resources and providing support in developing policies, regulations, and standards.

The National Centre of Excellence on Green Ports and Shipping (NCoEGPS) is a unique partnership between the Ministry of Ports, Shipping, and Waterways (MoPSW), Government of India and TERI, which deals with identification, development, and adoption of green solutions for ports.

In alignment with the nation's bio-economy objectives and climate security goals, the thrust areas of the Advanced Biofuels and Biochemicals Division encompass R&D and technology demonstration for the production of biofuels, biochemicals, bio-commodities, and green fuels. These efforts focus on both first-generation and next-generation feedstocks, including lignocellulosic agricultural residues, algal biomass, and various waste resources. These thematic research areas are aligned with India's biofuel policies and its broader clean and green initiatives, including Sustainable Alternative Towards Affordable Transportation (SATAT), Green Hydrogen Mission, Bio-E3 framework (Environment, Energy, and Employment), and the Ethanol-blended Petrol (EBP) Programme.

At the international level, the Programme's efforts resonate with the key global initiatives, such as the Mission Innovation Programme and the Global Biofuel Alliance (GBA), and support the achievement of several Sustainable Development Goals (SDGs), including SDG 7: Affordable and Clean Energy, SDG 13: Climate Action, SDG 2: Zero Hunger, and SDG 15: Life on Land.

The thrust areas of the Resource Efficiency and Governance (REG) Division focus on promoting sustainable consumption and production to ensure the efficient and responsible use of natural resources. These efforts are aligned with SDG 12: Responsible Consumption and Production and the objectives of Mission LiFE (Lifestyle for Environment).

THE WAY FORWARD

By developing sustainability standards, circular economy models, and green fuels, TERI aims to accelerate India's transition towards a resilient, low-emission future. The key activities that would be undertaken in alignment to our Vision 2030 are bifurcated into short-term and long-term priorities.

Short-term Priorities

- **Resource efficiency and governance**
  - » Collaborate with the Bureau of Energy Efficiency (BEE) to promote carbon credit framework for supporting production of biogas and biofertilizer.
  - » Promote a circular bioeconomy in agriculture and dairy through carbon finance models.
  - » Assist the Ministry of Mines in implementing the National Critical Mineral Mission.
  - » Develop standard operating procedures (SOPs), guidelines, and manuals to support sustainable mineral extraction and utilization.
  - » Develop lifecycle assessment-based sustainability standards to ensure responsible bioenergy production and utilization.
- **NCoEGPS**
  - » NAVIC Cell 3 Report Finalization.
  - » International Green Shipping and Ports Conclave 2025.
  - » Deployment of sustainability tools on the NCoEGPS Portal.
  - » Carbon-neutrality assessment of selected ports.
  - » Design specialized training programmes and skill development courses for port authorities, shipping operators, and workforce to support green shipping initiatives.
- **Microbial biofuels and biochemicals**
  - » Demonstrate bioprocesses for production of biohydrogen, biomethane (biogas), bioethanol, and biobutanol (liquid biofuels) at pre-commercial.
  - » Demonstrate bioprocesses for production of biochemicals (industry platform, special and bulk biochemicals, at precommercial scale.
  - » Enhance feedstock production (e.g., micro-algae-based solutions) for industrial applications.
  - » Bio-commodity production at pre-commercial scale.
- **Pyrolytic biofuels, biochar, and green chemicals**
  - » Develop technologies for the conversion of pyrolysis oil into sustainable aviation fuel (SAF) and marine fuel.

Long-term Priorities

- **NCoEGPS**
  - » Develop a comprehensive and scalable green ranking framework for Indian ports.
  - » Expand upon the completed research and implementation efforts for broader sectoral impact.
  - » Enhance a centralized knowledge hub for all maritime greening activities in India.
  - » Supporting sustainable ship recycling.
  - » Role of market-based mechanisms in decarbonizing shipping sector.
  - » Conduct techno-economic feasibility studies for green hydrogen production, storage, and bunkering at Indian ports.
- **Advanced biofuels and biochemicals**
  - » Commercialization of industry-relevant biochemicals including specialty and platform biochemical.
  - » Large-scale production of biohydrogen in an integrated manner.
  - » Commercialization of alcohol-to-jet (AtJ) sustainable aviation fuel (SAF).
  - » Commercialization of bio-commodities.
  - » Commercialize pyrolysis technology (TRL 5-9).
- **Cross-cutting enablers**
  - » Advance carbon nanomaterial development for efficient hydrogen storage solutions.
  - » Sustainability assessment of enhanced utilization of various biomass pathways.

Critical Minerals – Securing India's Green Transition

- Strengthen the critical mineral governance framework for India.
- Focus on strategic acquisition of critical minerals globally.
- Promote the circular economy to secure critical mineral supply chains.
- Accelerate EV adoption and efficiency through 'Green Rating' of automobiles.
- Support states in circular economy initiatives.

Strategic Rationale

Decarbonizing shipping and scaling biofuels/biochemicals will require critical minerals (for hydrogen electrolysers, biofuel catalysts, EV/port electrification, and storage solutions). By 2030, a resilient minerals strategy will ensure secure supply, recycling, and innovation to power India's green transition.

INDUSTRIAL BIOTECHNOLOGY

HARNESSING MICROBIAL INNOVATION FOR SUSTAINABLE SOLUTIONS

INDUSTRIAL BIOTECHNOLOGY

Through decades of dedicated research and innovation, the Industrial Biotechnology Programme has significantly advanced the development of bio-based products, large-scale bioremediation of oil spills and contaminated land, and sustainable energy solutions. The Programme's focus on indigenous technologies, such as prevention of paraffin deposition in oil well tubing by paraffin degrading bacteria (PDB), Oilzapper, and microbial enhanced oil recovery (MEOR), has not only led to successful commercialization but has also earned global recognition for their effectiveness.

Thrust Areas

- Microbial enhanced oil recovery
- Prevention of paraffin deposition in oil well tubing
- Bioconversion of CO_2 into value-added products through anaerobic fermentation
- Microbial-enhanced methane production in coalbed methane (CBM) wells
- Control of microbial-induced corrosion in industrial systems
- Production of biopolymers for drilling applications in oil wells and food
- Large-scale bioremediation of oil spill sites and pesticide-contaminated land

Vision

To protect the environment and develop sustainable, green solutions for broader application in India's rapidly expanding economy.

Mission

To provide biotechnological and environmentally responsible solutions that address industrial and environmental challenges. By developing bio-based products that drive business growth while maintaining ecological balance, the Programme ensures commercially viable and sustainable outcomes.

Achievements

Technologies developed and commercialized

- Oilzapper technology for large-scale bioremediation of oil spill sites.
- MEOR technology to improve crude oil production from stripper oil wells.
- Prevention of paraffin deposition in oil well tubing through action of bacterial strains to improve operational efficiency.
- Microbial-enhanced methane production in CBM wells for increased gas recovery.

Technology developed and successfully tested

- Xanthan gum (biopolymer) tested for its effectiveness in oil well drilling applications.

Aligning Actions with National and International Commitments

Industrial Biotechnology initiatives are strategically aligned with both national and international sustainability goals. Domestically, our work supports key programmes such as the National Bio-Energy Programme, Waste to Wealth Mission, and India's commitment to achieve net-zero emissions by 2070. Internationally, our priorities echo the objectives of the UN Sustainable Development Goals (SDGs)—notably SDG 7 (Affordable and Clean Energy), SDG 9 (Industry, Innovation and Infrastructure), and SDG 13 (Climate Action), SDG 15 (Life on Land), and SDG 17 (Partnerships for the Goals)—as well as the Paris Agreement's call for reduced GHG emissions and climate-resilient development.

Through pioneering research and deployment of microbial technologies for carbon capture and utilization (CCU), bio-based alternatives to petrochemicals, circular economy solutions, and decarbonization of industrial processes, TERI is helping hard-to-abate sectors transition towards low-carbon and resource-efficient models. Our approach integrates innovation with policy engagement to create scalable, real-world impacts that contribute to both national priorities and global climate commitments.

THE WAY FORWARD

The Industrial Biotechnology Programme is pioneering bio-based innovations that drive sustainability, resource efficiency, and environmental restoration. The key activities that would be undertaken in alignment to our Vision 2030 are classed into short-term and long-term priorities.

Short-term Priorities

Expanding bioremediation and pollution control

- Bioremediation of oil-contaminated sites
  - » Expand operations in India and enter international markets.
  - » Collaborate with M/s Contec Global Agro Limited (Nigeria), M/s Peter Kerg Company (UAE), and the Environment Protection Agency (Guyana).
  - » Apply for product registration, seek regulatory approvals, conduct field trials, and commercialize the technology.

- Advanced biodegradation technologies
  - » Continue R&D in partnership with Tata Consultancy Services Limited (TCS), Biotechnology Industry Research Assistance Council (BIRAC), government bodies, corporates, and international organizations.
  - » Develop novel bacterial strains and enzymes for degrading emerging pollutants and industrial waste.

Enhancing energy and resource recovery

- CBM production
  - » Expand market engagement with CBM operators.
  - » Conduct field trials in five CBM wells initially, followed by 10 additional trials.
  - » Collaborate with CBM Asset, ONGC, Essar Oil and Gas Exploration Production Limited.

Long-term Priorities

Aligned with our commitment to environmental protection, the Industrial Biotechnology Programme will continue to drive innovation through targeted initiatives and strategic partnerships.

Expanding bioremediation and pollution control

- Pesticide remediation
  - » Innovate solutions to remove pesticides from contaminated sites.
  - » Collaborate with Nagarjuna Fertilizers, Hindustan Unilever (HUL) Reliance, and other insecticide industry leaders.
  - » Conduct lab-scale R&D, pilot trials at client sites, and assess commercial viability.

Enhancing energy and resource recovery

- Biohythane production
  - » Conduct R&D at lab scale to develop and optimize biohythane (hydrogen together with methane) production from hydrocarbon.
  - » Feasibility study and pilot trial for biohythane production in depleted oil reservoirs to evaluate the commercial potential in collaboration with ONGC.

Optimizing industrial processes with green solutions

- MEOR for high-temperature oil reservoirs
  - » Advance R&D in partnership with ONGC Energy Centre and Institute of Reservoir Studies.
  - » Conduct lab-scale studies, coreflood analysis, feasibility assessments, and pilot trials.
- Paraffin deposition prevention in oil well tubings
  - » Improve the process in collaboration with ONGC.
  - » Conduct trials in coreflood model, and pilot-scale implementation to optimize commercialization.

Technology upscaling (TRL 3 to 8)

- Carbon dioxide-to-succinic acid conversion through anaerobic fermentation
  - » Develop fermentation-based CO_2 utilization in collaboration with government and corporate partners.
- Commercialization of biopolymers
  - » Develop cationic guar gum and high-temperature, high-pressure stable guar gum in collaboration with the petroleum and cosmetics industries.
  - » Modify guar gum for carboxymethyl hydroxypropyl guar gum (CMPHG), lactic acid, and biosurfactant production.
- Carbon dioxide-to-methane bioconversion
  - » Optimize processes in partnership with ONGC Energy Centre and CBM Asset (Bokaro, ONGC).
  - » Development of improved catalytic process for reduction of CO_2 concentration in methane gas to improve calorific value of methane recovery from CBM wells.
- Rare earth element (REE) extraction
  - » Collaborate with the Ministry of Coal and Mines and corporate stakeholders.
  - » Develop a lab-scale bioleaching process, optimize acid-producing bacterial strains, and target production of 100 g of purified scandium.

Strengthening partnerships for scaling and commercialization

To drive sustainability, technological advancements, and commercial success, we will forge collaborations with key industry and government stakeholders:

- Microbial enhanced oil recovery (MEOR) → ONGC, Oil India Limited, CAIRN
- Paraffin deposition prevention → ONGC, Oil India Limited
- CO_2-to-methane conversion in CBM wells → ONGC Energy Centre, ESSAR, CAIRN
- CBM production → ESSAR, CAIRN, ONGC, GEECL, Reliance
- Bioremediation of emerging pollutants → TCS
- Oil spill and organic pollutant remediation – OTBL, OIL, IOCL, BPCL, HPCL, CPCL, Reliance, BG Exploration India Limited, KOC
- Oilzapper market expansion → UAE, Nigeria, Guyana, Middle East country
- Environmental damage assessment → Conduct studies on oil spill impact
- Commercialization of bio-based products → Xanthan gum and guar gum in collaboration with DBT, ONGC, Tata Chemicals
- CO_2 utilization demonstration → Showcase lab-scale CO_2 conversion applications
- Bioremediation of explosive contaminants → Partner with the Ministry of Defence and Defence Research and Development Organization (DRDO) for remediation of explosive material contamination.

NATURAL RESOURCES, WATER, AND WASTE

ADVANCING SUSTAINABLE RESOURCE MANAGEMENT

NATURAL RESOURCES, WATER, AND WASTE

Natural Resources, Water, and Waste Programme focuses on climate resilience, water conservation, mineral governance, and sustainable land management. Through mineral resource governance, resource efficiency, circularity, and new technologies for innovative solutions for production of materials and energy, including carbon finance projects, and community-driven initiatives, the Programme works towards environmental sustainability and economic well-being.

Thrust Areas

- Carbon finance projects development for forestry and allied sectors
- Biodiversity assessment and valuation of ecosystem services
- Forest management and governance
- Rehabilitation of mined areas and land reclamation
- Water conservation and sustainability
- Integrated watershed management
- Safe, efficient, and sustainable use of water resources
- Promotion of treated water reuse through TERI Advanced Oxidation Technology (TADOX)
- Landscape restoration
- Spatial decision support for integrated natural resource management
- Urban biodiversity

Vision

To be a front runner in sustainable resource management by pioneering innovative solutions in carbon finance, water stewardship, including nature-based solutions, to create a resilient and climate-positive future for all.

Mission

To drive sustainable development by advancing carbon finance solutions, promoting efficient and climate-resilient water management, and strengthening wastewater management initiatives.

Achievements

- Issued over 684,620 carbon credits in Punjab afforestation, reforestation, and revegetation (ARR) projects.
- Provided livelihood support of approximately ₹350 million to 3,686 farmers, promoting sustainable agriculture.
- Integrated income generation, biodiversity conservation, and sustainable livelihoods into resource management strategies.
- Implemented carbon finance projects to mitigate climate change impacts.
- Won the Pathfinder Award for innovation in nature conservation.
- Commercialized wastewater treatment technology in collaboration with Ion Exchange (India).

- TADOX® Technology Demonstration Project ranked among the Top 3 at the IWA Project Innovation Awards 2024.
- Reduced water and energy consumption by 6% to 30% for farmers in Punjab.
- Facilitated groundwater recharge of approximately 19 lakh kilolitres (KL) in Punjab and Rajasthan.
- Enhanced water availability by 70 million litres per year in Bengaluru.
- Conducted glacier vulnerability assessments and hydrometeorological studies in the Himalayas to support climate adaptation efforts.

Aligning Actions with National and International Commitments

The Natural Resources, Water, and Waste Programme's initiatives are closely aligned with India's national missions such as the Swachh Bharat Mission, Jal Jeevan Mission, Namami Gange, and Green India Mission by promoting integrated water resource management, technology-driven waste treatment solutions, and nature-based solutions.

The Programme is contributing to India's Nationally Determined Contributions' (NDCs) target of creating an additional carbon sink of 2.5 to 3 billion tonnes of CO_2 equivalent by 2030 through expanded forest and tree cover.

The Programme contributes to the achievement of nearly all 17 Sustainable Development Goals (SDGs), particularly SDG 1 (No Poverty), SDG 2 (Zero Hunger), SDG 6 (Clean Water and Sanitation), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), and SDG 15 (Life on Land)—by promoting sustainable water and land management, sustainable forestry, and nature-based livelihoods.

The Programme plays a responsible role in advancing Mission LiFE (Lifestyle for Environment) by encouraging pro-planet behaviours, decentralized solutions, and local stewardship of natural resources, building a future that is both climate-smart and inclusive.

THE WAY FORWARD

TERI is developing robust carbon markets, advancing biodiversity conservation, and promoting sustainable land and resource management. The key activities that would be undertaken in alignment to our Vision 2030 are fractionated into short-term and long-term priorities:

Short-term Priorities

Scaling carbon finance projects

- Expanding initiatives in wetlands, agriculture, grasslands, blue carbon, waste, and wastewater to drive carbon sequestration and climate benefits.

Water sustainability and climate resilience

- Promoting efficient, equitable, and sustainable water use.
- Expanding activities in water neutrality/positivity and climate-resilient water management.

Community engagement and natural resource management

- Building capacity and awareness for effective management of natural resources including mineral resources.

Long-term Priorities

Advocacy for voluntary carbon standards

- Promoting carbon credit mechanisms tailored to the Indian context to support climate action and sustainability.

Enhancing biodiversity conservation and sustainable forestry

- Developing projects that generate biodiversity credits.
- Establishing certification standards for sustainable forest management (SFM) and forest products.
- Creating a high-resolution land-use and forest change database with future projections for India.

SOCIAL TRANSFORMATION AND STRATEGIC ALLIANCE

DRIVING IMPACT THROUGH INNOVATION AND INCLUSION

SOCIAL TRANSFORMATION AND STRATEGIC ALLIANCE

The Social Transformation and Strategic Alliance (ST&SA) Programme executes sustainability-driven projects related to youth and grassroots communities. While displaying advanced knowledge management skills, it also provides a robust platform for discourse, documentation, and dissemination of information related to contemporary environmental issues.

Thrust Areas

- Rural and community development through just transition and renewable energy technologies (RETs)
- Gender inclusion, social assessments, and environmental, social, and governance (ESG) initiatives
- Sustainable livelihoods and partnerships with community-based organizations (CBOs), non-governmental organizations (NGOs), and Panchayati Raj Institutions (PRIs)
- Knowledge management and data-driven dashboards for sustainability
- Sustainability communication via print and digital media
- Youth engagement for sustainable lifestyles and a greener planet
- Regional and intersectoral initiatives on natural resource management (NRM) and emerging issues

Vision

To drive inclusive and sustainable changes through strategic partnerships.

Mission

To drive inclusive and sustainable transformation by bridging research, policy, and grassroots action to create community-driven solutions. Through strategic partnerships, education, and livelihood empowerment, we promote social equity, environmental stewardship, and economic resilience.

Key Drivers

- **Social Transformation and Corporate Social Responsibility (ST&CSR):** Focus on action research and sustainable use of resources to achieve sustainable development.
- **Environment Education and Awareness (EEA):** Transform the future, through ideas for integrated solutions, and fueled by strategic approaches based on new-age pedagogy.
- **Knowledge Resource Centre (KRC):** Develop technology-enabled solutions and emerge as a skill development hub to transition to sustainability.
- **Communications and Publications:** Connecting minds, driving change, amplifying impact by designing and executing outreach initiatives to enhance the visibility of TERI's diverse knowledge while effectively engaging key stakeholders including policymakers, media, and the public.

Achievements

- Expanded impact of 'Lighting a Billion Lives' – Benefiting 13.1 million people across India and overseas; launched LaBL 2.0 (Lighting a Billion Lives).
- Strategic partnerships for MSMEs – Promoted inclusive, clean, and energy-efficient solutions across industrial clusters.
- Grassroots support in Jharkhand and Haryana – Strengthened natural resource management, health education, and WASH in schools.
- Environmental awareness initiatives – Engaged over 2 lakh students annually in sustainability projects.
- Educational outreach nationwide – Reached schools and higher educational institutions (HEIs) across all states and union territories (UTs).
- Green skills and entrepreneurship – Trained 1,200 individuals, with over 54% securing livelihoods or starting businesses.
- Mission LiFE (Lifestyle for Environment) engagement – Involved 1,12,000 stakeholders nationwide in various awareness programmes.
- Knowledge and data systems – Developed dashboards on sustainability for government and international bodies.
- Media and outreach – Achieved 9,825 print coverages and 2.4 lakh social media followers, with 19% growth.
- NGOs and advisory networks – Built a database of grassroots NGOs and regional experts aligned with TERI's themes.

Aligning Actions with National and International Commitments

The ST&SA Programme through its vision of activating inclusive and sustainable changes through strategic partnerships has diversified to design and implement several initiatives, focusing on priorities aligned with national and international commitments. While the Social Transformation & Corporate Social Responsibility Division (ST&CSR) has a mandate of transformation through action research and judicious use of resources, the Environment Education and Awareness (EEA) works towards transforming the future, through ideas for integrated solutions, and new-age pedagogy. The Knowledge Resource Centre (KRC) works towards technology-enabled solutions and has emerged as a skill development hub rested on principles of sustainability.

Work directed towards farmers' training, green skills, women entrepreneurship are aligned with Skill India/Pradhan Mantri Kaushal Vikas Yojana, National Mission on Education through information and communication technology (ICT), National Rural Livelihoods Mission, National Mission for Sustainable Agriculture, and National Mission for Empowerment of Women.

Environment education projects and activities driven through the Programme are aligned with Mission LiFE (Lifestyle for Environment), Poshan Abhiyan, National Education Policy (2020), National Curriculum Framework (2023). Interdisciplinary learning is the focus of projects driven through HEIs, and these promote activities under Jal Sanchay Jan Bhagidari, Unnat Bharat Abhiyan, and eco-friendly and sustainable campus development (SATAT framework) schemes of the Government of India (GoI). Projects and activities are endorsed by the Ministry of Environment, Forest and Climate Change, Ministry of Education, Ministry of Culture, Ministry of Earth Sciences, Ministry of Science and Technology, etc. The Programme activities are aligned with priority indicators of SDG 4 (Quality Education), SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), SDG 14 (Life below Water), SDG 15 (Life on Land), and SDG 17 (Partnerships for the Goals).

A systematic approach aligned with SDGs and GoI missions, the Programme bridges the knowledge gaps to shape climate-resilient sustainable future towards creation of thematic portals and knowledge products are aligned with priority areas of National Mission for Green India, National Solar Mission, National Mission for Electric Vehicles, and National Mission on Strategic Knowledge for Climate Change. Work is conducted closely with Ministry of New and Renewable Energy, Ministry of Development of North Eastern Region, Ministry of Ports, Shipping and Waterways.

Integration with both national and state-level government agencies is maintained to ensure a smooth execution of tasks. Association with National Skill Development Corporation, North Eastern Council (Shillong), National Bank for Agriculture and Rural Development (NABARD), Uttar Pradesh New and Renewable Energy Department Agency (Lucknow), Bio Resources Development Centre (Meghalaya) has led to successful completion of several projects. Association with directorates of education of several states and UTs are maintained.

Tie-ups with several central and state HEIs are maintained to facilitate a regional reach of activities.

THE WAY FORWARD

TERI is committed to fostering inclusive, low-carbon development, empowering youth and communities through knowledge-sharing, skill development, and strategic collaborations. The core values displayed by the ST&SA Programme for collaboration and implementation for short-term and long-term perspectives include:

- Environmental stewardship
- Innovation
- Social responsibility
- Accountability
- Continuous improvement

The key activities that would be undertaken in alignment to our Vision 2030 are bisected into short-term and long-term priorities.

Short-term Priorities

- Education for sustainable development (ESD) knowledge workshops for students and summer training programmes (e.g., LEAD: Leadership for Environment, Awareness and Development).
- Awareness-building sessions for school communities (parents, administrators, etc.).
- Green skills training and livelihood generation.
- E-learning platform/modules development on cutting-edge sustainability topics such as circular economy, energy transition, sustainable agri-practices, energy storage, ESG and electric vehicles, etc.
- Higher educational institutions (HEIs), industry, and community-based training programmes on climate actions (energy, environment, innovations, etc.), energy transitions, circular economy, corporate environmental, social, and governance (ESG), practices, etc.
- Training of trainers' programmes for farmer producer organizations (FPOs).
- Training and capacity building on innovative rural energy security models.
- Develop environment education (EE) performance indicators for academic institutions.
- Prepare annual e-newsletter for school and colleges.
- Organize National Educators' Conclave.
- Develop artificial learning/machine learning (AI/ML)-empowered knowledge management systems on sustainability issues (green shipping and ports, energy storage) and develop tools for research, decision support, and policy influence.
- Develop and maintain analytical dashboards on earth sciences, energy storage, climate actions including *TERI Energy & Environment Data Diary and Yearbook (TEDDY)*.
- Develop collaborative platforms/community forums for R&D networking.
- Develop a manual for monitoring and social impact evaluation framework.
- Documentation, assessment, protection, and monetization of indigenous knowledge.
- Design and customization of water conservation technologies.
- Develop methodology to quantify impacts created in the different domains of work in both technical and social terms.
- Strengthen project-based information services in TERI.
- Enhance community skills and livelihood generation through entrepreneurship and industry linkages.
- Educate government officials, students, and communities on sustainable lifestyle with focus on traditional knowledge practices, climate adaptations under Mission LiFE (Lifestyle for Environment).
- Develop certificate courses for vocational trainings on sustainability issues.
- Perform impact and gap analysis of domain-centric climate actions through systematic reviews.

- Develop model villages supporting farmer networks for environment management.
- Develop and impart green skill programmes in emerging areas, such as EV and agri-PV.
- Leverage AI/ML applications in sustainability tools, impact analysis of government schemes and other initiatives by various agencies.
- Scale up of energy entrepreneurship models.

Long-term Priorities

- Strengthen teachers' capacity building on ESD through partnerships at HEI level and introduce massive open online courses (MOOCs).
- Popularize competition-based activities like GREEN Olympiad via whole school approach and reach 1 million students in 5 years.
- Organize NextGen Climate Confluence.
- Develop knowledge products for various clean energy solutions under LaBL 2.0 (Lighting a Billion Lives).
- Develop age-appropriate EE modules (print and electronic), gamification modules, and DIY kits.
- Strengthen Youth Climate Conclave and expand its reach to 10,000 youth across India.
- Ideate and launch new and novel projects for schools and colleges, with CSR support.
- Provide consultancy on knowledge management systems.
- Strengthen media tie-ups to promote flagship projects and EE activities and regular monthly youth piece.
- Introduce and enhance AI-based EE projects.
- Hold trainings to capture social and cultural settings.
- Organize multi-stakeholders' capacity-building training and awareness programmes with reference to their potential roles in clean energy promotion and livelihood under LABL 2.0.
- Enhance national and global footprints through technology and process under LaBL 2.0.
- Scale up already tested decentralized renewable energy (DRE) in LaBL 2.0 for energy transition.
- Facilitate the setting up and operationalization of local-level clean energy business for marginalized communities to promote just transition.
- Organize ESG training of TERI professionals, corporate professionals, and businesses.
- Develop a trained evaluation team for carrying out impact evaluation and social assessments.
- Develop a partnership platform of innovation, implementation, funding, policy, knowledge, etc.
- Institutionalize 'School Award for Sustainability Excellence'.
- Translate projects into peer-reviewed papers and publications.
- Produce project-related films to showcase case studies.

- Explore tie-ups with Central Government schemes like PM SHRI (PM Schools for Rising India) to incorporate ESD in curriculum and school infrastructure.
- Popularize 'community, campus, and curriculum' concept through long-term projects with leading corporates.
- Implement frameworks for carbon market development for rural energy models.
- Promote convergence with schemes and programmes on energy transition through implementation and outreach.
- Promote energy justice and equity concerns.
- Build long-term global partnerships for innovative environment technologies.
- Pilot and scale emerging clean technologies.

SUSTAINABLE AGRICULTURE

ADVANCING INNOVATION FOR RESILIENT FARMING

SUSTAINABLE AGRICULTURE

The Sustainable Agriculture Programme focuses on pioneering advancements in soil health, bio-based agricultural inputs, nutrition, food security, sustainable farming practices, and reducing the impact of climate change on agriculture. The key activities that would be undertaken in alignment to our Vision 2030 are divided into short-term and long-term priorities:

Thrust Areas

- Innovative agri-inputs for enhancing nutrient-use efficiency of fertilizers for improving soil and crop health and farmers' wealth
- Zero-discharge production technologies for reduction in impact of agriculture on climate
- Disease-resistant planting materials for commercially relevant species
- Circularity of agro-waste
- Efficient biotechnologies for crop protection
- Algal bio-farming for biostimulants, poultry, and cattle feed
- Capacity building among regulators, industries, researchers, students, and farmers for sustainable agriculture practices
- Crop diversification and other climate adaptation strategies at agro-climatic zone (ACZ) level
- Improvement of agri-supply chains and delivering better nutrition
- Promotion of sustainability of agriscapes

Vision

To drive innovative interventions for a sustainable food production system, fostering climate-resilient agriculture, improving soil health, and enhancing farmers' incomes for a resilient and prosperous future on the one hand and improving health and nutritional outcomes of the population on the other.

Mission

To usher transitions to a cleaner and sustainable future through efficient technologies for agriculture, minimizing residue and reusing waste.

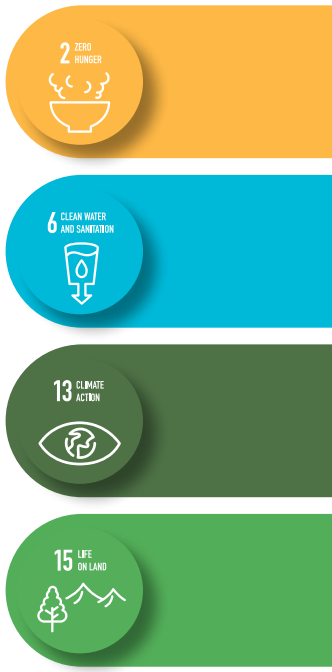
Achievements

- Developed micro-propagation protocols for over 70 plant species.
- Supplied 40 million disease-free micro-propagated horticulture plants to farmers
- Provided micro-propagated ornamental plants for urban landscaping.
- Guided and supported the Guyana Tissue Culture Lab, offering training and technical expertise.

- Expanded micro-propagation of high-value horticultural crops, including pomegranate and strawberries.
- Developed, patented, and commercialized *in vitro* mass production of Mycorrhiza bio-fertilizer, now covering 1 million acres of agriculture field in India. In FY 2025–26, we target to expand our cover to 2.5–3 million acres, with the support of existing partners including Chambal Fertilizer and Chemicals Limited, DCM Shriram, and Zuari Farm-Hub Limited. Additional partners for in-country and export business are to be identified continuously.
- Transferred Mycorrhiza technology to eight companies for large-scale application.
- Developed and commercialized Super Mycorrhiza product with bacterial associations.
- Reclaimed 120 acres of industrial waste land contaminated with heavy metals [Tata Chemicals Limited (TCL), Hindustan Zinc Limited (HZL), and National Thermal Power Corporation (NTPC)]
- Established a state-of-the-art Nano-biotechnology Centre for Translational Research.
- Developed unique technologies for green and biogenic synthesis of safe nanomaterials.
- Drafted guidelines and policies for the Department of Biotechnology, India, for the evaluation of Nano Agri-inputs and Nano Food-products in India.
- Commercialized biogenic nanofertilizers Nano Urea, Nano DAP, and Nano Phosphorus, improving nutrient-use efficiency and reducing impact on soil and climate.
- Developed package of practice for reducing GHG emission from agriculture and boosting soil health and agricultural yield.
- Developed tissue engineering scaffold and targeted drug delivery vehicles from bio-waste impregnated with nanomaterials and flavonoids.
- Conducted life-cycle assessments of nanomaterials and nanofertilizers.
- Created *in-silico* models for prediction of potential toxicity of nanomaterials.
- Created natural pigments for textile dyeing, reducing water and air pollution from synthetic dyes.
- Conducted biodiversity studies and extracted bioactive compounds from medicinal plants for human and animal health applications.
- Circularized bio-wastes for ligno-cellulose production.
- Developed algae-based feed for poultry.
- Led initiatives with the Global Coalition on Food and Land Use (FOLU) to promote sustainable food and land systems in India.
- Piloted local sustainable farming models enhancing farmer livelihoods and community access to micronutrients.
- Developed a region-specific plan outlining long-term strategies and a road map for sustainable crop diversification.
- Conducted a comprehensive evaluation of science, technology, and innovation capabilities and skill requirements for sustainable food and land use in India.

Aligning Actions with National and International Commitments

The Sustainable Agriculture Programme supports India's mission for doubling farmers' income, for which a major part of the Programme is involved in the development of cutting-edge technologies and their lab-to-land transmission, particularly for providing farmers with sustainable agri-inputs. Additionally, it also promotes SDG 2: to achieve food security, improve nutrition, and promote sustainable agriculture, SDG 6: for ensuring the availability and sustainable management of water and sanitation for all, SDG 13: taking urgent action to combat climate change and its impacts, and SDG 15: to protect, restore, and promote the sustainable use of terrestrial ecosystems.



THE WAY FORWARD

The Sustainable Agriculture Programme is transforming agricultural practices through biotechnology, nanotechnology, and nature-based solutions. The key activities that would be undertaken in alignment to our Vision 2030 are branched amongst short-term and long-term priorities:

Short-term Priorities

- Establish R&D facility for crop-protection.
- Expand the existing pipeline with new products for mycorrhiza and nano agri-inputs.
- Single organism-based biofungicide and bionematicide product development, registration and launch with Chambal Fertilisers and Chemicals Limited.
- Package of practice for reducing GHG emission from agriculture, to support Vera to develop protocol for carbon credit in agriculture.
- Lab to commercial-scale optimization of natural pigments/colours.
- Lab to commercial-scale optimization of poultry feed.
- Establish prior-art for nano-sensors for detection and bioremediation of heavy metal in water.
- Prior-art development for multiple-species-based biofungicide and bio-nematicide.
- Continue and expand supplies of plant-tissue-culture materials.
- Capacity development through on-going and new student-training-programmes, and development of policy research papers to support farmer and government.
- Develop white papers and support government policies in the areas of agriculture, food and nutritional security, fertilizers, biomanufacturing, and green technologies.
- White papers for modification in existing clause of Central Insecticides Board (CIB) for registration of bioactive-based pesticides, microbial consortia-based pesticides, microbial bio-extract-based pesticides.
- White papers for fertilizer control order (FCO) amendment of spore-count testing procedure in biofertilizer sampling by the Government of India.

- Strengthen partnerships with industries, academia, and government agencies and building new partnerships through outreach for expanding reach of TERI's agri-input technologies.
- Collaborate with key partners to promote crop diversification, strengthen agri-supply chains, and enhance nutrition outcomes.

Long-term Priorities

- Conduct research and establish fermentation-based technology for mass production of mycorrhiza.
- Development of crop-protection product, particularly active-ingredient (and not live-cell) based insecticides, fungicides, and nematicides to replace traditional and toxic agro-chemicals from the market.
- Development of new plant-nutrients, including biostimulants, composite nano-fertilizers, and Ecto-endo mycorrhiza products with bacterial bio-films.
- Algal bio-farming for carbon capture.
- Conversion of agro-waste to delivery vehicles of agri-input products.
- Bio-diversity conservation of medicinal plants and mycorrhizal species.
- Green technologies for easy recovery of rare-earth and critical minerals.
- Smart materials for energy efficiency of fuel cells and thermal equipment.
- Enhance TERI's visibility and thought leadership through engagements with industries and government agencies by organizing and participating in stakeholder meetings, brain-storming sessions, conferences, and workshops.
- Extend presence of TERI in Guyana and Caribbean countries around sustainable agriculture.
- Strengthen TERI's academic engagement by establishing partnership for joint PhD and post-doctoral programmes with renowned Indian and foreign universities.
- Expand funding and collaboration opportunities:
    - Actively seek domestic funding from agencies such as Department of Biotechnology (DBT), Department of Science and Technology (DST), Council of Scientific and Industrial Research (CSIR), National Medicinal Plants Board (NMPB), Science and Engineering Research Board (SERB), and State Forest Research Institute (ISFRI).
    - Strengthen partnerships with Indian universities and research institutions under the Indian Council of Agricultural Research (ICAR).
- Focus on impact:
    - Promote carbon-neutral, residue-free, natural farming practices through development of innovative products.
    - Reduce impact of agriculture on planetary boundaries, biosphere integrity, land-system change, and biogeochemical flows.
    - Support government for repurposing subsidies to strengthen practices for sustainable farming system.
    - Promote climate-resilient agriculture and enhance the nutritional content of food systems through crop diversification.
    - Isolation and identification of endophytes-based bioactives for obtaining lead molecules for various applications.

SUSTAINABLE INFRASTRUCTURE

BUILDING A GREENER FUTURE

SUSTAINABLE INFRASTRUCTURE

The Sustainable Infrastructure Programme drives the adoption of energy-efficient, low-carbon, and climate-resilient infrastructure. Through policy support, technology integration, and strategic collaborations, the Programme promotes sustainable urban development.

Thrust Areas

- Adaptation and infrastructure resilience to climate change
- Climate resilience and thermal comfort
- Market and mindset barriers
- Long-term carbon lock-in and high-retrofitting costs
- Fragmented expertise and knowledge gaps
- Transforming urban mobility for a sustainable future
- Circular economy in waste sector and treated water reuse
- Cleaner production implementation
- Bio-waste resource mapping and biogas plant installation

Vision

To lead the transition towards climate-resilient, resource-efficient, low-carbon, and net-zero built environments.

Mission

- **Sustainable Buildings** – To move towards self-sufficiency in green building value chains.
- **Transport and Urban Governance** – To transform urban mobility and governance for climate-resilient cities.
- **GRIHA Council** – To accelerate low-carbon and climate-resilient infrastructure development through innovative solutions, promoting sustainable construction and building practices and fostering partnerships.

Achievements

- Registered over 5000 projects, covering approximately 1 billion sq. ft of built-up area.
- Facilitated the installation of 500+ megawatt peak (MWp) of renewable energy systems, advancing clean energy adoption.
- Averted 8400 gigatonnes (GT) of carbon dioxide equivalent (CO_2e) emissions through sustainable infrastructure initiatives.
- Enabled the deployment of 200 electric vehicles in Lucknow, in partnership with Coca-Cola, promoting sustainable mobility.
- Collaborated with the Indian Railways to launch the Goods Shed Rating Dashboard, enhancing logistics efficiency.
- Pioneered Urban Living Labs (ULLs) in Indian cities, including Panaji and Visakhapatnam, by designing and implementing tailor-made solutions for urban challenges.
- Led impact assessments and vulnerability evaluations through various frameworks for cities across India.

- Facilitated the integration of vertical and horizontal governance, contributing to urban climate action initiatives aimed at fostering low-carbon, resilient cities.
- Collaborated with Container Corporation of India (CONCOR) to establish the CONCOR–TERI Centre of Excellence (CoE) for Green and Sustainable Logistics, promoting collaboration to advance eco-friendly and efficient logistics solutions.
- Successfully implemented an integrated waste management model in Ayodhya, with an anticipated generation of 275 certified emission reductions (CERs) supporting carbon mitigation goals.
- Commissioned a state-of-the-art anaerobic co-digestion facility in Udaipur, utilizing organic waste and sewage treatment plant (STP) sludge to generate renewable energy for powering fire station.

Aligning Actions with National and International Commitments

The Sustainable Infrastructure Programme is purposefully aligned with India's developmental priorities and climate commitments, positioning itself at the intersection of policy, innovation, and implementation.

Nationally, our initiatives support key missions such as the India Cooling Action Plan, the National Mission on Sustainable Habitat, the Smart Cities Mission, the PM e-Bus and e-Mobility Programme and Corporate Average Fuel Efficiency (CAFÉ) norms.

Internationally, our efforts are in sync with India's Nationally Determined Contributions (NDCs), Long-term Low-emission Development Strategy (LT-LEDS) and global frameworks such as the UN Sustainable Development Goals (SDGs), the Paris Agreement, and the Marrakech Partnership for Global Climate Action.

By advancing climate-resilient infrastructure, energy-efficient buildings, integrated urban governance and low-carbon mobility systems, we contribute meaningfully to SDG 11 (Sustainable Cities and Communities); SDG 13 (Climate Action); SDG 9 (Industry, Innovation and Infrastructure); SDG 7 (Affordable and Clean Energy); SDG 6 (Clean Water and Sanitation); SDG 5 (Gender Equality) and SDG 17 (Partnerships for the Goals). Our initiatives echo the principles of the UN's New Urban Agenda and align with Article 6 of the Paris Agreement by facilitating international cooperation for mitigation and sustainable development.

Informed by the International Energy Agency's (IEA) Net Zero Emissions by 2050 scenario, we are committed to reducing energy consumption across the building and infrastructure sectors—which collectively account for nearly 30–40% of the global energy use. Through data-driven planning, capacity building, and inclusive partnerships, the Sustainable Infrastructure Programme is helping to shape future-ready, resource-efficient urban systems—contributing directly to India's vision of Viksit Bharat@2047 and its long-term goal of achieving net-zero emissions by 2070.

THE WAY FORWARD

TERI is shaping climate-resilient cities through research, capacity building, strategic partnerships, and knowledge dissemination. The key activities that would be undertaken in alignment to our Vision 2030 are segmented into short-term and long-term priorities.

Division	Short-term priorities	Long-term priorities
Sustainable Buildings	• Forge industry partnerships to drive innovation and market collaboration • Support authorities in enforcing energy-efficient building codes • Align sector efforts for cohesive sustainability implementation • Expand expertise in the Carbon Credit Trading Scheme (CCTS) • Research for innovative thermal comfort strategies for climate resilience against heat stress	• Create a centralized database of sustainable building products and technologies • Strengthen presence in policy committees for sustainable infrastructure bylaws • Enhance international collaborations for best practices and funding • Establish a standardized testing framework for green technologies • Leverage carbon finance for self-sustaining green value chains • Promote adaptive design for climate-resilient buildings
Transport and Urban Governance	• Integrate sustainability into mobility policies and support green technology skill development • Electrify transport fleets and promote non-motorized transport infrastructure • Pilot innovative mobility solutions like battery swapping and hydrogen transport • Collaborate with stakeholders to exchange best practices and improve capacity • Develop real-time data dashboards for transport emissions and congestion • Introduce innovative urban planning concepts that promote participatory, data-driven decision-making in cities, (like, Urban Living Labs) • Establish Climate Cells in cities for localized climate action and governance	• Integrate transport emission reduction policies with the CCTS • Promote modal shifts and efficiency improvements across transport sectors • Strengthen transit-oriented development and multimodal transport solutions • Lead Green Ports and Shipping initiatives to reduce maritime emissions • Build a data-driven framework for urban mobility planning and emissions reduction • Clean and alternative fuel technologies for net-zero commitments • Scale nature-based solutions and climate resilience strategies via Urban Living Labs • Enhance institutional capacities for climate-responsive urban planning

Division	Short-term priorities	Long-term priorities
GRIHA Council	• Launch outreach programmes targeting key stakeholders (architects, engineers, policymakers, etc.) on green building principles. • Continue advanced training programmes to equip professionals with the necessary skills to assess, design, and implement green building projects nationwide. • Conduct initial capacity-building workshops for professionals in the construction industry. • Broaden engagement efforts to include regional programmes and increase the adoption of sustainable construction practices across urban and rural areas. • Develop a robust network of stakeholders, fostering deeper collaboration among industry, government and academia to advance green building initiatives.	• Integrate GRIHA-rated buildings into carbon credit mechanisms • Promote the Decarbonizing Habitat Programme (DHP) and Net-zero certifications (Energy, Water, Waste, Transport) • Collaborate with banks and housing finance companies to promote green bonds and JAN GRIHA Certification for financing green building projects • Build state-level online repositories showcasing GRIHA-rated buildings, green products, manufacturers, and incentives • Expand state-level repositories into a national platform to enhance the visibility of GRIHA-rated buildings across the country • Foster partnerships to position GRIHA as a key performance indicator (KPI) within ESG frameworks • Work towards global recognition by enlisting GRIHA into international green building certification standards
Circular Economy and Waste Management	• Strengthening waste management and circular economy in urban local bodies • Certification and skilling programmes for wastewater plant operators. • Research on urban mining (e-waste) for resource recovery. • Technology-driven integrated waste management solutions. *Resource efficiency in agri-food systems* • Promoting efficient production and processing practices to minimize environmental impact. *Driving cleaner industrial production* • Implementing efficient technologies, waste recycling, and resource-efficient processes. *Advancing bioenergy solutions* • Compressed biogas (CBG) plant installation to support renewable energy adoption. *Innovating in circular economy* • Scaling waste-to-value solutions to promote sustainable resource utilization.	

SPECIAL INITIATIVES

TERI COUNCIL FOR BUSINESS SUSTAINABILITY

Shaping Responsible Business for a Sustainable Tomorrow

TERI Council for Business Sustainability (CBS) serves as the interface for TERI's research work to be connected to the corporate world. The Council is a network of Indian business leaders working on a shared commitment to mainstream sustainability in business strategies and practices. Set up in 2001, member companies of the Council comprise public and private sectors, including multi-national companies (MNCs)—representing various industry sectors, sizes and geographies. Activities of the Council are governed by an executive committee from amongst member companies.

The Council co-creates business solutions with member companies to address national sustainability challenges; curates common interest forums of member companies with the participation of board members and Chief Sustainability Officers (CSOs); undertakes policy advocacy through thought leadership reports and industry dialogues; and builds capacity through trainings, learning visits, webinars, conferences, etc. With individual member companies, the Council provides a range of tailor-made advisory services. These comprise sustainability strategy development, performance assessment and improvements, capacity building, and facilitates showcasing best practices in national and international forums.

Thrust Areas

- Co-creating business solutions with members to address national sustainability challenges
- Policy advocacy through:
  - » Thought leadership
  - » Industry dialogues/forums
- Curating common interest forums of member companies:
  - » Board members
  - » CSOs
- Capacity building through trainings, management development programmes (MDPs), learning visits, webinars, conferences
- Tailor-made advisory services:
  - » Strategy development
  - » Performance assessment and improvement
- Showcasing best practices at TERI events, publications, etc.
- Leveraging TERI's programmes/initiatives to develop impactful CSR initiatives.

Vision

To enable responsible business for a sustainable future.

Mission

To provide an independent and credible platform for corporate leaders to address issues related to sustainable development and promote leadership in environmental management, social responsibility, and economic performance.

Achievements

- A Statement to promote policies that can stimulate green growth and create a resilient India was unveiled that outlines a set of 8 priorities for repurposing future business actions. This Statement is a shout-out by 24 Indian CEOs to lend predictability to India's future development pathways. The Statement intends to enable businesses, civil society and government come together to garner support and accelerate actions.
- To engage with diverse industry sectors, the Council has put together the *Industry Charter for Near-Zero Emissions Ambition by 2050*. Launched at the New York Climate Week 2020, today the Charter is represented over 94 (and counting) Indian CEOs.
- The potential for significant and sophisticated policy advocacy is strong, and TERI's global partnership with the We Mean Business Coalition (WMBC) offered the resources needed to super-charge these efforts. The foundational goal of this partnership was to accelerate the ambition loop in India and contribute to India strengthening its Nationally Determined Contributions (NDCs), putting forward an ambitious long-term strategy, and strengthening domestic policies in key sectors to accelerate emissions reductions.
- The engagements with industry representatives from steel and cement sectors have increased on building a narrative on importance of technological innovation and low-carbon industry transition with steel sector representing 45% of market share and cement sector representing more than 42% of market share.
- Voluntary actions on climate change by the signatory companies of the *Industry Charter* were showcased at a High-Level Convening at the annual UN Climate Summit COP28 in Dubai where Prof. Jim Skea, Chairman, Intergovernmental Panel on Climate Change (IPCC) and Indian corporate executives (CXOs) from major Indian industry conglomerates launched the Anniversary Update Report, titled, *Practices and Solutions: Accelerating Indian Industry Decarbonisation.*
- Garnering support from over 50 Indian CSOs, TERI CBS put together a Competency Framework for CSOs that aides understanding the key attributes of a Chief Sustainability Officer, and the key skills and competencies required for the role to galvanize a transformative change across the length and breadth of an organization, steering it forward effectively toward a green economy regime.

Aligning Actions with National and International Commitments

The inclusion of—sustainable solutions for climate change and sustainable energy transition; inclusive global value chains; employment generation, social protection and skilling—in the G20 New Delhi Leaders' Declaration brought to centre stage the solutions that will shape future development pathways. All these have been integral components of our engagements with

Council member companies and C-suite dialogues. The G20 reconfirmed one of the major messages from the G7 Hiroshima Summit, stressing that there should be 'various pathways' for our energy transitions. Such a message recognizes the needs, the vulnerabilities, the priorities as well as the different national circumstances of the developing countries. This message of various pathways is important and has been evident in our study findings and recommendations.

India has massive ambitions. It wants to become a US$5-trillion economy in the next few years. By 2025, it wants to add over 30,000 km of highways, 400 Vande Bharat trains, over 200 airports and double our port capacity. By 2030, it plans to leapfrog Japan and Germany to become the third-largest economy in the world. However, to get there, the government will need to invest massive sums of money across the board. Governments, firms, institutions, civil society groups, and citizens across the world need to act with the utmost sense of urgency on climate now. Carbon emissions must be brought down to zero at the earliest. This means we need a strategy, sector by sector, for a rapid reduction in carbon emissions. Leadership initiatives of our Council members and signatory companies of the *Industry Charter for Near-Zero Emissions Ambition by 2050*, instituted by TERI, clearly depict that these strategies need to be evolved by each country and should ideally combine a top-down as well as a bottom-up approach.

THE WAY FORWARD

The perspectives on interdependencies and low-carbon transition plans across industry sectors and the power of collective action by connecting businesses, environmental groups, researchers, and governments are paramount today. Achieving India's net-zero target by 2070 necessitates a radical, economy-wide transition to low-carbon practices, particularly in high-emitting, energy-intensive sectors. Significant technological and financial needs make India's hard-to-abate sectors particularly challenging to decarbonize. These sectors require substantial capital investments to overhaul their operations. Sectoral development is needed in terms of innovation, demonstrating viable low-carbon technologies, and developing markets to ensure the commercial feasibility and competitiveness of low-carbon products. The critical need for the transition to be both fast and fair is recognized in the Paris Agreement. The evidence shows that the shift to a resilient, low-carbon economy will boost prosperity and be a net driver of job creation. There will be transitional challenges; however, for workers, communities, and countries as this shift takes place. To address this, investor strategies to tackle the growing threat of climate change need to incorporate the full range of environmental, social, and governance (ESG) dimensions of responsible investment. In fact, for investors, the just transition provides the framework for connecting climate action with the need for an inclusive economy and sustainable development.

Short-term Priorities

Working towards achieving India's energy ambitions would require an unprecedented scale of transformation along a pathway never followed by other countries of rapidly increasing energy consumption and decarbonizing energy at the same time. The Council observes that forward-thinking Indian businesses will have a critical impact on India's success. The focus on 'Just Transition' as part of energy transitions and in view of achieving the Sustainable Development Goals (SDGs) of 2030 was well recognized in the New Delhi Leaders' Declaration. Enthused participation from

the Council members emphasized that companies have a critical role in advancing a just transition by taking concrete actions that address the social impacts of climate change mitigation and adaptation in partnership with other actors such as workers, unions, communities, and suppliers. Given the scale of the climate crisis, our engagements pointed out that there is an urgent need for the private sector to enhance its ambition, commitments, and actions for a just transition to an environmentally sustainable economy that leaves no one behind.

Long-term Priorities

The Council recognizes that as key drivers of energy transition in the Indian economy, Indian businesses will be required to mobilize resources, especially financial resources. TERI's Expert Group on Financing India's Long-Term Low-Carbon Development Strategies (LT-LEDS) has been initiated to evaluate India's financial strategy with respect to its LT-LEDS, especially in the context of hard-to-abate industries and the ancillary MSME sectors. Comprising members from the industry and financial sector, the Expert Group will analyse policy frameworks and investment markets that favour financing technology transfers and share recommendations that help strengthen existing policy and regulatory frameworks that promote green investments whilst ensuring just transitions.

TERI CBS has consistently engaged with policymakers at the subnational, national, and bilateral levels as a knowledge partner and convening multiple stakeholders. The high-level convening of *Industry Charter* and the interactive session with Indian CSOs hosted on the sidelines of our annual flagship World Sustainable Development Summit (WSDS), recorded key actions needed by corporate executives (CXOs) and CSOs to accelerate sustainability across the value chain of businesses. Our engagements with leading Indian industries have gained consistent traction to advance agenda of industry decarbonization and circular economy. Our technical proposals on why storage of electricity is necessary for meeting demand round the clock and the details of range of possible mitigation strategies for net-zero steel sector have witnessed significant uptake by Indian industries, while garnering concurrence from global partners.

SUSTAINABLE DEVELOPMENT AND OUTREACH

Steering Policy and Action Towards a Sustainable Future

The Sustainable Development and Outreach Division works at the intersection of policy, practice, and partnerships to catalyse sustainable development at scale. Through platforms such as the World Sustainable Development Summit (WSDS) and Act4Earth, the Division fosters inclusive dialogue, equity, and global ambition. It advances green policy innovations and promotes models of international cooperation by aligning national priorities with global goals and enabling cross-sectoral coherence to mainstream sustainability. Its core aims and objectives include:

Drive leadership and action: Lead impactful discussions, shape global discourse, and provide critical insights through the WSDS and Act4Earth. Drive ambition and action for sustainable development and global security, with a commitment to both intergenerational and intra-generational equity

Advance policy innovation: Promote policy innovations such as SDG-linked green budgeting, green public procurement, and the SDG blueprint to mainstream sustainable development and overcome siloed approaches to policymaking

Thrust Areas

- Global agenda setting through the WSDS
  - » Curating plenaries and collaborating on thematic tracks
  - » Facilitating spaces to showcase social and technological innovations
  - » Launching knowledge documents reflecting multi-stakeholder viewpoints
  - » Recognizing global leadership
- International cooperation
  - » SDG Charter and COP Compass initiatives under Act4Earth
  - » South–South cooperation, including regional cooperation
  - » International cooperation, global governance, discussions in G20
  - » Political economy and global security
- Green growth policy innovations
  - » Green budgeting
  - » Green public procurement
- Sustainable development and Agenda 2030
  - » SDG synergies
  - » SDG blueprints

Vision

To be a leading catalyst for integrating SDGs into policies and actions by fostering visionary leadership, evidence-based research, and inclusive multi-stakeholder dialogues.

Mission

Our mission is to catalyse ambition and action across all levels by advancing compelling narratives and fostering the exchange of knowledge, ideas, and best practices. Through transformative policy innovations, we are committed to accelerating progress towards the realisation of the SDGs.

Achievements

- Achieved a 3.5x increase in Puducherry's green budget allocations for FY 2023–24 compared to the baseline FY 2022–23, through targeted technical engagement on green budgeting.
- Facilitated a 2.7x increase in green budget allocation for the state of Bihar over the past five years through sustained capacity building and technical support.
- Launched the Green Budgeting Portal to enhance awareness and provide practical guidance on green budgeting concepts, rationale, and processes. The Portal includes a toolkit, case studies, and curated resources for government officials, academia, civil society, and other stakeholders.
- Conducted a comprehensive stocktaking study on green public procurement (GPP), covering all 36 states and union territories (UTs) assessing their readiness, existing policies, and implementation frameworks.
- Undertook a study to assess the potential for GPP in India's agriculture sector via a value chain analysis (pre-production, production, and post-production stages), informed by 23 stakeholder interviews and examination of 71 agriculture-related national policies and schemes.
- Mapped 258 policies across Asian countries to support the development of a South–South cooperation framework on sustainable agriculture for the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) and South Asian Association for Regional Cooperation (SAARC) member nations, and 55 policies in African countries for comparative insights.
- Developed the SDG Blueprint Tool, a publicly accessible knowledge platform offering national policy insights related to sustainable agriculture and linkages to all 169 SDG targets, capturing synergies and trade-offs.
- Facilitated cumulative engagement of 59 heads of state and government, 149 ministers, and 2,158 business leaders, 13 Nobel laureates, 3730 speakers, and 41,889 delegates through the WSDS series.
- Organized WSDS 2025, which saw participation from 1,527 in-person delegates, 361 speakers (including 12 ministers), and 116 business and industry organizations across 40 sessions. The Summit generated over 700 instances of media coverage, 500,000+ social media impressions, and reached 140,000+ users on the official website.

- Contributed to India's G20 Presidency by co-organizing three key events under the Development Working Group, Energy Transitions Working Group, and Clean Energy Ministerial tracks.
- Played a lead role in the G20 Think20 (T20) with Dr Vibha Dhawan as Chair of Task Force 4 on Green Transitions and Dr Shailly Kedia as Co-chair of Task Force 3 on Sustainable Lifestyles.
- Developed T20 policy briefs on sustainable lifestyles and the circular bioeconomy, contributing to G20 dialogues aligned with the SDGs.
- Provided technical assistance and capacity building for green budgeting to state governments of Bihar, Puducherry, and Assam. Also engaged with the government of Assam to advance green public procurement (GPP) initiatives.
- Identified Assam as a priority state for advancing green economy policy frameworks post-assessment.
- Produced analytical outputs using political economy and network analysis to examine governance gaps and institutional linkages for effective SDG implementation.

Aligning Actions with National and International Commitments

The Sustainable Development and Outreach Division supports Agenda 2030 and the SDGs by advancing SDG–climate synergies and aligning efforts with the UNFCCC and Paris Agreement. Its work contributes to India's National Action Plan on Climate Change, NDCs, and long-term strategies, while promoting climate justice and Mission LiFE. The Division also mainstreams sustainability in public finance by engaging with the General Financial Rules and integrating green budgeting into state/UT budget processes.

THE WAY FORWARD

The Sustainable Development and Outreach Division will advance the integration of sustainability principles into governance, policymaking, and global cooperation through strategic knowledge generation, dialogue, and institutional partnerships. Key activities aligned with our Vision 2030 are outlined under short-term and long-term priorities:

Thrust areas	Short-term priorities	Long-term priorities
Global agenda setting through the WSDS	Curate annual editions of WSDS focused on Global South issues through diverse plenaries and thematic tracks. Facilitate partnerships and networking platforms for multi-stakeholder interaction. Collate, disseminate and amplify messages from WSDS through knowledge documents such as special issues of magazines, Summit Overview document, and Act4Earth Manifesto.	Enhance the impact of the WSDS through knowledge coalitions and commissions.

Thrust areas	Short-term priorities	Long-term priorities
International cooperation	Articulate and advocate perspectives on internationalizing sustainable lifestyles, equity, and climate justice. Research on aspects related to SDG–climate linkages and multilateralism. Engage with international platforms and forums through strategic knowledge documents on international cooperation, geopolitics, and linkages between traditional and non-traditional security issues.	Engage in working groups and task forces across platforms to influence agenda-setting. Undertake research on models of South–South and Triangular Cooperation. Undertake work on global governance and multilateral reforms.
Green growth policy innovations	Provide technical assistance for mainstreaming green policy innovations, including green budgeting and GPP to government. Build capacity on green budgeting and GPP. Develop scorecards for analysing readiness on green budgeting and green public procurement.	Disseminate knowledge through portals on green budgeting and GPP. Upscale and replicate green budgeting and GPP through policy innovation labs.
Sustainable development and Agenda 2030	Develop frameworks to identify entry points for SDG integration and policy coherence. Critically analyse indicator frameworks for monitoring and reporting SDGs.	Contribute to the Post 2030 Agenda. Compendium on good practices on environmental SDGs.

INFORMATION AND TECHNOLOGY SERVICES

At TERI, the Information and Technology Services enable research, information, publishing, communication, outreach, and administrative tasks. Intranet applications are used for office automation, universal mailbox, personal calendar, online scheduling of resources and meetings, workflow automation, form processing, enterprise resource planning (ERP) including management information system (MIS) and decision-support system (DSS), knowledge sharing, collaborative working, and, information search on online information resources including the Internet and local databases. Relevant institute-wide information is disseminated and shared through mailing lists, Intranet, network (local), and other resources. Internet applications include development, hosting and maintenance of websites, discussion forums, mailing lists, blogs, and other interactive and debate platforms.

The Web and Interactive Media (WIM) Area of the Information Technology and Services Division of TERI is primarily focused on developing dynamic websites and web-enabled applications for the Institute, research projects, and external organizations. The Area is specialized and makes extensive use of open source technologies to deploy cost-effective solutions.

The Centre for Information Technology Application (CITA) of the Information Technology and Services Division of TERI is mainly responsible for planning and implementation of IT applications, and constantly ensures that the facilities available at TERI keep pace with the latest advancements in the field. Over the years, the CITA has developed expertise in diverse areas of IT including customized software development. The Area has dedicated teams for Microsoft and Oracle technologies.

In addition to these core areas, the CITA has expanded its capabilities to include artificial intelligence (AI) solutions. This comprises the development of chatbots and AI training programmes designed to enhance user interaction and streamline operations. By integrating AI technologies, the CITA continues to innovate and provide cutting-edge IT solutions tailored to meet the evolving needs of the Institute.

THE ENERGY AND RESOURCES INSTITUTE
Creating Innovative Solutions for a Sustainable Future

The Energy and Resources Institute

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