2021/22
ANNUAL REPORT

Vision

Creating Innovative Solutions for a Sustainable Future

Mission

Tackle issues of concern to Indian society, and the world at large, and develop innovative and cost effective solutions

Enhance networking for sustainable interventions

Realize potential for national and international leadership as a knowledge-based agent of change in the fields of energy, environment, other natural resources, and sustainable development

Inspire and reach out to diverse stakeholders for realizing a shared vision of global sustainable development, which could be translated into action

CONTENTS

Director General's Message

Marked in history as an unprecedented civilizational crisis, the last three years—2019 to 2022—afflicted with the Coronavirus pandemic has made a profound effect on both physical and psychological dimensions of a human life. World policies, which were earlier aimed at being 'open to all', were replaced by confinement policies including – but not limited to – travel bans, quarantine, and lockdowns. World economies were brought to a standstill by the virus spread. The pandemic has significantly threatened not only development, but sustainable development as well.

However, every dark cloud is accompanied by a silver lining; there are numerous positive takeaways from the Covid outbreak. First and foremost, the world must come out of this mirage: we, humans, are the exclusive inhabitants of planet Earth. We have to relearn **'to share the resources with the other earth dwellers'**. This single aspect aptly encapsulates the essence of **Sustainable Development**.

To illustrate, energy assumes the centre stage of human existence. In today's context, it is energy that makes the economies run and is a critical factor in upshifting and downshifting of a country's GDP. However, its unsustainable generation and utilization are accompanied by environmental repercussions. Next is resources' utilization: optimum utilization of Earth's natural resources leads to optimum balance between today and tomorrow. Our natural climate, which follows third, is highly governed by our interventions with nature. Climate change has always occurred on earth – it is a natural process. However, today's climate change is nature's reaction to our inconsiderate actions. It is primarily the anthropogenic activities due to which climate is changing at a faster rate, making it more difficult for the natural world to adapt.

At TERI, we do take pride in contributing significantly towards environmental amelioration. Our research-based solutions have had a transformative impact on industry as well as communities. We have fostered international collaboration on

sustainability action by creating a number of platforms and forums. We have been doing this for the last four decades by translating our research into technology products, technical services, as well as policy advisory and outreach.

In the year 2021/22, though challenging, our continuous perseverance formed the ground towards realizing our sustainability goals. Our programmatic focus — on energy, natural resources and climate, integrated policy analysis, sustainable habitat, social transformation, advanced biofuels, environmental and industrial biotechnology, and sustainable agriculture—and Programme research activities enable us to promote sustainable solutions and build resilience.

TERI's Energy Programme aims to promote, on both demand and supply sides, energy efficient and renewable energy-based technological solutions enabling India and other developing nations to achieve their developmental goals along low-carbon pathways. Being driven by the broad intent of promoting energy efficient and low-carbon solutions, the Programme interventions around the Industrial Energy Efficiency (IEE), Renewable Energy Technology (RET), and Electricity & Fuels (EF).

IEE also works on developing an evidence base to chart out a road map for decarbonization of Indian industry, as well as promoting energy efficient technologies. For RET, a key concern is the promotion of RE technologies through in-depth research studies, testing, development and deployment. Multiple projects covering: low-carbon pathways, energy efficiency, promotion of renewable technologies and studies, battery energy storage, e-mobility, RE integration, and capacity building across India and beyond, were executed under the Energy Programme in the year 2021/22.

TERI is also supporting Tata Steel Utilities and Infrastructure Services Limited under this programme, by implementing their DSM Action Plan. The platform Fourth India–*Japan workshop on Hydrogen and Fuel Cell 2022* brought together Indian and Japanese experts to exchange ideates on the future of hydrogen and fuel cell technologies.

The Integrated Policy Analysis (IPA) Programme, with its emphasis on integrated assessment and modelling as well as resource efficiency and governance, aims to inform policy on the critical sustainability issues through an in-depth and interdisciplinary research. Their extensive research revolves around developing policies that could scale-up solutions to successfully decouple economic development from natural resource use and environmental degradation; while simultaneously enhancing livelihood opportunities and the quality of life. The Programme accomplishes its goals through its two centres—Centre for Integrated Assessment and Modelling and Centre for Resource Efficiency and Governance. Some of their focus areas include: energy modelling, integrated modelling linking, sectoral demand estimation and forecasting tools, energy with economy, resource and energy governance, product stewardship, etc.

In 2021/22, the IPA completed 9 projects and undertook 4 new projects, while 2 could be categorized as ongoing. Research studies under this programme are chiefly related to green recovery from pandemic, disaggregated (sectoral, regional, and seasonal) power demand forecasting, renewable energy trade, energy/integrated modelling related to net-zero/ decarbonization target.

TERI leads work on the various dimensions of climate change and cross-cutting themes. In the context of building climate resilience, our Natural Resources and Climate (NRC) Programme spearheads research in providing innovative and resource-efficient solutions for the management of water resources, waste resources, and bio- resources; thereby aiming to become a global leader in providing scientific knowledge and solutions.

On-field programmes are also conducted under this programme, to eradicate malnutrition from rural and urban areas of India. Earth Science and Climate Change, Environment and Waste Management, Water Resources, and Land Resource constitute the four key focus areas under the NRC Programme, leading work on various dimensions of climate change and cross-cutting themes. It completed 60 projects in 2021/22 and made a marked contribution towards knowledge building.

To influence the policy making at national level, the Programme closely works with State Departments all over India, as well as the Ministries in the Central Government. The Programme also works with a number of corporates, academic Institutions, number of community-based Institutions across India, multilateral and bilateral organizations of both national and international repute.

In 2021/22, held in Asia for the first time, the *Adaptation Futures conference* was hosted by TERI – in collaboration with World Adaptation and Science Programme (WASP). In the recent 26th Conference of the Parties (COP26), TERI organized a high-level panel discussion 'Demystifying COP 26: *Key takeaways and future roadmap for India',* with the principal members of the Indian delegation to discuss outcomes and future roadmap to achieve the targets laid out by India.

Through the Programme, TERI partnered with the Embassy of France in India and organized cross country knowledge exchange sessions under the flagship of *TERI's Multi-Country Cooling Platform and as a part of project SHEETAL - Alliance for Sustainable Habitat, Energy Efficiency and Thermal Comfort for All.* The sessions brought together policy and cooling industry experts from India and France to converse around sustainable cooling across sectors, such as building and cold chains. In 2021/22, for its objective of knowledge building, workshops were organized by TERI for the municipal officials in selected cities of Varanasi, Panjim, Vadodara, Surat, Delhi and Raebareli.

The Sustainable Habitat Programme (SHP) promotes sustainability in the urban context through developing a wide range of solutions for buildings, sustainable mobility and planning, governance of low-carbon resilient cities. Rating of built environment projects is another flagship initiative that the SHP pursues through GRIHA Council. GRIHA is committed to minimize resource consumption, waste generation, and overall ecological impact within certain nationally acceptable limits / benchmarks.

In 2021/22, the SHP executed 37 projects across India; it is worth mentioning that GRIHA is engaged in executing projects across the country with a combined footprint spanning more than 721 million square feet. GRIHA-rated projects have an installed capacity of 533 MWp of renewable energy systems, along with other energy efficiency measures, well known for offsetting 8,393,046 tonnes of carbon dioxide from being released into the atmosphere every year.

TERI's Social Transformation Programme is a research- and action-based endeavour, pioneering through its pan-India grassroots initiatives. These initiatives involve research, modelling, policy advocacy, demonstration, consultancy, CSR activity, and many others. Its activities touch the lives of a diverse range of communities.

With its focus on clean and rational use of energy, TERI continues to strive for a climate-resilient and Atmanirbhar rural India. Interweaving elements of gender and social inclusion at every stage of design and implementation in all its interventions, this has been the cornerstone of TERI's aspirations.

Till date, 177 projects had been executed across India and with the objective of 'social transformation' – 43 grassroots initiatives are still ongoing. A special focus on carbon dioxide emissions' mitigation is placed in all the projects undertaken by the social transformation programme. To illustrate, 134 units of Hybrid Solar Charging Units for Power Looms were installed in Varanasi, resulting in reduction of 484.81 metric tonnes of carbon dioxide per year. In addition, clean cook-stoves promoted through rural disseminations mitigated 30–35% of indoor air pollution. Through this Programme, TERI has successfully reached the remotest of areas to provide energy-poor communities the access to clean technologies for basic and productive use.

TERI's Advanced Biofuels (ABF) Programme, through its circular bioeconomy approach, focuses on integrated production of clean fuels and green chemicals and broadly addresses climate, energy and food security goals.

In the bygone year, 18 projects were executed across Mumbai, Goa and Gual Pahari. Major target segments catered under this programme are oil- making industries, farmers, rural sector, industries associated with manufacturing of commodities, aquaculture, and animal husbandry. The ABF Programme has been developing technologies for production of Green Hydrogen in pilot scale using non-edible feed (aquatic plant, algae biomass, organic waste); this has the potential to contribute towards the nation's net-zero aspiration. The ABF Programme is also actively exploring to produce next-generation biofuels and high-value renewable raw material in a sustainable manner, in the pursuit of making these processes economically viable.

Today, technology indigenously developed by TERI has entered a stage where bio-oil and biochar can be recognized as the building blocks for thermal biorefinery, for coproduction of fuels and chemicals.

The Environmental and Industrial Biotechnology (EIB) Programme is committed towards protecting the environment, finding new solutions, and developing innovative sustainable technologies for large-scale applications in a fast-growing economy. It has been exploring opportunities to develop and demonstrate sustainable solutions for clean and green energy production.

TERI has successfully developed a best-selling technology, *'Oilzapper'* at a large scale. It is globally acknowledged for its broad-scale implication in cleaning of oil spills and treatment of oily sludge generated by refineries.

Through its EIB Programme, TERI contributes towards promoting sustainable solutions such as microbial oil enhanced recovery; bioremediation; biologically enhanced methane production; and water-based drilling fluid applications.

The Sustainable Agriculture Programme dedicates itself towards creating innovative solutions and developing new ways for profitable farming and livelihoods, at the same time, conserving natural resources. Key research areas include sustainable agriculture, environment, and bioenergy by developing plant and microbe-derived products that help reduce the use of chemical fertilizers while substantially improving crop yields: thereby reducing the carbon footprint. Multi-pronged efforts are aimed at improving soil and plant health, leading to sustainability in agriculture and the environment.

The Centre for Agri Nanotechnology addresses challenges in agriculture and environment through innovative and interdisciplinary nano- biotechnology and nature-based solutions.

The Micro-propagation Technology Park has emerged as a pioneering initiative on using tissue culture for mass propagation of economically important crops including medicinal plants, cash crops, aromatic, fruits crops and forest plants. This is also linked to creating livelihoods through proactive market linkages and business development.

In the year 2021/22, over 40 projects were executed across India. The primary target segments were agriculture, farmers, fertilizer, agrochemicals, seed and nutraceutical industries, and industries associated with the manufacturing of bio- commodities. Over 250 research papers, book chapters, and review articles which have found space in various international and national journals documented and disseminated the research outcomes of our initiatives.

The Sustainable Development and Outreach (SDO) Programme seeks to drive leadership through pioneering conversations, contributes towards achieving SDGs and the goals of the Paris Agreement, and creates a societal impact through outreach. The projects undertaken by this programme range from policy research, to coverings and communication related activities, wherein a variety of stakeholders are engaged.

The 21st edition of the *World Sustainable Development Summit or WSDS* was held virtually from 16th –18th February, 2022; under the theme— *Towards a Resilient Planet: Ensuring a Sustainable and Equitable Future.* The Summit was inaugurated by the Hon'ble Prime Minister of India, Shri Narendra Modi, and witnessed participation from 143 countries. This summit is the only independently convened platform in the Global South that has a mission to propel ambition and action on sustainable development and climate response.

TERI Press and Environment Education and Awareness (EEA) also complement various initiatives and outreach activities of the Institute.

During 2021/22, while the world continued to grapple with the Covid-19 pandemic and was following its path to recovery from this unprecedented crisis, TERI Press continued disseminating relevant content to its readers via both analogue and digital platforms. In the preceding year, the Press was involved in more than 400+ outreach activities of the Institute.

Through EEA's focus and work on creating an environmentally conscious society, TERI has reached out to nearly 69,140 students directly in India and has also been working on community campaigns with various stakeholders; including government, corporates, and communities. 10 projects have been implemented on a PAN-India level on issues relevant to environment and sustainable development; which eventually resulted into adoption of sustainable practices.

Before I handover the Annual Report 2021/22, I take this opportunity to thank each and every member of TERI family for their invaluable contributions to the Institute's cause in the bygone year. I would also like to express a deep sense of gratitude to all our stakeholders, donors, partners and beneficiaries for their engagement and value addition.

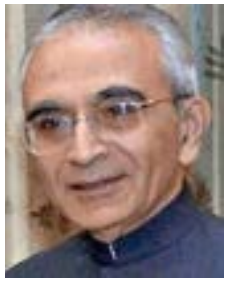
I conclude with the hope that we would continue our relentless efforts in 2022/23, embark on journeys in paths less travelled and carry on with a resolve of building a better future. We have a long way to go in order to build a safer and resilient planet – and we shall continue to move forward with a renewed passion and a zeal to make a difference.

Vibha Dhawan
Director-General, TERI

Who's Who at TERI

TERI'S GOVERNING COUNCIL

Mr Nitin Desai
Chairman



Mr Vijai Sharma

Dr Shailesh Nayak

Mr Nawshir H Mirza

Dr Naushad D Forbes
(Till 18/8/2021)

Prof. (Ms) Basabi Bhaumik
(Till 18/8/2021)

Mr R Mukundan
(From 6/1/2022)

Mr Mahendra Singhi
(From 19/1/2022)

Mr M S Unnikrishnan
(From 19/1/2022)

Dr Vibha Dhawan
(From 24/2/2021)

THE MANAGEMENT TEAM

Dr Vibha Dhawan
Director General, TERI

Mr Girish Sethi
Energy

Mr Sanjay Seth
Sustainable Habitat

Dr Banwari Lal
Environmental and Industrial Biotechnology

Dr Syamal Kumar Sarkar
Natural Resource and Climate

Mr R R Rashmi
Resource Efficiency and Governance

Dr Vibha Dhawan
Sustainable Agriculture

Dr Jitendra Vir Sharma
Land Resources

Dr Vibha Dhawan
Advanced Biofuels

Mr A K Saxena
Electricity and Fuels

Dr Suneel Pandey
Environment and Waste Management

Ms Suruchi Bhadwal
Earth Science and Climate Change

Colonel (Retd) Sanjai Joshi
Administrative Services

Dr Dipankar Saharia
Agricultural and Rural Extension

Mr Shirish Garud
Renewable Energy Technologies

Dr G Rudra Narasimha Rao
Industrial Energy Efficiency

Dr Shailly Kedia
Sustainable Development and Outreach

Mr Anshuman
Water Resources

Ms Shabnam Bassi
Sustainable Buildings

Mr Prosanto Pal
Industrial Energy Efficiency

Dr Livleen K Kahlon
Environmental Education and Awareness

Mr Souvik Bhattacharjya
Resource Efficiency and Governance

Ms Anupama Jauhry
TERI Press

Dr P K Bhattacharya
Knowledge Resource Centre

Mr Amit Singhal
Information Technology and Services

TERI'S DISTINGUISHED FELLOWS

Dr Prodipto Ghosh
Distinguished Fellow, Earth Science and Climate Change

Mr K Ramanathan
Distinguished Fellow, Electricity and Fuels Division

Mr Shri Prakash
Distinguished Fellow, Transport and Urban Governance

Mr Ajai Malhotra
Distinguished Fellow and Senior Advisor (Climate Change), Director General's Office

Mr R R Rashmi
Distinguished Fellow and Programme Director, Resource Efficiency and Governance

Mr Ajay Shankar
Distinguished Fellow, Director General's Office

Air Commodore (Retd) M M Joshi
Distinguished Fellow, Administrative Services

Mr S Vijay Kumar
Distinguished Fellow and Lead, Food and Land Use Coalition, India

Mr Dipak Dasgupta
Distinguished Fellow, Earth Science and Climate Change

Mr Sanjay Mitra
Distinguished Fellow, Transport and Urban Governance

Dr Syamal Kumar Sarkar
Distinguished Fellow, Transport and Urban Governance

Mr Manjeev Singh Puri
Distinguished Fellow, Earth Science and Climate Change

Research Programmes

- Energy
- Integrated Policy Analysis
- Natural Resources and Climate
- Sustainable Habitat
- Social Transformation
- Advanced Biofuels
- Environmental and Industrial Biotechnology
- Sustainable Agriculture
- Communication Outreach and Advocacy
- Sustainability and Engagement with Businesses

Energy

The **Energy Programme** aims to promote, on both demand and supply sides, energy-efficient and renewable energy-based technological solutions that will enable India and other developing countries to achieve their developmental goals along low-carbon pathways.

Themes and Commitments

Thematic focus – a bird's eye view

We address issues and solutions pertaining to energy efficiency, cleaner technology options, renewable energy and energy transitions. Primarily we design sustainable solutions aligned with the needs of the stakeholders, based on measurements, in-depth analysis, field testing, demonstrations and a joint dialogue.

Being driven by the broad intent of promoting energy-efficient and low-carbon solutions, the Energy Programme encompasses the following thematic domains:

Industrial Energy Efficiency

Renewable Energy Technology

Electricity and Fuels

Industrial Energy Efficiency (IEE) focuses on promoting **energy-efficient technologies** (EETs) and best operating practices (BOPs) in medium, small and micro enterprises (MSME) sector (audits, implementation support, cluster studies, knowledge sharing, etc.). Undertaking energy audits for Indian and international clients like, large industries, power plants, commercial complexes and water pumping installations – including implementation support in selected cases, is also one among IEE's many activities. The programme works on developing an evidence base to chart out a road map for decarbonization of Indian industry, particularly, hard-to-abate sectors like iron and steel, cement, etc. It also provides business advisory services and capacity-building services such as, sectoral studies, workshops/training programmes, technology assessments, etc.

Renewable Energy Technology (RET) provides consulting services for domestic and international clients across the range of renewable energy technologies covering solar photovoltaic, solar thermal, floating solar, wind, bioenergy, energy storage, hydrogen, etc. This division focuses on facilitating **bio-energy utilization** through resource studies, gasifier marketing in Indian and Overseas markets, along with agro-waste and kitchen waste conversion solutions (TEAM technology). A key concern for RET is the promotion of RE technologies through in-depth research studies, testing, development and deployment. RE resource potential and RE integration in energy planning: Including solar rooftop applications, as well as Thermal energy storage applications or product development are some of RET's key activities. It also undertakes RE technology assessments and testing of solar PV products like pumps, batteries, etc.

Electricity and Fuels (EF) is concerned with **energy transition**: promoting Low-carbon pathways through integrated demand – supply studies, at the national and state levels, to inform capacity and electricity generation mix scenarios in the medium to longterm. It focuses on grid-scale storage solutions including battery energy storage, smart distribution with storage and electric vehicles adoption. Conducting studies for assessment of future role of coal, oil and gas as well as the attendant issues and challenges; carrying out consultancy studies on critical/key thematic areas/ issues; carrying out policy and regulatory analysis (regulatory impact assessment); promoting demand-side management for Energy Efficiency and BOPs; capacity building and ensuring just transition – these are some of the major activities of the EF Division.

Visit of DERC Chairperson at TERI Smart Controller LAB

Larger goals and the context

Energy Programme endeavours to primarily focus on affordable and clean energy. The varied activities under this programme also touch upon SDG 1, SDG 2, SDG 8, SDG 9, SDG 11, SDG 12, SDG 13, and SDG 17.

The Energy Programme envisions an overall socio-economic development of India being driven by clean energy along a low-carbon pathway. It focuses on supporting the transformation of the nation's energy landscape by ensuring adequate, reliable, affordable and easily accessible supplies of clean and renewable energy, as well as by developing and promoting energy-efficient technological solutions/measures for end-users in diverse sectors of the economy.

Sustainable solutions promoted

Paddy straw-based briquetting plant for decentralized applications in the state of Punjab

This initiative focused on addressing the challenge associated with the utilization of paddy straw in the state of Punjab. Demonstration unit of a briquetting plant using improved technology was set up in January 2022 . The results are promising and the technology has wide-scale replication potential in India, addressing the stubble burning issue and solving the associated air pollution.

Solar-powered electric vehicle

A "lightweight, flexible, low-cost, third generation thin film solar PV module" development supported by Innovate, UK (developed by Power Roll, UK) was tested to assess its performance under Indian conditions . An electric vehicle on-the-go charging system has been developed by TERI.

Road map prepared for a net-zero steel sector

A study report was published, titled 'Achieving Green Steel – Roadmap for a Net Zero Steel Sector in India'. It lays down a road map for meeting future steel demand growth sustainably.

India's Electricity Transition Pathways to 2050

TERI also conducted a study to develop insights on contribution of clean energy in the supply mix to meet the anticipated demand, role of various technologies, impact on system cost, emissions, etc.

Low-carbon pathways study for the state of Madhya Pradesh

Focused on finding out least cost investment in new-generation technologies and generation dispatch to meet the anticipated electricity demand in Madhya Pradesh in 2025 and 2030.

Studies on renewable energy for Cambodia and Papa New Guinea

- Fast Track Assistance undertaken on behalf of Climate Technology Centre and Network (CTCN).
- Consultancy for Provisions of Technical Services for Development of Investments in climate resilience and access to renewable energy technologies for Papua New Guinea – A study on roof top solar feasibility and capacity building under UNDP funded project.

Achieving green steel -steel road map

Solar-powered vehicle

Our Accomplishments

Number and nature of projects

More than 100 projects were executed, covering: low-carbon pathways, energy efficiency, promotion of renewable technologies, Just Transition, battery energy storage, e-mobility, RE integration and capacity building across India and beyond (for example, in Guyana, Grenada and Cambodia). A few examples are:

- In the MSME sector, situation analysis reports with regard to energy consumption patterns was prepared for four clusters – covering Ahmedabad, Howrah, Raipur, and Rajkot. This work will shape future cluster-level energy interventions planned by TERI.
- TERI has been playing a supportive role in implementation of the PAT scheme of BEE, Government of India, through mandatory energy audits and verification audits; mainly in cement, iron and steel, pulp and paper, power and textile sectors. In addition, detailed energy audits carried out for large industries like Hatti Gold Mines and Cairn Energy. Energy audits in many other plants were undertaken during the last year.
- A preliminary report on '**Detailed Assessment on Potential of Industry Sector in Reducing GHG Emissions in India**' was prepared to assess GHG emissions reductions from industry sector up to 2030–31.
- A technology compendium: **Energy-efficient Technology Options for Direct Reduction of Iron Process (Sponge Iron Plants)**, was published in collaboration with Sponge Iron Manufacturers Association (SIMA) in 2021, which acts as a ready-reckoner and provides techno-economic details of appropriate energy-efficient technologies that can be adopted by the coal-based DRI industries.
- Energy and resource mapping studies in two energy-intensive MSME sub-sectors – glass and refractory and chemicals – were undertaken to enable industries access and adopt EETs and BOPs.
- A detailed study titled '**India Hydrogen Landscape - Current status and future opportunities**' was undertaken for an international client.
- RET-based solutions were promoted - Greening of Lakshadweep islands, state-level solar rooftop aggregation, etc.
- A study report '**Assessment for Aggregating DSM Opportunities among Industrial Consumers at Utility Level for Low Carbon Growth**', was published under the MacArthur-TERI partnership. It has the potential for replication in other utilities in India.
- In-depth studies exploring Indian electricity supply mix scenarios to 2030 and 2050 were carried out.
- Developed **e-AMRIT portal** for creating awareness about electric mobility in India. Ensuring 24×7 reliable power supply to the state of Goa: Strategies for greening the sector and improving reliability of supply.
- Review of EHV network development studies of CESC.
- The Energy Programme provided technical assistance to the Government of the Republic of Guyana in the electricity sector. It also extended capacity-building services around clean energy solutions in Grenada and Cambodia.

Battery-cell testing using battery simulator at TERI Smart Controller Lab

Role in reducing carbon footprint

- TERI undertook a study on re-powering potential of solar PV projects and wind power projects in India. It is estimated to be in the range of 3 GWp and 5 GWp, respectively, which can lead to a reduction of 400 million tonnes CO2equivalent annually.
- TERI conducted studies on the MSW characterization in around 23 cities. It was found that there is a potential to establish about 50 CBG plants with a capacity to process around 750 tonnes/day of MSW, resulting in a reduction of 10 million tonnes CO2equivalent annually.
- TERI undertook third-party inspections of rooftop solar PV projects in two cities with approximate capacity of 3 MW. CO2offset benefits through Solar PV Generation this year was to the tune of 3.13 tonnes in the two sites.

Approach and innovation

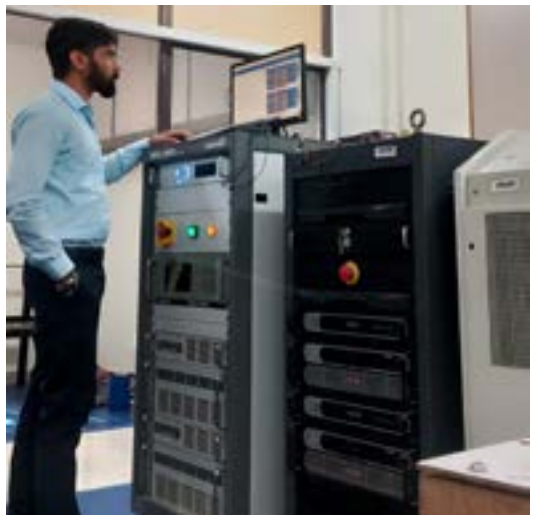
Through its field-based studies and demonstrations, in-depth analysis, simulations and modelling, this programme strives to promote low-carbon pathways and clean energy solutions. It believes in data base generation and analysis through industry-centric and need-based primary as well as secondary research. Our relentless endeavour in testing innovations, building proof of concepts and replicable models, facilitation of policy discourse and creating evidences of success for large-scale adoption and mainstreaming of efficient and cleaner technologies helps transition towards a green economy.

Vapour absorption-based cold storage operated with biomass gasifier

Inspirational Evidences

Demonstrations

- **Waste-to-energy plant (bio-methanation) of 100 kg capacity at NTPC, Hazari Bagh commissioned using improved TEAM technology developed by TERI**



BESS pilot site visit by DST, IUSSTF, PMC team

A 100 kg per day capacity bio-methanation plant was commissioned at NTPC, Hazari Bagh, Jharkhand, to treat the food waste generated from the canteen. This solution addresses the waste management challenges and associated emissions.

- **Pilot project on Battery Energy Storage System (BESS) at Distribution level** TERI, in association with partner utility BSES Rajdhani Power Limited (BRPL), is undertaking the installation of 410 kWh (cumulative) battery energy storage system at distribution level to study its application for addressing DT overload management, peak shaving, energy arbitrage, etc.

Success stories

- TERI is supporting Tata Steel Utilities and Infrastructure Services Limited in implementing their DSM Action Plan. The focus is on energy-efficient lighting, promoting energy-efficient appliances, developing a dedicated energy efficiency programme for industries and undertaking employee awareness programmes.
- **Pune forging unit saves Rs 73 lakh annually by adopting best practices in compressed air system.** This was possible after adopting energy conservation measures recommended through on-site studies by TERI-IGES experts.

> "Optimal utilization of resources with a focus on greening the sector and system resilience, end-use efficiency and above all a people-centric approach are the key mantras of a successful energy transition strategy."
>
> -Mr K Ramanathan, Distinguished Fellow, TERI

Impact we created

Biomass–Solar microgrid coupled with a cooling system commissioned at Khajuripadar and Bilaput villages in Koraput district, Odisha, India

The microgrid was tested and is running successfully. This intervention allows replacing cold stores, to be operated on green electricity. The hybrid biomass solar electricity and cooling solution project, in two villages of Odisha, was undertaken as a part of the Mission Innovation challenge programme – supported by the Department of Science and Technology, Government of India.

TERI's dialogue with the leaders of Indian business on industrial decarbonization and energy efficiency

It led to on-boarding of Indian CEOs as signatories of the TERI's Industry Charter for Near-Zero Emissions by 2050.

Knowledge Building and Dissemination

- IEE Division organized four webinars under Japan-India Technology Matchmaking Platform (JITMAP) to introduce Japanese low-carbon technologies and environmental technologies in India.
- TERI, in collaboration with BEE and other stakeholders, has established a collaborative platform called **SAMEEEKSHA**. Four issues of the SAMEEEKSHA newsletter were published and circulated among key stakeholders.
- Research and development in the field of smart grid, BESS, e-mobility, DSM & EE, mapping of demand and supply centres for potential green hydrogen opportunities in India, etc. helped gain insights and disseminate learning.
- Conducted knowledge sharing webinar/workshops on Just transition, e-mobility, DSO, etc.
- The ASEAN-India High Level Conference on Renewable Energy , co-organized by MNRE and the MEA of India, in collaboration with TERI and The ASEAN Centre for Energy (ACE).
- **World Wind Energy Conference:** International Annual Wind Energy Conference organized by TERI for the World Wind Energy Association (WWEA).
- The **4th India-Japan workshop on Hydrogen and Fuel cell 2022** brought together Indian and Japanese experts to discuss the future of hydrogen and fuel cell technologies.

Contribution to knowledge building

- 20 publications
- 7 international presentations

Partnerships and Networks

Diversified mix of donors consisting of international organizations, government agencies and corporate sector supported multiple projects in energy sphere. Major research grants were secured from UNEP, GIZ, MacArthur Foundation, DST, SSEF, BEE, Bloomberg Philanthropies, CIFF, IFC, CTCN, etc. Consultancy projects were secured from many domestic corporate players as well as international players like GGGI, Government of Guyana, World Bank, etc., in the field of energy efficiency in countries like Guyana, Grenada, Uzbekistan, Mexico, Cambodia, etc.

Additionally, the following initiatives are worth highlighting specifically:

1. India Development Partnership Activity (IDPA): Diagnostic Study to Augment Triangular Cooperation (India-US-partner country) in Renewable Energy (RE) in southeast Asian countries
2. Study on Enabling Readiness for Capacity Building on Installation and Maintenance of Solar PV in Timor-Leste', commissioned during the year.

Details on Knowledge Building; Partnerships and Networks can be viewed via the following URLs:

[1] https://www.teriin.org/sites/default/files/files/Partnerships_and_Networks_List.pdf

[2] https://www.teriin.org/sites/default/files/files/Knowledge_Contribution_List.pdf

Integrated Policy Analysis

The **Integrated Policy Analysis (IPA) Programme** aims to inform policy on the critical sustainability issues through an in-depth and interdisciplinary research. The research seeks to answer the central question, 'How can policy be designed to scale up solutions that successfully decouple economic development from natural resource use and environmental degradation while enhancing livelihood opportunities and the quality of life?'

Themes and Commitments

Thematic focus – a bird's eye view

IPA Programme has two broad thematic domains:

- Integrated Assessment and Modelling
- Resource Efficiency and Governance

Centre for Integrated Assessment and Modelling

Centre for Resource Efficiency and Governance

Centre for Integrated Assessment and Modelling (CIAM) Under this domain, we are engaged in policy research through modelling and stakeholder consultation which includes:

- Energy modelling
- Integrated modelling linking energy with economy, environment and bio-physical resources
- Macro-economic and econometric modelling
- GIS-based modelling
- Sectoral demand estimation and forecasting tool

We carryout extensive research in areas pertaining to:

- Demand and availability of resources mapping from multiple perspectives and scenarios, including carrying out capacity assessments
- Sectoral energy demand and load pattern/ variability estimation and forecasting
- Demand-supply integrated techno-economic modelling
- Impact assessment of various policy changes on India's development trajectories with special focus on energy access, jobs and clean energy / sustainable urbanization
- Alternative development scenarios based on alternative energy-use pattern
- Energy-food-water linkage
- Energy-land and bio-diversity linkage
- Energy-pollution linkage
- Agent–behaviour dynamics and modelling
- Trade- economy-environment linkage analysis

Centre for Resource Efficiency and Governance (CREG) Under this domain we disseminate policy-relevant knowledge and information, validated through state-of-the-art quantitative and qualitative analysis, which helps to address natural resource security challenges. The focus areas include:

- Resource efficiency and circular economy
- Resource and energy governance
- Product stewardship
- Environmental, social, and corporate governance
- Blue economy
- Trade and environmental issues
- Sustainable agriculture policy

Larger goals and the context

Integrated Policy Analysis Programme endeavours to address 10 SDGs. Key activities of the programme have strong influence on goals related to SDG 1, SDG 2, SDG 7, SDG 8, SDG 9, SDG 10, SDG 11, SDG 12, SDG 13, and SDG 14.

A critical **evaluation of the development-related challenges of coal-dependent districts** in the country was undertaken and a framework enabling a just transition strategy as India embarks on a clean energy path was suggested.

A bottom-up participatory approach has been adopted under the **FOLU Initiative** in India for developing proof points (pilot implementation by stakeholders in a scale for evidence building) and a replicable farmer-led model is being developed

Organizing **Blue Economy Diginars and Meetings** witnessing participation of key experts from the Blue Economy Task Force, Ministry of Environment Forest and Climate Change, Ministry of Earth Sciences, Department of Science and Technology, etc.

Launch of the report on '**Science, Technology, and Innovation Capabilities and Skilling Approaches for Sustainability of India's Food and Land-Use Systems',** in the presence of the National Skill Development Council Chairman, Member of the NITI Aayog, etc.

The Programme employs innovative data-driven analytical tools, energy-economy-environment modelling tools, monitoring and evaluation frameworks and policy coherence tools for effective and efficient execution of the projects.

Our Accomplishments

Number and nature of projects

In 2021/22, we had completed nine projects under the IPA Programme, while undertaken four new projects and two ongoing projects. Among these research studies, one study was related to green recovery from pandemic, one was about disaggregated (sectoral, regional and seasonal) power demand forecasting, another related to renewable energy trade and rest of these projects are in the area of energy/integrated modelling related to net-zero/decarbonization target.

Role in reducing carbon footprint

- Development of an-all sector encompassing carbon-neutral action plan for economy-wide decarbonization of Ladakh and presentation of findings of the Carbon Neutral Study to Lt Governor's office, UT administration of Ladakh

Approach and innovation

Based on modelling research validated with stakeholder and expert (internal and external) consultation TERI provides informed policy inputs to various ministries and other policymakers (including NITI Aayog). Our research input regarding suitability of alternative decarbonization pathways in terms of emission reduction, investment requirement, technology mix and socio-economic implication will go a long way in helping the policymakers in national policy formulation and international/bilateral/multilateral discussions.

Our capability in energy modelling, economic modelling and integrated modelling is well recognized across various types of beneficiaries (government, industry, academics). Because of our modelling capability, we are part of many international consortiums and part of various global modelling networks.

We also ensure that the key findings are disseminated at large, particularly among the policymakers because of the strong message that most of the projects carry. Some of the initiatives include:

Use of state-of-the-art analytical tools and frameworks helps policymakers and decision makers in the public and private sectors to adopt right strategies that supports sustainability. These frameworks include:

- environmental life cycle assessments,
- social life cycle assessments,
- financial assessments that incorporate environmental performance factors/parameters,
- general equilibrium models,
- integrated energy environment models,
- climate-smart agriculture (CSA) that integrates challenges related to food security and
- climate change, health economics.

Most of these frameworks use primary/ground-level data that makes the analyses most relevant and insightful.

Inspirational Evidences

Success stories

- **Segregated power demand and load forecasting tool**

Complementary to existing econometric demand estimation and forecasting tool, excel-based power demand and load estimation and forecasting tool using end-use estimation method has been successfully developed at disaggregated level (regional, seasonal and appliance wise) for residential sector. It can estimate and forecast residential power demand and load for various appliance penetration possibility, adoption of energy-efficient appliances, population growth and urbanization structure.

- **Identification of alternative decarbonization pathways**

Using our well-known capability of energy modelling, alternative decarbonization pathways have been identified which will portray optimal level of energy and technology mix across sectors and required level of investment. This exercise is very useful for India's net-zero target framework.

TERI-KAS National workshop on "India's energy scenario: 2040 and beyond" at Leh, 6th to 8th September, 2021

TERI-KAS National workshop on "India's energy scenario: 2040 and beyond" at Leh, 6th to 8th September, 2021

- **Capability in new modelling framework**

Regional energy modelling framework through TIMES model has been developed by our research team in partnership with our Norwegian partner IFE. Prototype model for India having five grid regions with various calibration facility was successfully developed. Open-source energy model Message-IX capability was also developed and linked with land-use model was successfully explored by our research team.

- **TERI's flagship publication TEDDY**

Our research team is in charge of TERI's flagship annual publication "TERI Energy and Environment Data Diary and Yearbook (TEDDY)". This annual publication presents the state-of-the-art information on energy supply, energy demand, and environment.

- **Sustainability of India's food and land-use systems**

The study and the report on 'Science, Technology, and Innovation Capabilities and Skilling Approaches for Sustainability of India's Food and Land-Use Systems' has covered a broad conceptual range of capabilities and skills components of India's food and land-use systems and mapped the relevant actors and government institutions along the various stages of the value chain.

- **Developing carbon-neutral strategy for Ladakh**

Ladakh is the first union territory (erstwhile, a state) in the country to have prepared the carbon- neutrality strategic framework even before the PM's announcement of 2070 Net Zero target. The approach adopted a systematic top-down and bottom-up approach for economy wide decarbonization of Ladakh, which is again the first of its kind to be used at a sub-regional level.

Impact we created

Because of our modelling capability, TERI is the lead institute/coordinator in Task Force 1 of India Climate Energy Modelling Forum and partner in all other task forces of the same.

Provided sector-specific (power and industry) inputs for preparation of BUR (Biennial update report) II for Government of India

Provide regular inputs regarding decarbonization strategy to MoEFCC for preparation of NDC

The road map for Carbon Neutral Ladakh identifies strategic and ambitious alternate scenario envisioning the accelerated efforts for region wide decarbonization. Many of the proposed interventions have already been approved and implemented by selected agencies including TERI.

> "Environmental research is often limited by unidimensional perspectives of science or economics. With the felt need of sustainable solutions being not only green and viable but also just and acceptable, the importance of a Programme that offers integrated analysis of the issues of green growth, natural resource use, and environmental impact is the need of the hour."
>
> -Mr R R Rashmi, Distinguished Fellow and Programme Director, TERI

Knowledge Building and Dissemination

Our research team is part of various national and international modelling consortiums for national and global energy/GHG modelling exercise. We made an effort to disseminate learning and research findings through the following platforms:

- In collaboration with international partners, our team provides modelling-based policy inputs to national government and international policy forum/decision-making bodies.
- TERI-KAS National workshop on, "India's energy scenario- 2040 and beyond".
- National Conference - Quadrilateral Dialogue Series on Blue Economy- India's Pathway to a Sustainable, Secure and Resilient Economy
- India – Australia Industry and Research Collaboration for Reducing Plastic Waste
- Emerging Role of Blue Finance in the Asia Pacific Region
- Emerging Opportunities towards Sustainable Packaging Solutions – Ball Corporation – Event in WSDS 2022
- Plastics and Circular Economy: Making EPR Workable- Event in WSDS 2022
- People-Centred Transition – An Indian Perspective - Event in WSDS 2022
- Financing Energy Transition in India - Event in WSDS 2022

Contribution to knowledge building

- About 15 journal articles/book chapters/working paper
- More than 15 conferences/workshops/seminars presentations

Partnership and Networks

- Regular support from MoEFCC, GoI
- Long term support from European Commission
- Long term support from Norwegian Government
- Frequent support from Industry (Shell India, Federation of Indian Petroleum Industry)
- Long term collaboration with IIASA, Austria & PBL, Netherlands
- Long term relationship with ERIA/ERIN
- Technical Knowledge Partner to Resource Efficiency Cell of Ministry of Environment Forest and Climate Change (MoEFCC)
- Coordinator for Sustainable Consumption and Production (SCP) – HAT South Asia Regional Centre of Excellence (RCoE), UNEP
- Consultative Committee Member of the Comptroller and Auditor General of India on Asset Accounts on Mineral and Energy Resources in States.
- Forging partnerships with leading Australian academic institutions like CSIRO, UTS, UNW as well as Indian scientific research organizations like CSIR NEERI, CSIR IMMT.

Details on Knowledge Building; Partnerships and Networks can be viewed via the following URLs:

[1] https://www.teriin.org/sites/default/files/files/Partnerships_and_Networks_List.pdf
[2] https://www.teriin.org/sites/default/files/files/Knowledge_Contribution_List.pdf

Natural Resources and Climate

The **Natural Resources and Climate (NRC) Programme** spearheads research in providing innovative and resource—efficient solutions for management of water resources, waste resources, and bioresources—including application of bioresources. It aims to become a global leader in providing scientific knowledge and solutions through evidence of air pollution, climate change, and their impacts, by involving ecological processes, technology, institutions, and policy initiatives; and seeks to spearhead on-field programmes to eradicate malnutrition from rural and urban areas of India.

Themes and Commitments

Thematic focus - a bird's eye view

The NRC Programme seeks to facilitate release of climate pollutants from waste disposal; provides safe water and improvement in water-use efficiency in industrial, domestic, and irrigation sectors and enhance water availability through water conservation interventions; links sustainable forest management and biodiversity conservation with poverty alleviation; facilitates actions at the Centre and state levels to improve air quality in Indian cities; facilitate governments to go beyond commitment in Nationally Determined Contributions (NDCs) and create sustainable models, demonstrating efficient resource use in rural and tribal areas.

The key focus areas of the Programme are:

Earth Science and Climate Change

Environment and Waste Management

Water Resources

Land Resources

Earth Science and Climate Change initiatives centre around:

- Conducting impacts and vulnerability assessment for climate-sensitive sectors
- Carrying out research in the areas of water and climate-related disasters
- Assessing technology needs as per the national circumstances and evaluate technology options.
- Undertaking activity on climate finance and carbon markets
- Carrying out sampling and analysis of all the ambient air pollutants
- Assessing impact of air pollution on health, agriculture productivity, etc.
- Conducting studies to assess indoor air quality at both rural and urban scales.
- Undertaking studies in both *in-situ* and *ex-situ* management of post-harvest crop residue

The ongoing work is inextricably linked to policy research and recommendations for the Indian government to shape its domestic policies, as well as contribute to its position in global negotiations.

Our work under the domain of **Environment and Waste Management** revolves around research on policies, regulation, governance, health, technology, assessment for resource-efficient cleaner production (RECP) potential in industries and other solutions for holistic waste management and resource optimization.

- Waste management auditing and environmental audit
- Research on converting waste into useful products
- Organize programmes for capacity building of stakeholders ULBs (urban local bodies) in India and globally on waste minimization
- Providing policy advocacy and policy lab set up for Social Entrepreneurship and Ecosystem Development (SEED)
- Conducting GHG emissions modeling from waste sector
- Generating scientific evidence on air pollution and climate change affecting human health

Awareness programme regarding segregation of dry and wet waste organized at Varanasi

- We assess toxic contaminants in the air, water, and food and their associated health effects
- We develop digital tools and information, education, and communication (IEC) materials on environmental pollution, climate change and health
- We work on resource efficiency, circular economy and sustainable consumption and production (SCP) consulting and implementation support in Central Asia and South Asia for small and medium enterprises (SMEs).

Water Resources: We develop and implement integrated and strategic solutions for achieving water security. We carried out pond rejuvenation work for groundwater recharge in the states of Haryana and Rajasthan to enhance water security of this region by artificially recharging groundwater.

- **We contribute towards the goals of the National Water Mission:** One of the key areas of work is on enhancing water use efficiency in various sectors including agriculture and industries. We are developing benchmarks for water use in water intensive industries.
- **Our work contributes towards targets of SDG6:** By unlocking the environmental and economic benefits of municipal wastewater treatment and reuse solutions for urban and peri-urban areas in India through a project jointly undertaken by Indian and European Research institutes and sponsored by the Department of Biotechnology, Government of India and the European Union. The project links directly to the Namami Gange programme and builds on existing cooperation between EU/India, supported by the National Governments.
- **We create policy and social impact through outreach:** We build capacity of the stakeholders including water users and managers on various aspects of water management including water conservation, water management, water quality, etc.
- **We engage through the Centre for Himalayan Ecology (CHE)** in research on high altitude hydro-meteorological parameters and their implications on local livelihoods, through their influence on local water resources, especially glaciers and snow.
- **We contribute towards the goals of the National Mission for Clean Ganga:** TADOX® technology Centre for Water Reuse (TTCWR) work with the National Mission for Clean Ganga (NMCG), MoJS, GoI towards technology development, deployment and commercialization of TADOX Technology for wastewater treatment and water reuse through a newly established Centre called the NMCG-TERI Centre of Excellence on Water Reuse and project funded by NMCG to demonstrate TERI's TADOX Technology for Textile Sector in a CETP in Kanpur.
- **We undertake tailor-made solutions for wastewater treatment for industry**

Land Resources initiatives focus on promoting sustainable forest and biodiversity management, providing solutions towards reclamation of mine waste through eco restoration activities, generating finance through carbon mechanisms for forests and farmlands, and supporting the livelihood of forest-dependent communities.

Water conservation through Rejuvenation of Ponds Project Launch

> The Natural Resources and Climate Programme at TERI comprehensively addresses issues of sustainability and climate (reflected in several key SDGs) through multidisciplinary research covering science, technology and policy. Degradation of air, water, soil, and climate are the focus of the NRC, which also looks ay questions of justice in access to and rights over natural resources, the utilization of traditional knowledge, and actual demonstration of solutions

-Dr Prodipto Ghosh, Distinguished Fellow, TERI

IFS Training Programme on Significance and Scope of REDD/ REDD+ for India's Forests

- We provide solutions for the benefit of future generations, for reducing land degradation, restoring damaged areas, and assuring the best possible use of land resources. The challenges of mine rehabilitation, training and capacity building on forestry and climate change issues, and policy support are the key issues we address.
- We undertake steps for mine rehabilitation
- We undertake carbon finance projects for community welfare and biodiversity conservation
- We develop technologies for measuring and monitoring and maintaining ecosystem services from forests
- We conduct projects on traditional ecological knowledge of local communities
- We support the valuation of mountain forests and mangroves
- We deal with a diverse range of issues related to socio-economic, institutional, policy, and technical aspects of India's forest resources and rural development.
- We develop voluntary carbon market projects for agroforestry plantations
- We restore, conserve and protect forest and tree cover for NDC implementation in India

Larger goals and the context

NRC Programme's Earth Science and Climate Change Division contributes to all 17 Sustainable Development Goals.

Our Accomplishments

- We accessed regional and small-scale climate adaptation and vulnerability, climate mitigation for reducing GHG emission, climate finance, and decarbonization.
- We conducted studies centring on managing air quality and sources apportionment of studies for about 10 cities in India, a surveillance system was developed for air pollution-linked hospital admissions, pilot in Delhi for the Ministry of Health, supported by the World Bank and offered technical solutions for reducing air pollution in Indian cities, managing post-harvest crop residues creating emission standards for diesel locomotives in India, etc.
- We conducted waste audits, upscaling and enhancing uptake of resource efficient and provided waste management solutions, provided solutions towards reducing marine litter and plastic waste management as well
- We have identified and embedded mitigation opportunities for short-lived climate pollutants (SLCPs) in India, and also worked on assessment of air quality from the crop residue burning in the close proximity to residential areas adversely affect respiratory health
- We supported Information, Education, and Communication (IEC) Material on National Programme on Climate Change and Human Health coordinated by the National Centre for Disease Control
- We supported enterprises in implementing SCP (700 SMEs) including capacity building in Uzbekistan and Tajikistan
- We conducted research and development in the area of waste based materials, wastewater treatment and bioplastics leading to publications and products in TRL 3-5
- We worked with a large number of Industries to test TADOX technology at different scales and implement solutions in field with Industry support. Link to add (to take from Nupur)
- We worked towards recharging groundwater through its implementation-based projects, wherein, rejuvenated ponds in Punjab and Rajasthan
- Developed meltwater vulnerability index to quantify the degree of impact due to variation in glacier and snow melting in Himalayan states

Number and nature of projects

The NRC programme has been executing various projects under various themes. All in all, 94 projects were completed during the last financial year.

Approach and innovation

The NRC through its innovative research offers scientific knowledge and solutions for management of water resources, waste resources, and bioresources as well as application of bioresources).

- We developed Fully Automated Flood Early Warning System (FEWS) to provide inundation forecast
- We created TERI Climate Tool (TCT) with the goal of making it easier to integrate the results of climate modelling
- We undertook studies on India's progress towards sustainable development pathways.
- We conducted the Sustainable Consumption and Production (SCP) work with enterprises starts with low-cost and no-cost recommendations which allow the enterprises

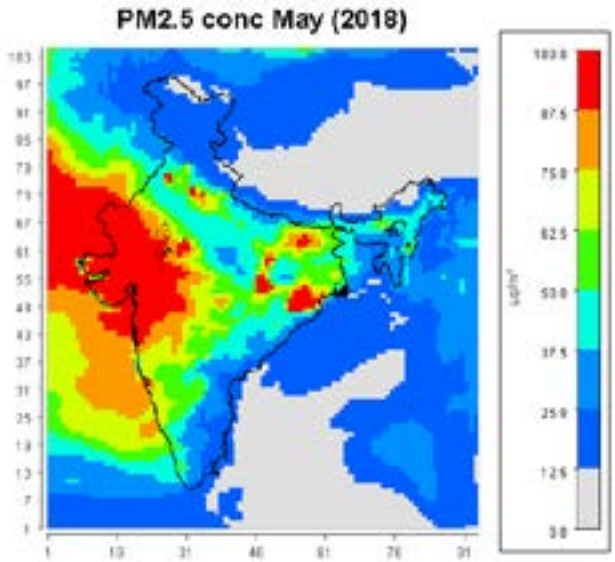
to see immediate benefits thus encouraging them to implement high cost options
- In our SCP and entrepreneurship work, in addition to working directly with SMEs, ecosystem activities (such as policy, access to finance) are also carried out
- Our R&D work focusses on products and processes keeping in view their life cycle
- We provided technologies and solutions to minimize waste generation and convert waste into useful products
- We developed TADOX technology for treatment of waste water. The key feature of TADOX® is its retrofit ability at pre-biological, post-biological and for polishing in the conventional treatment system.

Inspirational Evidences

- We developed research-informed evidence for policymaking aiding government bodies for the formulation of state of environment reports and environmental policies
- Under the ambit of Montreal Protocol, TERI's research on sustainable cooling has added value to national policies. A landmark in this direction is a study titled 'Public Procurement Policies for Refrigeration and Air-Conditioning equipment using non-ODS based refrigerants' carried out by the TERI in collaboration with the Ozone Cell, Ministry of Environment, Forest, and Climate Change (MoEFCC).
- We undertook activities as part of enabling activities of HCFC phase out management Plan Stage-II jointly implemented by the Ozone Cell and United Nations Environment Programme (UNEP).
- We recommended emergency response for air pollution in the form of Graded Response Action Plan (GRAP).
- We suggested air quality assessment, emission inventory and source apportionment Study for Bengaluru city for strengthening city level air quality management plan.
- We developed Air Pollution Health Effects online tool (https://statconsulta3.shinyapps.io/app_instruction5/) and Vulnerability Index Tool: Vulnerability assessment for health (https://statconsulta4.shinyapps.io/teri-vulnerability/)
- Under India-Norway cooperation we are working on building knowledge and capacity to tackle plastic and chemical pollution from important sources within key industries, public sector, and civil society.
- TERI is assisting the National Water Mission in improving industrial water-use efficiency, by developing potential benchmarks for industrial water use in the four water-intensive sectors (thermal power plants, textile, steel, and pulp and paper industry).
- TERI along with consortium partners from India and Europe has developed a policy brief which brings together the learnings from successful and unsuccessful case studies from India and EU with an analysis of the Indian and EU policy and regulatory frameworks.
- TERI based on scientific study and using participatory approach has rejuvenated ponds in rural parts of Punjab, Haryana and Rajasthan.
- TERI in partnership with Cenergist, Jain Irrigation Systems Limited tested a prototype for enhancing water-use efficiency of micro-irrigation system.
- Centre is developing a modelling prototype for the quantification of socio-economic vulnerability of mountain communities due to variability in meltwater across Himalayan states.
- Basis scientific studies and techno-economic assessment of TADOX technology recommendations provided to Haryana State Pollution Control Board, Delhi Jal Board, etc.
- Recognition of efforts in achievement of SDG6 through conferment of Water Sustainability Awards 2021-22.
- Completed online digital media campaign with Editorji – digital media news network, on water conservation
- Having outstanding deliverables from DST Water Mission (WTI) Project, Ministry of Science and Technology, Government of India issued a Press Release on 25th Aug. 2021 endorsing the successful development of TADOX® Technology.
- DST Published findings from the DST Water Mission, Water Technology Initiative (WTI) Project on its website: https://dst.gov.in/new-advanced-oxidation-technology-can-enhance-waste-water-reuse-lower-cost.Inspiritional

Success stories

- **Air quality modelling:** TERI was involved in the pioneering source apportionment study for Bengaluru city and has also been working for many years on the use of state-of-the-art three-dimensional multi-grid air quality models (ISCST3, AERMOD, WRF, C-MAQ, etc), to predict urban/regional scale pollution of criteria as well as emerging pollutants, like ozone.



Air quality modelling in Bengaluru

NABL-certified laboratory for carrying out ambient air and stack emissions monitoring

- EWM implemented measures contributing to Reduce, Reuse and Recycle concept of an integrated circular-economy waste management system the solid waste sector in selected cities of Panjim and Varanasi, includes setting up models for source segregation, for integration of the informal sector, providing training and building awareness of various stakeholders involved.

Small and medium enterprises (SMEs) assessment visits in (a) Uzbekistan and (b) Tajikistan

- **Satoyama Project**

- Under Satoyama Project in its second phase, TERI in collaboration with Tizü Valley Biodiversity Conservation and Livelihood Network (TVBCLN), Zunheboto, organized a three- day Farmer's Market Meet in Zunheboto from 22nd to 24th September, 2021. More than 100 farmers, mainly women and other self-help group (SHG) members participated in this market initiative by setting up 25 farmer stalls. Farmers from the villages of Sapotimi, Asukhomi, Kiyekhu, Sukhai, Kivikhu, Gukhuyi, Philimi, Akhakhu and Khumishi turned up to sell their crops. The Farmer's Market was a successful initiative, which highlighted the fact that a proper market channel and infrastructure is required to make Jhum remunerative. Subsequently, an exposure visit organized locally resulted into an insightful interaction with the members of the Village Council members and the dialogue revolved around conservation, biodiversity, shifting cultivation practices and its sustainability.

Interaction with farmers

A four-day exposure visit to Fakim Village

Nursery activities at Gual Pahari

TERI maintains an advance nursery-cum research centre for forest tree species, medicinal and ornamental plants. TERI has conserved gene bank with over 42 clones of Eucalyptus hybrid, 22 clones of Poplar, and various clones of Shisham (Dalbergia sissoo) and more than 50 medicinal plant species.

Assessment of carbon stocks of forest areas of selected Van Panchayats (VPs) under UFRMP, and facilitate these VPs in generating carbon finance

Carbon finance project in Van Panchayat has rejuvenated panchayati forests with the help of REDD interventions. By addressing the drivers of deforestation and degradation, the project activities helped to recharge carbon stock in panchayati forests, the implementation of this project also generated alternative livelihood opportunities for villagers as well.

One of the many ponds developed under a rejuvenation project in rural parts of Punjab, Haryana and Rajasthan

Water conservation through rejuvenation of pond with participatory community engagement

TERI undertook rejuvenation of ponds in rural parts of Punjab, Haryana and Rajasthan. Scientific assessment was done to evaluate the recharge potential of each pond using modelling/ GIS techniques and available data on rainfall and soil-type. Civil work included dewatering, pond excavation, inlet and outlet, and recharge structure construction. The project also focused on capacity building of the local community and raised their awareness on the aspects of water conservation. In total TERI rejuvenated 8 ponds and the total water potential created was 19,51,475 kilolitres per year.

Knowledge exchange

Adaptation Futures (AF) conference was first to be held in Asia hosted by TERI in collaboration with World Adaptation and Science Programme (WASP) spanning for 5 days starting from October 04, 2021 to October 08, 2021.

In recent 26th Conference of the Parties (COP26) from 1–12 November 2021 in Glasgow, TERI organized a high-level panel discussion 'Demystifying COP 26: Key takeaways and future roadmap for India' with the key members of the Indian delegation to hear their views on the outcomes and future roadmap to achieve the targets laid out by India.

TERI partnering with The Embassy of France in India organized cross country knowledge exchange sessions under the flagship of TERI's 'Multi-Country cooling platform' and as a part of project SHEETAL - Alliance for Sustainable Habitat, Energy Efficiency and Thermal Comfort for All. The sessions facilitate panel discussion, bringing together policy and cooling industry experts from India and France around sustainable cooling across sectors such as building and cold chains.

Along with The Incubation Network team workshops were organized by TERI for the municipal officials of the selected cities of Varanasi, Panjim, Vadodara, Surat, Delhi Municipal Corporation, Raebareli and State Pollution Board.

26th Conference of the Parties (COP26) from 1–12 November 2021 in Glasgow

Impact we created

Global contributions by the earth science and climate change sphere:

- Contributed to the IPCC special reports and assessment report, AR6.
- Analysed the proceedings at UNFCCC and Montreal Protocol, including mitigation, adaptation, finance and technology along with informing the negotiation process by facilitating Track-2 discussions.
- National Policy Contributions made in Indian NDCs, India's Cooling Action Plan, recommended national-level intervention on clean air and scalable solution, contributed to national-level emission inventory and provided advisory to several institutes.

Sub-national policy contributions:

- Prepared State Action Plans on Climate Change for Uttarakhand, Puducherry, and Chandigarh
- Contributed in Heat Action Plan for Odisha
- GHG inventory and climate mitigation plan for Andhra Pradesh.
- State of environment report for Nagaland, Chandigarh, and Punjab.
- EI and SA for Delhi-NCR and provided policy recommendations to reduce air pollution.

Contributions towards corporate actions in the form of:

- Preparing carbon pricing handbook, Public-Private Partnerships on Disaster Risk Reduction for 3 cities (Cuttack, Vijayawada, and Visakhapatnam) in India, climate risk and disaster profiling of APSEZ Mundra, Gujarat, Technological solutions for reduction of air pollution in Surat, Pune and Nagpur.
- Estimating potential reduction in emission while Transition to natural gas from solid fuels in the industrial clusters of Sanga Reddy, Varanasi and Gurugram and cost effectiveness of interventions for control of air pollution in Delhi, innovative climate products at a granular scale for various stakeholders.

Alternate packaging materials study aimed at analysing the alternatives to plastic packaging in Tamil Nadu, Kerala, and Uttar Pradesh helped in reducing society's dependence on the unnecessary use of plastics and marine litter.

With support from UNICEF India, a **heavy metal assessment of water of the River Yamuna** was conducted, resulting in recommendations by government bodies for the river water quality-related exposures vis-à-vis health risks and prohibitions by the National Green Tribunal (NGT).

An assessment of benzene concentration at retail outlets of petrol resulted in the final **'Comprehensive Action Plan, 2017'** by the Environment Pollution Control Authority (EPCA) and the NGT guidelines came into force for installation of Stage I and Stage II Vapour Recovery System (VRS) in all retail outlets with a capacity of 3000 km.

We provided recommendations to enhance water-use efficiency in industrial and agriculture sectors. In agriculture sector, package of practices demonstrated on farm for Kharif crop which led to **water saving in the range of 6-30%.**

TADOX® Technology is adopted by the Office of the Principal Scientific Advisor, GoI under City Knowledge Innovation Cluster-Delhi Research Implementation and Innovation for Wastewater Management.

Tangible impact created in terms of providing carbon incentive to the farmers and the local communities through **carbon finance project**. The mined reclamation work is converting the red mud dump sites into cultural areas.

We worked towards **developing finance from carbon trading** which helped in generating an additional finance and use it for community development as well as activities that help in conserving the biodiversity.

The **SCP work** through building local capacities and working with ecosystem stakeholders, contributed to sustainability.

We initiated various pilot projects in states of Punjab, Gujarat and Haryana to promote **agroforestry,** enhance the income of farmers, and also help these states to move forward towards **carbon neutrality.** In case of Punjab and Gujarat, this initiative has been proven successful as the carbon credits will be issued by **VERRA** and it is processing the issuance for Punjab and Gujarat projects.

Mechanized road sweeping operations and audits for Delhi Municipal Corporation, TERI, as a third party identified the areas for improvements in such operations and enhance the effectiveness of these machines. This led to waste minimization, resource optimization and also enhanced municipality's awareness on environmental records and regulatory compliance.

Awareness and sensitization through training programmes

Partnerships and Networks

The NRC Programme closely works with State Departments all over India, with the Ministries in the Central Government, such as, MoEFCC, MoTA, MoRD, Ministry of Water Resources, MoUD, etc. to influence the policymaking at national level. The Programme also works with a number of corporates, academic Institutions, number of community-based institutions across India, multilateral and bilateral organizations, nationally and internationally.

TERI's work on water resources attempts to disseminate knowledge through research guidance, research publications in peer-reviewed international publications and media articles published from time to time, engagement in talks on the occasion of World Water Day, National Science Day, International Women's Day, etc.

Knowledge Building and Dissemination

Under the NRC Programme efforts are made to consolidate learnings from various projects, build capacity of stakeholders and disseminate achievements and key insights.

Contribution to knowledge building

It is worth mentioning about 63 publications under NRC Programme and the list of the range of publications may be seen in the link provided below.

Details on Knowledge Building; Partnerships and Networks can be viewed via the following URLs:

[1] https://www.teriin.org/sites/default/files/files/Partnerships_and_Networks_List.pdf

[2] https://www.teriin.org/sites/default/files/files/Knowledge_Contribution_List.pdf

Sustainable Habitat

Sustainable Habitat Programme promotes sustainability in the urban context through developing a wide range of solutions for buildings, sustainable mobility and planning, governance of low-carbon resilient cities, and GRIHA building ratings.

Themes and Commitments

Thematic focus – a bird's eye view

In Sustainable Buildings Space we strive to promote low-carbon, integrated and low-cost solutions to developmental concerns in the built environment. Such endeavour enables TERI to mainstream the principles of sustainability in the buildings sector.

TERI's engagement in **Sustainable Mobility** encompasses long distance mobility, aspects of urban mobility, modelling and projections for transport demand – both in the passenger and freight businesses.

TERI's work on **Urban Planning and Governance** focuses on strategic planning, policy research, and capacity building to foster improved and informed decision-making for sustainable urban development.

Rating of built environment projects is another flagship initiative that **GRIHA Council** pursues. GRIHA is committed to minimising resource consumption, waste generation, and overall ecological impact within certain nationally acceptable limits / benchmarks.

Larger goals and the context

Sustainable Habitat Programme's research endeavours cover 10 SDGs: SDG 3, SDG 5, SDG 6, SDG 7, SDG 9, SDG 10, SDG 11, SDG 12, SDG 13 and SDG 17.

Sustainable solutions promoted

Environmental design consultancy

We specialize in improving performance of green buildings, suggest energy efficient systems and include resource efficiency in building designs.

Centre of Excellence for Sustainable Habitat

In partnership with Mahindra Lifespaces, TERI established a Centre of Excellence (CoE) for Sustainable Habitat that aims to perform in-depth studies on thermal comfort, building envelopes and visual comfort. The NABL-accredited Lab provides support to building construction industry with state-of-the-art lab for evaluating the thermos-physical properties of building materials.

GRIHA Council

- **Ratings and Review:** To upkeep with striking the balance between existing and upcoming market trends, the rating requirements are periodically updated.
- **Training and Capacity Development:** The details of all our training related activities can be found at: https://www.grihaindia.org/all-events

Resource and energy efficiency audits

- We conduct audits and recommend retrofit measures with the intent of optimizing energy consumption and improving resource efficiency in existing buildings.
- We have developed novel and cost-effective movable window-shading solutions, developed benchmarks and framework for performance assessment of new age shading devices, through field studies, lab testing, test bed monitoring.

Sustainable building policy research and consultancy work

- Linked to implementation of energy efficiency building codes, Modification of building bye laws to include resilience, promotion of passive solar buildings and bringing circularity in built environment.
- Our Centre of Sustainable Mobility offers low-carbon solutions and taken lead in designing web-based tools and curriculum for capacity building, etc.
- Through effective **Urban Planning and Governance** we are supporting cities in actively working towards mainstreaming the concept of liveability in urban planning and policy frameworks and developing strategies to drive their climate agendas forward.

Our Accomplishments

Over all 37 projects were executed across India, out of these:

- 14 were environmental design consultancy projects for green buildings
- 18 were research projects, and
- 3 were project management cells created for implementation of energy efficiency in buildings

We work with a diverse range of organizations, including nodal ministries/departments, PSUs, corporates, academia and international development agencies.

Pan-India projects cover states of Ladakh, Odisha, Madhya Pradesh, Maharashtra, Goa, Chhattisgarh, Telangana, Karnataka and Kerala.

Two International research projects carried out cover China, Indonesia, Nepal, Pakistan and Sri Lanka, Bangladesh, Bhutan, Maldives, Myanmar Thailand, and Timor-Leste.

In addition, GRIHA launched **several ratings and certifications** including SVA GRIHA V3, JAN (Jan Awas Nirman) GRIHA, GRIHA Water Positive Certification, Zero Waste Certification and Decarbonizing Habitat Programme.

Role in reducing carbon footprint

- Improving resource efficiency of existing and new buildings
- Promoting building materials and construction technologies having low embodied energy
- Promotion of circularity in built environment
- Mainstreaming sustainable mobility and decarbonization of transport sector
- Managing urban heat island effect

> "TERI's deep engagement with the states and urban bodies augurs well for the national initiative on sustainable mobility. At this juncture, we need to broaden our coverage to include the deployment of electric buses through the opex model and at the same time take a closer look at issues affecting the financial viability of the State Road Transport Undertakings"
>
> -Mr Sanjay Mitra, Distinguished Fellow, TERI

Approach and innovation

Diverse nature of projects requires unique approaches. Implementation projects strive for mainstreaming of energy conservation building codes and technologies in the states that depend heavily on local expertise and knowledge available with the stakeholders and fine-tuning an appropriate strategy calls for an objective understanding of local wisdom and technical prerequisites.

TERI adopts a multidisciplinary approach in providing low-carbon transport solutions to various stakeholders. Further, TERI carries out research to help create sustainable, resilient and smarter cities.

GRIHA Council evaluates and rates a vast variety of buildings including newly constructed buildings and existing buildings. All rating variants undergo periodical technical revisions based on in-depth research to enhance ease of implementation and adoption, incorporate national and international building standards, market feedback, user experience and technological advancements.

Inspirational evidences

Release of 'Guidebooks and Toolkits under Mahindra-TERI Centre of Excellence (CoE)'

Mahindra Lifespace Developers Ltd (MLDL) and The Energy and Resources Institute (TERI) jointly hosted a launch event on 22nd November 2021 for the release of 'Guidebooks and Toolkits under Mahindra-TERI Centre of Excellence (CoE)' with a special focus on disseminating the innovation and outcomes of the project and creating awareness amongst the built environment professionals.

Report Launch at MoHUA

The event also saw the kick-off for the project **Multi-pronged Approach to Promote Use of Energy Efficient Glazing in Indian Context**, which is envisaged under the aegis of MoU signed between TERI and Glazing Society of India (GSI) in February 2021.

Details can be found at
https://mahindratericoe.com/events.php

MoU Signing at MoHUA

Eco-Niwas Samhita Design Aider

Eco-Niwas Samhita Design Aider tool is a unique, user-friendly, design-based tool developed under the research project Mahindra-TERI Centre of Excellence for Sustainable Habitats, a joint research initiative of Mahindra Lifespaces and TERI. This tool facilitates the user to devise the different configurations of materials and assemblies and select the optimized solution to meet the compliance for VLT, WFRop, Uroof, and RETV for affordable housing at the preliminary/pre-construction design phase.

More details can be found at:
http://mahindratericoe-ens-design-aider.com

Guidelines on Water Efficient Measures for Residential Townships

Mahindra Lifespaces (MLDL) and Sustainable Habitat Programme, TERI jointly released the Guidelines on Water Efficient Measures for Residential Townships' on the occasion of 'World Water Day'.

Report on circular built environment, highlights from Asia launched at UN COP26 Climate Change Conference

TERI launched a report on Circular Built Environment, Highlights from Asia: Policies, Case Studies & UN2030 Agenda indicators at the United Nations COP26 Climate change conference in 2021 for UN One Planet Network's Sustainable Building Construction (SBC). It is a deep dive into the SBC state of play for the circular built environment in six countries — China, India, Indonesia, Nepal, Pakistan, and Sri Lanka.

- TERI launched Sustainable Urban Freight Charter and Website on 25 June 2021 through a virtual platform. The website was launched by Mr Pawan K Agarwal, Special Secretary, Logistics Division, Ministry of Commerce and Industries. The Coalition is a consortium of stakeholders of urban freight from government, industry, and academia.

Become a member:
https://sufcoalition.org/public/index.php

For more details:
https://www.teriin.org/project/sustainable-urban-freight-initiative

- Urban Living Lab on Sustainable and Smart Cities in India with the support from the Royal Danish Embassy (RDE), established India's first Urban Living Lab (ULL) in Panaji, Goa. The objective was to develop and integrate global and local sustainable solutions that would enable the smooth implementation of the Smart Cities Mission by the Ministry of Housing and Urban Affairs (MoHUA), Government of India.

Beta Launch of Digital Initiatives — SLDE and GHG Calculator (organized by Department of Logistics, Ministry of Commerce and Industry)

Ministry of Commerce and Industry (MoCI) launched the beta version of its digital initiatives – Secure Logistics Document Exchange (SLDE) and Greenhouse Gas (GHG) Calculator – on 28 July 2021. The GHG Calculator has been developed by TERI with the support of GIZ and the beta version is available in the public domain. TERI has designed the calculator by including the air and water transports.

Link for the Calculator:
http://freightghgcalculator.com/

TERI signs MoU with DULT, Bengaluru

TERI signed a Memorandum of Understanding (MoU) with Directorate of Urban Land Transport (DULT), Government of Karnataka on 30 June 2021 to develop low-carbon urban freight in Karnataka. Details can accessed through:

https://www.teriin.org/press-release/dult-teri-sign-mou-work-developing-low-carbon-urban-freight-karnataka

TERI has also been nominated as the member of the City Logistics Coordination Committee by the Government of Karnataka

TERI Organised Virtual Learning Event of the Project Urban Living Lab

TERI along with Oxford Policy Management and Transitions Research organized a virtual event on the Project Urban Living Lab on 20 December 2021. The deliberations focused on key intervention areas, namely, Urban Flooding, Urban Ecology, Mobility (Non-motorized Transport), and Data-driven Governance for achieving urban sustainability in India.

More details can be found at:
http://www.urbanlivinglabindia.org/

TERI Launches First International e-Certificate Course on Mainstreaming Urban Climate Action with EUD India, IURC and NIUA

TERI in collaboration with the Delegation of European Union to India (EUD India), the European Union International Urban and Regional Cooperation (IURC) programme, and National Institute of Urban Affairs (NIUA) launched an e-Certificate Course on Mainstreaming Urban Climate Action on 29 September 2021.

Mainstreaming Urban Resilience

The policy document launched with NIUA at the World Urban Forum-10 focuses on mainstreaming urban resilience in policy and planning, data-driven decision-making, strengthening capacities, and building partnerships for enabling development of resilient cities.

TERI Organized a Stakeholder Round-table on Sustainable Mobility for COP26 Charter of Actions

TERI organized a round-table on Sustainable Mobility and actions required by India towards Low-carbon Transport on 31 August 2021. TERI is preparing a COP26 Charter of Actions, which will look into the current challenges and solutions towards low-carbon transport in India.

Organized a Session on Strategies to Decarbonize Transport Sector During WSDS 2022

As part of TERI's flagship event World Sustainable Development Summit (WSDS) 2022, a thematic session was organized on Strategies to Decarbonize Transport Sector.

Organized Thematic Session on Electrification of Heavy-duty Vehicles during WSDS 2022

TERI organized a thematic session: Electrification of Heavy-duty Vehicles – An Emergent Economic Opportunity on February 17, 2022. The panel discussed the short-term and immediate steps to incentivize this sector for faster adoption of e-trucks and the long-term action plans towards a zero-emission sector and making India a global leader in manufacturing and export hub.

Organized Thematic Session on Electrification of Heavy-duty Vehicles during WSDS 2022

- GRIHA organized its annual summit as **The GRIHA Event** on 10th December, 2021. The theme for the event was **Restoring Green Economy.**
  Details available at:
  https://www.grihaindia.org/newsletter/dec21_2.html
- The **GRIHA Product Catalogue Dashboard,** GRIHA's annual magazine **Shashwat Let Nature Be** (Link to the magazine: **https://www.grihaindia.org/files/shashwat/2021/mobile/index.html)**
- Besides, **SVA GRIHA V3** rating were launched during the GRIHA Event, and an MoU was signed with Govardhan Ecovillage.

GRIHA Council launched the Decarbonizing Habitat Programme manual at the World Urban Forum in Poland to estimate an Organization/ company/ industry's current carbon footprint and adopt cost-effective strategies that will help in reducing the footprint in the future.

Impact we created

TERI helped Madhya Pradesh remove language barrier for implementation of Energy Conservation Building Code (ECBC) by helping the state to notify ECBC in two languages, Hindi and English, thus improved penetration of ECBC in the masses.

TERI is undertaking large-scale training and capacity building for implementation of ECBC and promotion of innovative construction technologies in the in both government and private sectors the efforts of TERI will help government achieve the targets of NDC and Housing for All.

Report on 'Water Sustainability Assessment of Chennai and Gurugram ' launched under the MTCOE has identified the potential risks of existing water infrastructure of the cities and supported local authorities in making decisions for augmenting their infrastructure for year 2025.

TERI helped in mainstreaming of Passive Solar Heated Building in Ladakh, and provided the administration way forward for inclusion of passive design measures in energy conservation building codes and draft building byelaws for Ladakh.

Online platform a and tools like Digital Library on Green Mobility and Web-based cost and emission calculator, has created awareness for in low-carbon transport in India and help authorities to examine high-impact policy solutions and pathways that lead to transport decarbonization.

'Demonstration of Geothermal-based Heating and Cooling System Integrated with Solar Power' project showcases energy efficient and long-lasting technology that could be replicated to meet the state's space heating problems and solutions. The project is conferred with the SKOCH Silver ward under the 'State Governance Category 2022' for its innovation.

GRIHA has projects across the country with a combined footprint spanning more than 721 million square feet. GRIHA-rated projects have a installed capacity of 533 MWp of renewable energy systems along with other energy efficiency measures which are offsetting 83,93,046 tonnes of CO_2 from being released into the atmosphere every year.

Based on the development of a web-based cost and emission calculator by us Indian Railways has introduced the concept of Rail Green Points for their freight operations.

GRIHA-rated projects have resulted in water savings of 10,36,11,250 kL/annum. About 2,66,770 newly trees have been planted and 28,000 trees have been preserved through sustainable site planning.

Building material testing services of MTCoE is helping industry, academia and research laboratories across the country in evaluating thermal performance of building materials, thereby promoting thermal comfort and energy efficiency in building sector.

Knowledge Building and Dissemination

Sustainable Habitat Programme has carried out the knowledge building and dissemination of its work through various platforms. The efforts are summarized below.

- 5 reports
- 2 patent reports
- 2 policy briefs
- 8 opinion articles
- 3 guidebooks
- 3 conference papers

- Apart from assessing the environmental performance of green buildings, GRIHA Council organizes several research, training, and CSR activities ensure the promotion of energy efficient building construction throughout the building industry. The details of all our training-related activities can

Launch of Manual on 'Decarbonizing Habitat' Programme at the World Urban Forum 2022, in Poland

be found at: **https://www.grihaindia.org/all-events**

- GRIHA also has a GRIHA Learning Centre, where training modules on GRIHA V.2019 are available. Details at: **https://www.grihaindia.org/learning-centre**
- Case study brochures of all rated projects of GRIHA are uploaded in the website. Details at: **https://www.grihaindia.org/case-study**
- GRIHA Trophy at the annual **National Association of Students of Architecture (NASA)** convention to inculcate the idea of sustainability through thought provoking approach to design in the young and budding architects.
- Webinars with various organizations like IIA, ISHRAE, EMC Kerala, COA, etc. on various aspects of green buildings and GRIHA rating were conducted.
- An intensive complimentary training on the latest GRIHA V.2019 rating was conducted as a handholding activity to extend support to all our stakeholders understand the latest version better.

Partnerships and Networks

The link provided here gives an idea about partnerships developed in the financial year of 2021/22.

Details on Knowledge Building; Partnerships and Networks can be viewed via the following URLs:

[1] https://www.teriin.org/sites/default/files/files/Partnerships_and_Networks_List.pdf

[2] https://www.teriin.org/sites/default/files/files/Knowledge_Contribution_List.pdf

Social Transformation

TERI's **Social Transformation Programme** focuses on pan-India grassroots initiatives. These initiatives involve research, modelling, policy advocacy, demonstration, consultancy, CSR activity, etc. and touch lives of a diverse range of communities such as farmers, micro and small entrepreneurs, fishermen, school students, women-led SHGs, costal and tribal communities, etc.

Themes and Commitments

Thematic focus – a bird's eye view

With its focus on clean and rational use of energy, TERI continues to strive for a climate-resilient and Atmanirbhar rural India. Interweaving elements of gender and social inclusion at every stage of design and implementation in all its interventions — this has been the cornerstone of TERI's endeavours. In the Rural Energy and Livelihoods (REL) space, TERI addresses a wide spectrum of techno-social dimensions such as:

- Technology design and customization to address energy access issues unique to each geography
- Building green skills for better absorption of RE technologies in rural parts of India
- Action-driven research to strengthen green energy implementations
- Business model development for livelihood opportunities
- Renewable Energy-based solutions for quality and reliable power
- Amplification and linkage creation between livelihoods, health, and education

Larger goals and the context

Social Transformation Programme REL initiatives encompassing clean energy solutions and sustainable capacity building, envision helping India achieve its Net Zero targets by 2070.

Some of the key projects undertaken include development of **clean and reliable solar-based power infrastructures** and **green skill-based training programmes** to improve the operational reliability and just transition of power.

In the process, Social Transformation Programme addresses 10 (out of 17) SDGs: SDG 3, SDG 5, SDG 6, SDG 7, SDG 8, SDG 9, SDG 10, SDG 12, SDG 13 and SDG 17.

Sustainable solutions promoted

- **Off-shore wind floating energy platform**
- **Solar-based solutions: irrigation pumps, home lighting system, LED street lights and DC fan, portable solar powered cold storage and boats, solar water pumps for drinking water supply, etc.**
- **Hybrid solar charging units for power looms**
- **Clean biomass cook stoves**
- **Large-scale village adoption programmes for community development**
- **Developing green skills of rural India is a key intangible sustainable solution, actively advocated by TERI**

Our Accomplishments

Number and nature of projects

Till date, 177 projects have been executed across India and with the objective of social transformation, 43 grassroots initiatives are still on-going. In the reporting year 32 projects have been executed.

These projects involve research, modelling, policy advocacy, demonstration, consultancy, CSR activity, etc. The projects touch lives of a diverse range of communities such as farmers, micro and small entrepreneurs, fishermen, school students, women led SHGs, costal and tribal communities, etc.

Promoting solar-powered solutions in MSMEs of rural India

> "Social Transformation Division strives for an inclusive society through partnerships, policies and practice."
>
> -Dr Asha Ram Sihag, Distinguished Fellow

NRL's Solar Domestic Systems Project The project will undertake Installation of Solar Domestic Systems (SDS) with provision of Solar Home lights and Fan in and around the villages of Numaligarh Refinery Limited's CSR Initiative in the un-electrified households of the villages in the pheriphery of NRL in Assam.

Sustainable Energy in Micro-enterprises for Income and Livelihood Enhancement (SMILE) The project would attempt to work with multitude of stakeholders, following an ecosystem development approach, to identify and remove barriers, specifically for the micro and tiny industries, towards improvement of energy efficiency and adoption of renewable/solar energy, build capacity, create financial instruments and establish linkages with financial institutions and facilitate/support deployment of energy efficient and solar equipment for the processing value chain.

Energy access for livelihood promotion This engagement promotes the idea of livelihood enhancement and incremental income for weavers, through energy provision for power loom. With the financial assistance received from Indus Towers, under their CSR initiative, and co-funding mobilized from the community, over a period of 12 months, 37 units of Hybrid Solar Charging Unit (HSCU) for power looms (Type-I) for energizing ~ 148 power looms, 36 units of HSCU for power looms (Type-II) for energizing ~ 144 power looms will be made.

Role in reducing carbon footprint

A special focus on CO_2 emissions' mitigation is placed in all the projects undertaken by REL.

- One-hundred and thirty-four units of Hybrid Solar Charging Units (HSCU) for power looms installed in Varanasi helped reduce emission of 484.81 metric tonnes of CO_2 per year.
- Clean cook-stoves promoted through rural disseminations mitigated 30-35% of indoor air pollution (per unit).

Approach and innovation

Sustainable and customer-centred Social Transformation Programme initiatives helped develop clean energy technologies that are shared through open source platforms. Implementation methodologies are being adapted to changing contexts, in order to increase process efficiencies and to reinforce best practices through policy advocacy and capacity building.

Relentless efforts were made to create sustainable, market-led value chains that align commercial and social objectives of stakeholders. This has led to developing customized technology options, responsive service mechanisms, localized and inclusive entrepreneurial business models, generating awareness and livelihood opportunities at the grassroots level.

Solarizing remote areas of India to improve energy access

Inspirational Evidences

Demonstrations

Various holistic village and school development programmes with CSR funding on the theme of **Natural Resource Management** have been implemented majorly in Haryana, Jharkhand and other parts of India. The on-ground factors that manifest positive changes, transformation, greater adoption of clean energy practices and behavioural changes in the rural communities have been captured through some audio-visuals are listed below:

Film / Video	YouTube link
Weaving in The Sunshine: a film on hybrid solar charging unit for power loom	https://youtu.be/2oQEHmjIMdU
Solar Flow in Mandakini: a film on battery-powered boat	https://youtu.be/bJ2N50_S5jA
Anjora: the light	https://www.youtube.com/watch?v=WNTk-Qx6Nmc
Solar Chandna: a documentary on solar micro grids	https://www.youtube.com/watch?v=_N63ERilrEE
Chai Talk (online) 2021, virtual seminar on Zoom app, organized by Weber Shandwick in partnership with PR moment India	https://www.youtube.com/watch?v=yALdTUmwLA0

Success stories

- We took lead in providing infrastructure for reliable energy in remote schools to ensure quality education for the children. The initiative integrated renewable energy with quality learning and local economy imaginatively.
- More than 380 students were imparted training in solar energy-related skills by leveraging the **'Green Skill Development Programme'** of the Ministry of Environment Forest and Climate Change (MoEFCC). About 50% have been placed in different industries and a few of them have started their careers in green entrepreneurship.

- As a part of a major project with World Bank Group, we successfully established **25 women-led Uttam Urja Shops** and disseminated 4,000 clean cookstoves in Bihar.
- An integral stepping stone for pan-India penetration is TERI's flagship initiative for clean energy access – 'Lighting a Billion Lives'.
- Commissioning of solar-powered boats directly benefitted 10 boatmen in enhancing their income and impacted lives of 50 persons. It has also helped in reducing the emission of CO_2 by 32.16 metric tonnes per year. In addition to that, all boatmen were also trained regarding the safe handling of trolling motors and minor rectifications.

TERI's work at national-level events

Impact we created

Owing to prevailing problems of energy access, reliability of energy supply, poor operation and maintenance there was wastage of 3-4 working hours due to power cut, sound pollution and CO_2 emission due to diesel generators, disruption of household chores and livelihood activities, etc. Interventions targeting these issues, benefitted the rural population, which resulted into **regular power supply, reduced electricity bill, no disruption of livelihood activities, greater time saving, reduced CO_2 emission, sound and indoor air pollution.**

Provided **Green Skill trainings to 380 rural youth** of India. About 50% have been placed in different industries and a few of them have started their careers in green entrepreneurship.

Provided livelihood to 25 women in Bihar with establishment of **Energy Enterprises**, more than 4000 clean cooking solutions were also disseminated.

The initiative on **ensuring reliable energy supply to remote schools** helped promote green jobs, enhanced career and entrepreneurial opportunities.

TERI designed the **Solar Charging Stations and retrofitted boats** for a project in consultation with the boatmen community of Uttar Pradesh, to address their productivity challenges arising due to unreliable and unaffordable energy supply.

Knowledge Building and Dissemination

Consolidation of learning from varied projects geared towards sustainable energy promotion and social and gender inclusion enabled TERI in sharing innovative and proven ideas, ground insights and policy perspectives – at various local (village and state), national and international levels for a thorough participation in knowledge exchange events. Various publications based on action research and other innovations helped in reaching out to researchers, practitioners, policymakers and other actors.

TERI Team with our flagship Integrated Domestic Energy System (IDES) technology

Solar boats on the shores of Ganges

Contribution to knowledge building

- 62 publications
- 100+ articles
- 1 patent
- 4 patents have been filed

Partnerships and Networks

TERI constantly strives to draw synergies with national and state-level government programmes, to integrate the scope of energy access into other related sectors such as: livelihoods, health, education and women's empowerment.

Working in conjunction with government schemes, programmes and a range of rural development initiatives, TERI has successfully reached the remotest of areas to provide energy poor communities the access to clean technologies for basic and productive use. To create a cadre of socially conscious youth, contributing towards a better and brighter future and for facilitating progress towards the achievement of the Sustainable Development Goals (SDGs), TERI also incorporates students and young professionals in the rural energy access framework.

Details on Knowledge Building; Partnerships and Networks can be viewed via the following URLs:

[1] https://www.teriin.org/sites/default/files/files/Partnerships_and_Networks_List.pdf

[2] https://www.teriin.org/sites/default/files/files/Knowledge_Contribution_List.pdf

Advanced Biofuels

Advanced Biofuels Programme (ABF) through its circular bioeconomy approach focuses on integrated production of clean fuels and green chemicals and broadly addresses climate, energy and food security goals.

Themes and Commitments

Thematic focus – a bird's eye view

We address climate, energy, and food security issues. Advanced Biofuels Programme has been exploring opportunities to develop and demonstrate sustainable technologies for clean and green energy production from renewable non-edible resources such as lignocellulosic woody biomass, agricultural residues, aquatic weeds, algae, and organic matter.

We make these technologies commercially viable. TERI has been relentlessly pursuing research to produce the high value industry platform green chemicals, renewable materials by using the co-products generated from biofuel process, as the feed.

We are actively engaged in demonstrating innovative technologies under the aegis of the Department of Biotechnology, Ministry of Science and Technology, Government of India that has helped set up the DBT-TERI Centre of Excellence Project on, 'Integrated production of Advanced Biofuels and Bio commodities".

Being driven by this intent, **Advanced Biofuels** Programme attaches significance to the following thematic areas:

Microbial Biofuels and Biochemicals (biotechnological approach)

Pyrolytic Biofuels, Biochar and Green Chemicals (thermochemical approach)

Microbial biofuels and biochemicals: The research activities centre around the domain of bio-based renewable technologies. Further, this area is also exploring the possibility of production of renewable chemicals along with biofuels. These production processes are being carried out in an integrated manner to make the bio-based products cost economical with an emphasis on zero waste production.

Pyrolytic biofuels, biochar and green chemicals: It revolves around R&D on thermochemical and catalytic conversion of agro-residues and waste residues. Besides, technologies have been developed for production of green chemicals like allyl alcohol, acrylic acid from renewable glycerol for bioplastic applications.

Larger goals and the context

Advanced Biofuels Programme research endeavours cover 4 SDGs: SDG 7, SDG 9, SDG 14 and SDG 17.

Dedicated research studies paved the way for technology demonstration for marine algae cultivation in the coastal. This technology holds importance in the context of water, energy, climate, and food security issues.

Technologies have been developed for production of green H_2 in pilot scale using non-edible feed (aquatic plant, algae biomass, organic waste) and this has the potential to contribute towards the nation's net-zero aspiration.

Moving forward, Advanced Biofuels Programme's research is aiming at production of renewable materials from non-fossil-based resources.

Sustainable solutions promoted

Marine algal production and bio-refinery

- Marine algae cultivation in the coastal site in a 100,000-litre scale
- Deployment of algal biotechnology for enhanced marine algae productivity
- Co-production of biodiesel, bio-H2, bio-oil, aqua feed, and animal feed in a bio-refinery approach using marine algae as platform feed

Biocommodity and green chemicals

- Microwave-assisted extraction technology for recovery of high value pigment from algae
- Lactic acid production from commercial grade sugar, black strap molasses, and biomass
- Biochar/high grade carbon through pyrolysis
- Renewable glycerol to platform chemicals (allyl alcohol and acrylic acid) for bio-plastic, 2,3 butane diol

Advanced biofuel

- Microbial biotechnology for green H_2 production in pilot-scale from marine algae, agri-residue biomass, sugarcane black strap molasses
- Green 2,3 butane diol product made from low-cost commercial feed and crude glycerol
- Integrated bio-refinery for generation of varied products from marine algae
- Microbial technology for bioethanol production
- Microbial technology for enhanced biomethane prodution from livestock waste and agri-residues
- Production of aviation/transport, refinery grade fuel from agro residues, de-oiled algae and wet marine algae, plastic, tyre, etc through pyrolysis technology.
- Green diesel and bio-diesel from used cooking oil (UCO) and marine algal lipid

Policy research / consultancy

Policy recommendations and consultancy in the areas of:

- Sustainable biofuel
- Bioenergy and
- Bio-plastics

Our Accomplishments

Number and nature of projects

Overall, 18 projects were executed across Mumbai (Airoli, Navi Mumbai), Goa and Gual Pahari (Gurugram). The major target segments catered are oil-making industries, farmers, rural sector, industries associated with manufacturing of commodities, aquaculture, and animal husbandry.

> "Optimal usage of bio-mass based resources through coproduction of industrially important bio-commodities, along with clean biofuels paved the way for demonstration of biorefinery process that can contribute to offset the biofuel cost as well as mak the process zero waste. This holds importance in the context of circular bioeconomy."
>
> Dr Vibha Dhawan, Director General, TERI

Advanced Biofuels Programme

One demonstration project was executed

DBT-TERI Centre of Excellence

Under DBT-TERI initiative, executed 11 research projects on "Integrated production of advanced Biofuels and bio-commodities"

Other research projects

Six individual research projects carried out, one policy research, and one research and networking project executed

Role in reducing carbon footprint

- **Production of high-density liquid fuels account for 10% of anthropogenic CO_2 emissions.**
- Microalgae-based high density renewable fuels can offer **environmentally-sustainable pathway towards decarbonization of transport sector.**
- Large-scale onsite marine algae cultivation in the Mumbai coastal site has contributed to **sequester around 3 tonnes of CO_2.**

Ultimate objective set

- To enhance productivity of biofuel and reduce production cost
- To develop end to end indigenous technologies to coproduce high-value biocommodities — aqua/animal feed, bioplastic, 2,3 butane diol, biochar, etc.

Risks faced in achieving the objective

- High cost of advanced biofuel production
- Pyrolytic oil not yet penetrated in Indian market though it has potential

Approach and innovation

The major challenge for microalgae biofuel is the economic viability, which is mainly attributed to the cost of microalgae. Considering the water, food, energy and climate security issues, ABF research explorations dealt with technology deployment for microalgae production.

These explorations **contributed to enhance biomass productivity by 1.5 fold higher scale and reduced the microalgae cost by 40–50%. Optimization of process parameters led to enhancement of oil productivity of microalgae (25% enhancement in outdoor scale).**

Oil extraction technology from wet algae helped set the milestone to reduce the cost of microalgae.

Further, to offset the algal biofuel cost, end-to-end technologies were developed to produce value-added green bio-commodities.

To derive more value, the co-product (crude glycerol) of biofuel process has been used as feed to produce renewable chemicals for industrial applications.

Our collective interventions led to enhance the process efficiency and operation cost reduction.

More than 95% biodiesel conversion efficiency has been achieved through thermo-chemical interventions.

In order to create wealth from waste, agro residues and oil extracted marine, algae biomass has been used to produce pyrolytic biochar.

Inspirational Evidences

Demonstrations

Marine algae cultivation for application in biodiesel and bio-commodity production

This is the first-of-its-kind demonstration for marine algae cultivation in India.

This technology deployed across the coastal region of India to raise the marine algae biomass as feed for production of clean and green fuel and high value bio-commodities.

Demonstration of end-to-end technologies, enhanced biomass productivity of marine algae, on-site harvesting, oil extraction from wet algae, has addressed the challenges of algal biofuel.

Technology development for production of third-generation biofuel (algal biodiesel)

Marine algae cultivation in 100,000 L (220 sq. m) sunlight distributed algal production system in Mumbai coast	Onsite harvesting of wet marine algae	Wet marine algae processed for lipid extraction	Lipid extracted from marine algae	Green chemical from renewable glycerol

TERI's technology has entered a stage where bio-oil and biochar could be recognized as the building block for thermal biorefinery for co-production of fuels and chemicals.

TERI pilot pyrolyser (patented)

Biochar green pellets

Green H_2 production through biological route

TERI's interventions in this domain has led to technology demonstration for green H_2 production. Photofermentation method was integrated to enhance the overall H_2 yield efficiency and to make this process zero waste.

Success stories

- Renewable (Green) 2,3 butane diol (2,3BD) production
  Deployment of this technology will assist in developing a cost economical bio-product — '2,3-butane diol'. This is a specialty industry platform chemical that has profound applications in several industries (synthetic rubber, cosmetics, flavour, and pharmaceuticals). In the recent past, this molecule is gaining global attention as a precursor molecule of biojet fuel.

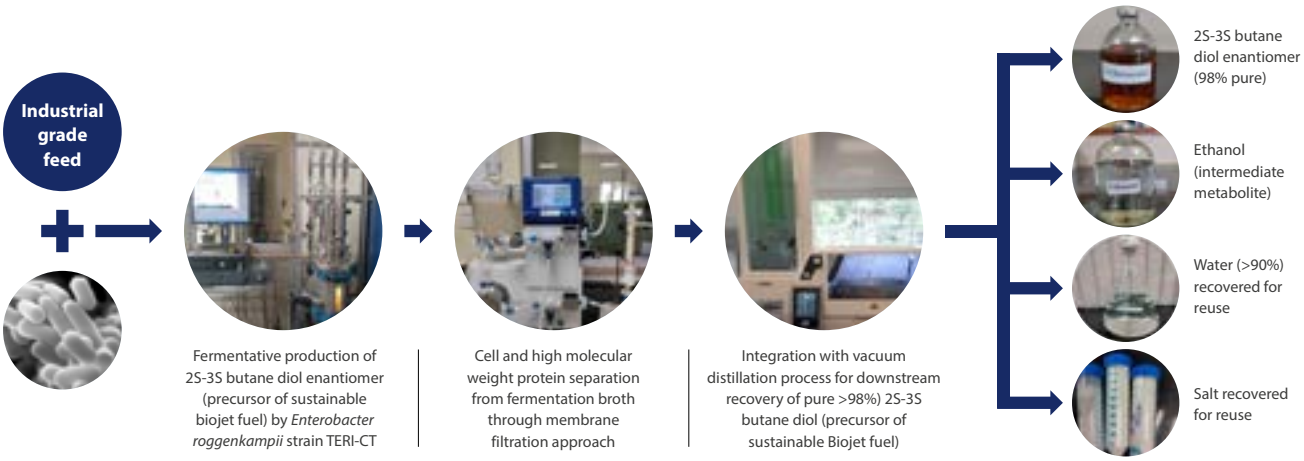
- Bioethanol production
  For industrial-scale production, high ethanol yielding, thermos-tolerant and solvent tolerant strains are desired and TERI's interventions led to develop process for bioethanol production using the host with these desired traits.

- Enhanced methane recovery from organic livestock waste
  Major challenge of conventional biogas (methane) process from cattle dung is low-methane yield and long-hydraulic retention time (HRT). To address these challenges, interventions were made through next-generation sequencing approach, analysis of microbial population and their abundance.
  These studies led to the enhancement of biogas process efficiency in terms of high-methane yield and reduction of HRT. Methane proportion in the biogas got enhanced from 35% to 60% and HRT of the process got reduced from 21 days to 8 days.

- Green biodiesel production
  A two-stage in-house acidic and basic ionic liquid (IL) catalyzed process has been developed for production of biodiesel from renewable oil
  feedstocks.
  More than 95% biodiesel conversion efficiency could be achieved. The life cycle environmental impact of TERI's solar integrated biodiesel conversion process shows significant reduction for 14 impact categories.
  TERI has developed and patented a green process of making acrylic acid through ally-alcohol pathway from renewable glycerol.

- Biochar production from biomass
  TERI has developed the process for pyrolytic char derived green pellet production for combustion applications.

TERI's pyrolytic biochar made from mustard and rice stalk at different pyrolytic conditions is used for soil fertility experiments and growth of medicinal plants of *Centalla asiatica* and results are promising.



Impact we created

Formulation of special growth medium led to enhanced oil productivity of microalgae by 25%. These interventions led to reduce microalgae cost by 40–50%.

Oil extraction technology from wet algae has eliminated the energy-intensive drying process.

The Ionic Liquid (IL) catalyst-based green diesel process developed by TERI, has eliminated the water use for purification process.

Solar integrated Ionic Liquid catalysed biodiesel conversion led to low water and carbon footprint.

Technology (zero waste) developed for 2,3-butane diol production has led to enhanced extraction efficiency and reduced extraction cost. More than 90% water recovered (with >95% purity) for reuse.

Coventional petroleum feedstock replaced by renewable feedstock (glycerol) for acrylic acid production through allyl alcohol pathway.

Technology developed for green H_2 production from biomass has led to enhanced H_2 yield efficiency.

Customized aqua feed formulated using de-oiled algae biomass has boosted immunity in fish breeds.

Knowledge Building and Dissemination

To achieve the net-zero aspiration, it is essential to look for alternate renewable fuels and chemicals that are carbon neutral.
Demonstration of alternative technologies addressed the current challenges of bioproces.
These explorations paved the way to make this process zero waste and reduce the overall cost of the biofuel. The results and learning from these interventions and research led to an insightful understanding of sustainable solutions, and strengthening the well as team's conviction to amplify these results for greater adoption and scaling.

Contribution to knowledge building

- 18 publications
- 14 international presentations
- 4 patents

Partnerships and Networks

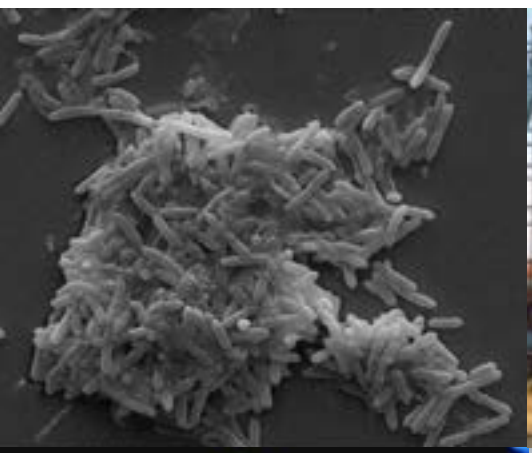
- Most of the research grants (>90%) secured from the Department of Biotechnology, Ministry of Science and Technology, Government of India.
- Few grants received from private industries, national and MNCs (The Araville Green Energy Ventures Pvt. Ltd; L'Oréal Group, Paris; Asian Clean Fuels Association, Singapore; and Global Challenges Research Fund).
- Long-term partnership with the Department of Biotechnology, Ministry of Science and Technology, Centre of High Technology (MoPNG), Government of India, is worth mentioning.

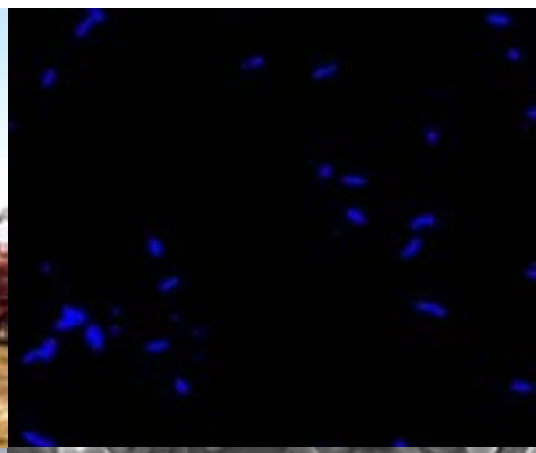
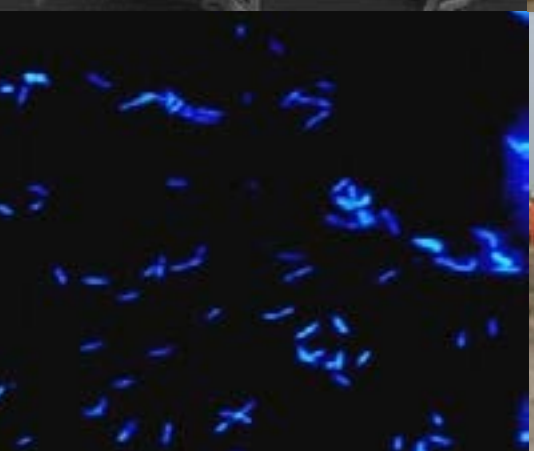
Details on Knowledge Building; Partnerships and Networks can be viewed via the following URLs:

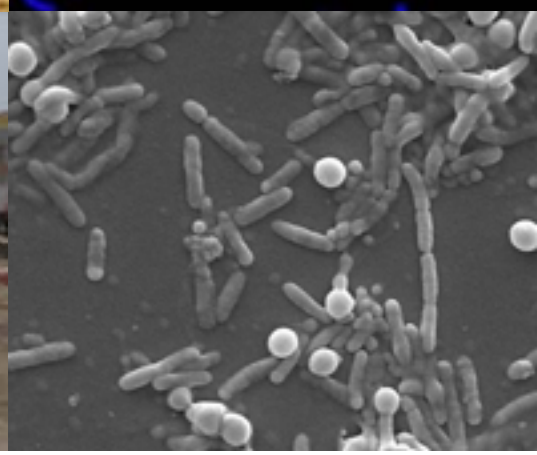
[1] https://www.teriin.org/sites/default/files/files/Knowledge_Contribution_List.pdf

Environmental and Industrial Biotechnology

The **Environmental and Industrial Biotechnology (EIB) Programme** is committed towards protecting the environment, finding new solutions, and developing innovative green sustainable technologies for large-scale applications in the fast-growing economy.





Themes and Commitments

Thematic focus – a bird's eye view

The EIB programme addresses bioenergy, and environmental issues. The Programme has been exploring opportunities to develop and demonstrate sustainable solutions for clean and green energy production, with an intent to replace non-renewable energy sources and restoration of degraded environment.

We make technologies of ecologically friendly commercial value. TERI has successfully developed a best-selling technology, 'Oilzapper', at a large scale. It is globally acknowledged for its broad-scale implication in cleaning of oil spills and treatment of oily sludge generated by oil refineries.

We are actively engaged in demonstrating innovative technologies under the aegis of the Oil and Natural Gas Corporation, or ONGC. A technology for enhance oil recovery in dead or abundant oil wells is currently being commercialized by the joint venture company OTBL (ONGC-TERI Biotech Limited) formed by ONGC and TERI.

Being driven by this intent, **EIB Programme** attaches significance to the following thematic areas:

Microbial Biotechnology

Bioremediation Technology

Microbial Biotechnology intervention promotes sustainable approaches for protection of the environment, development of innovative technologies and non-renewable energy production for commercial application. The basic and applied research enables microbes towards development of a sustainable solution for industry.

The Bioremediation Area is working on large- scale implementation of different environmental technologies; particularly on bioremediation of oil spills to restore crude oil contaminated oilfields, treatment of hydrocarbons, pesticides contaminated and other organic compound polluted sites and production of biopolymer based drilling mud for oil companies.
Further commercialization is undertaken by ONGC TERI Biotech Ltd (a joint venture of ONGC and TERI, www.otbl.co.in).

Fermentation Technology Research Centre has a state-of-the-art bioreactor facility, with series of bioreactors from 3.2, 15, 30, 100, 200, 1500 and 13,000 litres to carry out research at TERI, Gual Pahari.

TERI has developed globally acknowledged technology- **'Oilzapper'** on an industrial scale, using the bioreactor facility.

Industrial-scale bioreactors at TERI, Gual Pahari

Larger goals and the context

EIB's research endeavours cover 4 SDGs: SDG 7, SDG 9, SDG 13 and SDG 17.

- Currently, in partnership with the government agencies and various public and private industries, the Programme is keen on finding a sustainable solution to climate change-related problems and environmental sustainability. EIB plans to do so by identifying and engineered bacteria for the production of cleaner energy forms, carbon capture and storage that would displace the methane on coal seams with carbon dioxide, as well as bio-remediation of mine water treatments.
- The EIB Programme has also started some corporate social responsibility (CSR) initiatives, such as, development of green corridor and awareness generation to educational programmes that focus on the given SDGs and overall skill enhancement in schools, community, governmental agencies and other stakeholders, with the objectives to promote entrepreneurship skills that may lead to a generation of healthy young minds.

> "Oilzapper has demonstrated its efficacy in treating oil sludge and cleaning oil spills in India and abroad. A healthier planet demands we promptly scale up and widely implement such proven bioremediation technologies."
>
> -Amb. Ajai Malhotra, Distinguished Fellow, TERI

Our Accomplishments

Number and nature of projects

Over all 14 projects are being carried out across the country. EIB Laboratory is NABL accredited for water testing/hydrocarbon analysis, enabling us to get more projects from research, monitoring and testing. Projects executed were sponsored by the Department of Biotechnology (Government of India), Department of Science and Technology, Oil and Natural Gas Corporation Ltd, Oil India Ltd, and many other public and private Industries.

The Bioremediation Technology Area created a facility which is now spread over 33,000 sq. ft. with state-of-the-art bioreactors and utility facilities for large-scale production of oilzapper and other bacterial cultures.

Demonstrated and studied feasibility of bioconversion of carbon dioxide to methane in coal seams/ subsurface conditions of coal mines.

Demonstrated water-based sustainable biotechnological polymer-based solutions for drilling fluid applications in the oil and gas sector.

Carbon sequestration to commodity chemicals, targeting major industries.

Role in reducing carbon footprint

- Bioconversion of CO2into methane (CH4) provides an alternative to conventional coal-based energy sources and contributes to the reduction of CO2in coal seams.
- Development of green corridor (plantation) on highways and greening of schools has offered environmental sustainability.
- There has been focus on sequestration of carbon dioxide with simultaneous production of commodity chemicals.

Sustainable solutions promoted

Microbial enhanced oil recovery (MOER)

- A technology for enhancing oil recovery in dead or abandoned oil wells
- Highly effective bio-based technology for tackling viscosity reduction of heavy oil in flow line

Bioremediation

- Sustainable solutions to industries – oil and gas, pharmaceuticals and pesticides
- Environmental risk mitigation arising out of industrial operations
- Industrial research through development of innovative bio-based technologies
- Restoration of degraded land

Biologically enhanced methane production

- Utilization of biotechnological processes to convert lowest grade or unrecoverable coal into methane
- Use of methane-generating bacteria that can act on coal seams to produce biogas; consisting mainly of methane and carbon dioxide
- Enhancing methane production for commercial use with the aim of phasing out other coal-based non-renewable energy sources

Water-based drilling fluid applications

- Indigenous drilling fluid (mud) for the replacement of chemical-based fluids currently being imported and used by oil and gas industries

Application of oilzapper at the bioremediation site, ONGC, Mehsana, Gujarat

Approach and innovation

The EIB Programme mainly focusses on basic and applied research and exploring innovative solutions; particularly in the area of oil and gas sector.

Conversion of coal into methane and conversion of CO_2

Conversion of coal into methane and conversion of CO_2 into valuable products through anaerobic fermentation process, control of souring of oil reservoir, microbial enhanced oil recovery, prevention of paraffin deposition in oil well tubings, and control of microbial induced corrosion.

Production of D (-) Lactic acid production using membrane integrated bioreactor

TERI's team has collaborated with IIT, Guwahati, for the integrated biofermentative production of D (-) Lactic acid at low cost. The intent was to develop a techno-economic strategy for effective valorization of whey to D (-) Lactic acid – for additional revenue generation and mitigation of environmental pollution.

Consultancy services for environmental monitoring and assessment

The Programme has provided consultancy services for the ONGC oilfields of Ankleshwar, Gujarat for the assessment of soil fertility loss caused by exploration and exploitation.

Inspirational Evidences

Demonstrations

Development of hexachlorocyclohexane (HCH) degrading bacterial formulation and field trial demonstration

Our studies have reported that biostimulation and bioaugmentation methods are practically viable approaches for decontamination of HCH; as observed at the HCH dumpsite located at Umari Village of Barabanki district in Uttar Pradesh.

HCH dumpsite located at Umari Village, Uttar Pradesh

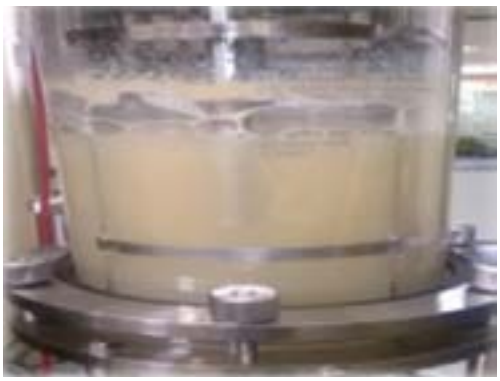
Bioremediation activity under progress

University of Delhi, TERI, CSIR-NBRI joined hands together with complementary expertise are involved to undertake demonstration of the remediation of large HCH dumpsite.

TERI has conducted bioaugmentation and biostimulation field demonstration at site. The bacterial formulation and specially designed nutrient mixture developed by TERI were applied into the field. Field trial assessment has been going on over the last two years and the progress is satisfactory.

Development of eco-friendly oil well drilling fluid: XC polymer (xanthan gum)

In 2015, TERI initiated research in the area on development of XC polymer with a view to provide an eco-friendly technology in the oil industry, to be used for drilling fluid/viscosifier. The feasibility studies of the developed product has been analyzed and further tested at the Institute of Drilling Technology (IDT), ONGC Dehradun, and Chemical Laboratory, Oil India Limited, Duliajan. Currently TERI and OEC are exploring the opportunity of enhanced biological methanation at the Raniganj CBM block.



Bioreactor containing Xanthan gum

International collaboration

TERI collaborated with Korea Maritime and Ocean University, South Korea and developed the hybrid system called 'up-flow anaerobic bioelectrochemical system' (UABE) for enhanced methane production from distillery wastewater.

UABE system and its application

Success stories

- **Microbial enhanced oil recovery**

  A technology for enhancing oil recovery from dead or abundant oil wells was jointly developed with Institute of Reservoir Studies, ONGC. Three patents have been granted for the process: Indian, Canadian and US Patent.

  A customized biological solution has been developed for US oilfields in a joint venture with Glori Oil and is being implemented in oil wells in Texas, USA.

- **Microbial Treatment for paraffin deposition in surface flow lines**

  A technology for microbial mitigation of paraffin deposition in surface flow lines was jointly developed with Institute of Reservoir Studies, ONGC. The patent for paraffin mitigation in well tubulars has been filed.

- TERI has completed a mega-sized **international soil bioremediation project with the Kuwait Oil Company** in Kuwait (funded by Kuwait Oil Company).

- **Oilzapper** technology has been used at most oil-producing companies and refineries in India and abroad, on a turnkey basis.

Oilzapper product

Before bioremediation

Application of Oilzapper at Kuwait Oilfield

After bioremediation

Impact we created

Commercialization of technologies through ONGC TERI Biotech Ltd (joint venture between ONGC and TERI)

Oil and Natural Gas Corporation Ltd (ONGC) joined hands with The Energy and Resources Institute (TERI) in forming ONGC TERI Biotech Ltd (OTBL), a joint venture, to find sustainable solutions and provide 'green' technology services to the oil and gas sector. For details, please visit www.otbl.co.in.

Biologically enhanced methane production from coal

TERI, in association with OEC, has developed and demonstrated the microbial process for enhancement of gas in coal bed methane (CBM) wells at Jharia, Bokaro. The field demonstrations have validated that there is multi fold increase in methane gas production. The intent is to take the technology forward to wells in Raniganj; eventually extending it to other operators that have a national presence.

Microbial enhanced oil recovery (MEOR)

The developed technology is currently commercialized by the joint venture OTBL, formed by ONGC and TERI, and implemented in stripper wells – 126 jobs have been completed so far. Currently carrying forward MEOR activities with heavy oilfields, the programme has developed a highly effective bio-based technology for tackling viscosity reduction of heavy oil in flow line. In India, there are more than 7000 stripper oil wells identified for enhanced oil production by using the MEOR technology.

Microbial treatment of paraffin deposition in surface flow lines

Paraffin mitigation jobs implemented and monitored have given success ratio of 84% with average scrapping free period being 5-6 months against daily/alternate day/ weekly scrapping. Prevention of paraffin deposition by using microbes has proven to be an economically viable and sustainable approach.

Knowledge Building and Dissemination

Contribution to knowledge building

- 7 publications
- 10 patents

Biological methane production demonstration at Bokaro job site

Biological methane production demonstration at Jharia job site

Partnerships and Networks

- Most of the research grants for EIB are sponsored by the Department of Biotechnology, Ministry of Science and Technology, Government of India.
- Long-term partnership built with the Oil and Natural Gas Corporation Ltd, Oil India Ltd, ONGC Energy Centre and ONGC TERI Biotech Ltd.
- Funding for numerous projects has been received from various oil companies.
- There have been collaborations for research work with various educational institutes from India and overseas.

Details on Knowledge Building; Partnerships and Networks can be viewed via the following URLs:

[1] https://www.teriin.org/sites/default/files/files/Partnerships_and_Networks_List.pdf

[2] https://www.teriin.org/sites/default/files/files/Knowledge_Contribution_List.pdf

Sustainable Agriculture

The **Sustainable Agriculture Programme** dedicates itself towards creating innovative solutions and developing new ways for profitable farming and livelihoods, at the same time, conserving natural resources.

Themes and Commitments

Thematic focus - a bird's eye view

Our research focuses on Sustainable Agriculture, Environment, and Bioenergy by developing plant- and microbe-derived products that help reduce the use of chemical fertilizers while substantially improving crop yields, thereby reducing the carbon footprint.

Our other key areas include nano-biotechnology and plant biotechnology, are to develop a range of green products like nano- and bio-fertilizers and agriproducts, superfoods, algal-based bioenergy, and resilient crop plants to biotic and abiotic constraints, besides enhancing their nutritional profile.

Our multi-pronged efforts are aimed at improving soil and plant health, leading to sustainability in agriculture and the environment.

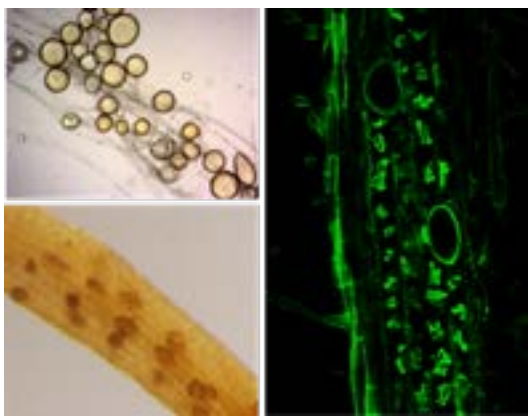
Agri Nanotechnology
Nano Biotechnology
Nano, Microbial, and Biotechnology

Mycorrhizal Research
Mycorrhiza for Soil and Plant Health

Community Farming and Livelihood
Capacity Building

Micro-propagation Technology Park
Tissue Culture

Nano, Microbial, and Biotechnology theme addresses challenges in agriculture and environment through innovative and interdisciplinary nano-biotechnology and nature-based solutions utilizing microbiomes, microbes and plants. Key aspects include microbiome-based advanced bioformulations, delivery of nutrients and agrochemicals, and nano-sensors for use in agriculture, etc. Such products would enhance productivity in agriculture and reduce risk to human health and environment.



Arbuscular mycorrhizal fungi symbiosis with plant roots

Research on mycorrhiza has successfully translated the nutrient-tapping potential of the symbiotic system and developed a technology that eventually produces mycorrhizae-based biofertilizer. The facility supports in-vitro mass production technology that produces healthy, genetically pure, and high-quality mycorrhizal propagules for

practical applications. More on Centre for Mycorrhizal Research can be accessed at **<http://mycorrhizae.org.in/cmcc/>**

Efforts are being made to promote novel farming initiatives and sustainable farming practices, primarily aimed towards improving livelihoods and effectively reducing migration in Uttarakhand. **Community farming** with its primary focus on promoting local vegetation including medicinal, horticultural, and aromatic crops, providing training and serving as a resource centre for value-added products, especially for women and tribal farmers as an economic activity. Some landless families who were earlier working as bonded labourers have now been able to produce their own harvest through community farming initiatives. These initiatives are being replicated in many villages of the state.

Reclamation of wastelands with TERI technologies

Micro-propagation Technology Park has emerged as a pioneering initiative on using tissue culture for mass propagation of economically important crops including medicinal plants, cash crops, aromatic, fruits crops and forest plants. This is also linked to creating livelihoods through proactive market linkages and business development.

Larger goals and the context

Majority of the work we accomplish on sustainable agriculture aligns with major UNSDGs.

We are achieving sustainability in agricultural practices

by improving soil quality and health while enriching soil biodiversity, using a rich microbial germplasm bank to develop biofertilizers and nano-agri inputs. Active efforts are now being made to study the effects of carbon sequestration in soil.

We have successfully designed safe biological and nano-delivery systems for efficient and cost-effective solutions to overcome challenges in agriculture and combat/ mitigate climate change effects.

Sustainable solutions promoted

New formulations of mycorrhizal biofertilizer

Harnessing the mycorrhizal–microbiome and isolating many synergistic, agriculturally relevant bacteria is an important component of the programme. Three new formulations are being developed, tested in house and are now being tested on large scale by industries and large farm holders, not only in India but in other parts of the globe including Jordan. The initial results have shown that apart from reduction in chemical fertilizers, irrigation water consumption has decreased significantly.

Nanonutrients and nanofertilizers

Biologically produced multiple nano-nutrients with efficient adsorption, diffusion and uptake ability (Nano Zn–Fe, NanoP, and NanoDAP) are being produced.

Microbial products

Development of microbial pigments as natural and sustainable sources of colorants for food, cosmetic and application in textile are being pursued.

Value-added products from agro-residues

Lignin depolymerization and isolation of high-purity lignin (>99%) with ~79% yields from 2-G biorefinery residue.

Microalgal farming

Ecology-inspired solutions by growing algal consortia increased algal productivity and supported in crop protection. We have successfully developed a tool to track nutrient stress in real-time algal cultivation system for a successful cultivation of marine microalgae.

Microencapsulation technology

Next-generation microencapsulation technology for nodulating rhizobacteria (non-sporulating bacteria) species using natural polysaccharides with the desired size of microspheres loaded with microbes for seed coating applications with higher shelf life has been developed.

Reclamation of wastelands

Successful examples of sites reclaimed using this beneficial microorganisms include fly ash overburdens, alkali–chlor laden sites, distillery effluent discharge sites, phosphor–gypsum ponds, coal mines, red mud, saline, and arid sites.

Plant biotechnology

Development of rice with enhanced photosynthesis for obtaining higher yields under elevated carbon dioxide conditions. The bioengineered rice capable of synthesising its own nitrogen with no adverse effect on climate has been developed.

Our Accomplishments

Number and nature of Projects

Research and development, consultancy, technology transfer, product development, implementation, skill development and research networking are the key focus areas of the ongoing projects. Funding sourced from government, industry, corporate social responsibility and bilateral projects is utilized to implement the associated activities.

Centre of Excellence in Agrinanotechnology (CoEA)

The collaboration between TERI–Deakin Nano Biotechnology Centre (TDNBC) and partners—All-India Institute of Medical Sciences (AIIMS), Tamil Nadu Agricultural University (TNAU), region-specific nanotechnology solutions for the selected locations in India are being developed.

In addition to nanoagro-inputs, CoEA also specializes in:

- the biomass refining and converting waste to wealth using green and biomining approaches.
- nano-sensors for pathogen detection in food and field.
- development of nano-technologies for addressing issues such as water contamination and soil health.
- serving as a platform for lifecycle analysis and safety assessment of nanomaterials, evaluated as per the OECD and NIH guidelines.

For more information, access to **<https://www.teriin.org/projects/coe-ncearan/>,** can be made.

Farming of microalgae for upscaling and value-added products

Role in reducing GHG emission

- **Nanofertilizers:** Development of nanofertilizers using biological approach, leading to minimal generation of chemical waste. We have achieved reduction in application rate by 100 times as compared to conventional fertilizers.
- **Next-generation mycorrhizal biofertilizers:** Climate-responsive mycorrhizal biofertilizers have superior field performance with improved plant and soil health with less use of water.
- **Reclamation technology:** Replenishment of wasteland while creating green cover of native species.

Skill development and capacity building

TERI–Deakin Nanobiotechnology Centre (TDNBC): In collaboration with TERI SAS, India and Deakin University, Australia, we extensively contribute in building capacity of next-generation scholars. For more information, please visit **<https://tdnbc.teriin.org/index.php>**

DBT–TDNBC–Deakin – Research Network Across continents for learning and innovation (DTD–RNA): Considering the importance and relevance of joint research platform, TERI–Deakin Nano Biotechnology Centre (TDNBC), Gurugram, India and Deakin University, Australia, in association with Department of Biotechnology, Government of India has

Advanced laboratory facilities for developing technologies for sustainable agriculture

created DBT–TDNBC– DEAKIN–Research Network across continents for learning and innovation (DTD–RNA). This is the unique network and has the vision to contribute to a better world through nanotechnology. For more information, please visit **<https://tdnbc.teriin.org/index.php>**.

Approach and innovation

The major work challenge is bringing sustainability in agricultural practices through reduced use of chemical fertilizers while substantially improving crop yields.

A notable progress is being made in nanofertilizers, super foods, renewable energy-based agricultural solutions and algal-based bioenergy.

To derive more value, efforts are being made to reach potential stakeholders and disseminate proof of concepts and knowledge through public–private partnerships for making agriculture sustainable in India.

Inspirational Evidences

Extensive efforts are being made to transfer products to private sector and enhancing the capacity and awareness on the respective technologies.

Licensed technologies

Nanofertilizer and pesticides: Nano-agriproducts developed for meeting regulatory compliance along with maximizing benefits and minimizing risk among farmers and consumers.

Next-generation mycorrhizal biofertilizers: Next-generation advanced and climate-responsive mycorrhizal biofertilizers are being powered by TERI's patented high-quality in-vitro mass production technology.

Technology for reclaiming wastelands: Providing expertise for greening and reclamation of wastelands using mycorrhiza.

Product launch of 'Uttam Superrhiza', which commercializes an advanced mycorrhizal biofertilizer

Next-generation micro-encapsulation technology: Functional and compatible with commercial polymers, known carriers, and existing technologies that pave the way for incorporation for seed coating.

Seed coating: Efficient film coating of structured semi-synthetic hydrogel and beneficial microorganisms to provide a beneficial environment and improved yields of pre-inoculated seeds.

Licensed services

Instrumentation: Facility is equipped with advanced range of instruments that are being leveraged by stakeholders and collaborators.

Consultancies: Training programmes in capacity building for technology development and quality assurance for mycorrhiza-based products, bacteria-based products and nanomaterials for:

- Biotechnology and agriculture SMEs
- Technology commercialization
- Product development
- Production/business plans
- Quality assurance services

Molecular marker and fingerprinting: We provide AFLP- and SSR-based services to seed and horticulture industries.

Barcode development for commercial isolates of arbuscular mycorrhizal fungi (AMF): For identifying conserved protein-encoding housekeeping as well as functional symbiotic associated genes of these fungi, that can serve as molecular traits. This would help open opportunities to develop agriculturally important AMF isolates for sustainable agriculture.

For more information on licensed technologies and services, please visit **<https://terismartagrisolutions.com/>.**

Success stories

- Successful field trials were conducted with ICAR institutes of major nanofertilizers (NanoUrea, NanoP, NanoDAP), resulting in significant increase in yield and plant health.
- Three new advanced mycorrhizal biofertilizer formulations have been developed and tested by industries.
- World Economic Forum recognized TERI's reclamation technology as one of the innovative technologies working to conserve and restore India's forest landscapes.
- Developed effective formulations of nano-copper and nano-sulphur fungicides which would reduce the dosage of application by 15–50 times on common fungal diseases like early blight in tomato and potato, and powdery mildew in okra.

Impact we created

Application of **TERI Nano Urea 100% only foliar (T4)** and **RDN 50% + TNU 100% (T7)** resulted in more vegetative growth as well as girth of the maize stem as compared to other treatments at pre-tasselling stage after first foliar spray.

Nano-agri inputs including (fertilizers, pesticides, and smart carriers) provided by us are being **used by the public sector and the farmers,** followed by commercialization by the private sector.

250 women farmers in Himalayan villages were **trained for growing high-altitude medicinal plants** and linked with the markets to diversify their livelihoods.

Skill development and **capacity building** of researchers, farmers, fertilizer company personnel on nanoscience led to greater commercialization of nanoproducts by the private sector.

- Launched an advanced mycorrhizal biofertilizer product—Uttam Superrhiza—a unique granular product that is powered by TERI's *in-vitro* PEG Technology of Performance Enhancing Green Biologicals. This is an exceptional growth promoter technology, providing native biological inputs that complement mycorrhiza performance for synergistic effects and superior field performance.

DTD RNA Research Network Programme under DBT-TERI-Deakin University collaboration

Knowledge Building and Dissemination

The work carried out under different areas of sustainable agriculture programme enables TERI in developing effective partnerships with various stakeholders such as public organizations, private, NGOs, industries for research and development required for product translation and dissemination of best practices.

Contribution to knowledge building

- Projects: 40
- Trainings: 38
- Publications: 250
- Patents: 5

> "Sustainable agriculture – meeting today's food and fibre needs without compromising the ability of future generations to meet their's – calls for accelerated innovation in a wide range of fields from natural resource management to livestock, crop improvement and value creation in agri-food markets and supply chains."
>
> -Dr Marco Ferroni, Chair, CGIAR System Board

Over, 40 projects were executed across India. The primary target segments are agriculture, farmers, fertilizer, agrochemicals, seed and nutraceutical industries, and industries associated with the manufacturing of bio-commodities.

Around 29 training, skill and capacity-building programmes were conducted on recent trends in precision agriculture through webinars, conferences, summer and winter school, and hands-on training helped next-generation researchers.

Research outcomes were reflected in over 250 research papers, book chapters, and review articles were published in various international and national journals that are available at <**https://tdnbc.teriin.org/publication.php**>

Partnerships and Networks

- Research grants secured from the Department of Biotechnology; Department of Science and Technology; Science and Engineering Research Board and Indian Council of Agricultural Research.
- Few grants received from private establishments and MNCs.
- Long-term partnership with the Deakin University, Australia has led to effective collaborations, leading to the next phase.
- DBT supported the DTD RNA, this is leading to effective community of practices and networking of diverse stakeholders.

Details on Knowledge Building; Partnerships and Networks can be viewed via the following URLs:

[1] https://www.teriin.org/sites/default/files/files/Partnerships_and_Networks_List.pdf
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Communication Outreach and Advocacy

The Communication Outreach and Advocacy (COAU) Programme serves as the organization's pillar of support and the crucial link for all its outreach activities. Its primary focus is to ensure that TERI as a whole evolves to cater to multiple stakeholders that enable the establishment of resilient partnerships, effective collaborations, and long-term associations with the communities as well as across the multidisciplinary programmes within the organization

Sustainable Development and Outreach

Sustainable Development and Outreach (SDO), through its constructivist and stakeholder engagement approach advances the cause of integrating and mainstreaming sustainable development across various actors and segments of the society .

We drive leadership through pioneering conversations. Through our convenings, research and engagement, we seek to advance narratives that drive global ambition and actions at all levels. We provide a platform for exchange of knowledge, ideas, and best practices to advance leadership.

We contribute towards achieving SDGs and the goals of the Paris Agreement. By bringing together leaders and stakeholders, we encourage informed, integrated and collectively driven discussions and actions. We promote mainstreaming of sustainable development through promotion of policy approaches such as green budgeting, research on SDGs and climate action.

We create societal impact through outreach. Through conceptualization and supporting of outreach activities for a diverse range of knowledge outputs, we amplify actionable messages to key stakeholders including policymakers, media, and the public.

Being driven by this intent, the Sustainable Development and Outreach comprises two functional domains:

- Sustainable Development Research and Leadership (SDRL); and
- Communications and Stakeholder Engagement (CSE).

Mobilizing collective leadership is key to mainstreaming sustainable development. World Sustainable Development Summit (WSDS), the annual flagship event curated by TERI, is the only independently convened international Summit on sustainable development and climate action based

Statistics @WSDS 2022

12,000+	143	45	327	25	22	10
Registered Delegates	Countries	Sessions	Speakers	Ministers	Partners	E-Expo Booths

1,800+	600,000+	40,000+
Media Coverage	Social Media Reach	Website Users

in the Global South. The Summit series aims to extend its reach through closer engagement with stakeholders to collectively act through a major initiative on policy research and dialogue - #Act4Earth.

Effective communications and outreach are crucial for a research organization to make societal impact. Cutting edge research at TERI strives to bring about change—small and big—through stakeholder engagement and uptake. Through its multiple channels, the SDO Programme works to communicate TERI's research to stakeholders including policymakers, civil society, research and academia, business and industry, and the media and public at large.

Larger goals and the context

SDO's research and engagement endeavours to cover 6 SDGs: SDG 7, SDG 12, SDG 13, SDG 14, SDG 15, and SDG 17.

Concerted engagement and innovation in the domains of policy research, sensitization and curation have paved the way for driving leadership at all levels.

Sustainable solutions promoted

Annual convening platform

- World Sustainable Development Summit (WSDS) opened up a space for the actors to construct knowledge rather than just passively taking in information.
- Promoted platform for world leaders across the board to reflect upon their experiences and further build on their own representations and incorporate new information into their pre-existing knowledge.
- Reinforced and strengthened commitments at all levels to enhance ambition and action to create a more sustainable and equitable world for present and future generations.

SDG-linked green budgeting

- Design policy processes for integration is sustainable development in budgeting.
- Technical support for preparation of green budget statements and tagging of SDGs, themes, and activities.
- Stakeholder engagement and capacity building to enable design of effective processes to facilitate green budgeting.

Community outreach

- Create content that benefits the farming communities in Uttarakhand on agriculture, education, women's health and nutrition issues.
- Local community driven community radio station with radio jockeying, as well as editorial and technical production.
- Grassroots engagement with the community by promoting community driven knowledge and engagement.

Our Accomplishments

The projects with SDO are multidimensional which range from policy research, and mass communications related activities wherein a variety of stakeholders are engaged with. The reach of the World Sustainable Development Summit Series (2001-2022) is depicted in the map given on the next page.

54 Heads of State and Government | 103 Ministers | 13 Nobel Laureates | 1888 Business Leaders | 2745 Speakers | 38,280 Delegates

WSDS Summit Series (2001-2022)

WSDS 2022 was inaugurated by the Hon'ble Prime Minister of India, Shri Narendra Modi

Approach and innovation

The theory of change for SDO is based on constructivism and stakeholder engagement for advancing the cause of integrating and mainstreaming sustainable development across various actors and segments of the society.

From community engagement to engaging with global leaders, SDO prides itself in being unique in its approach towards outreach.

Inspirational Evidences

WSDS: The 21st edition the Summit was held virtually from 16-18 February 2022, under the umbrella theme- Towards a Resilient Planet: Ensuring a Sustainable and Equitable Future. The Summit was inaugurated by the Hon'ble Prime Minister of India, Shri Narendra Modi, and saw participation from 143 countries.

The 2022 edition of the Summit saw 12,000+ registered delegates from across 143 countries, 22 entities partnered for the Summit.

The media coverage for the Summit was 1,800+, social media reach was 600,000+ and the Summit website users were more than 40,000. Launched flagship knowledge initiative- Act4Earth with two main components: COP Compass; and SDG Charter.

WSDS prides itself in being the only independently convened platform in the Global South that has a mission to drive ambition and action on sustainable development and climate response.

> "The World Sustainable Development Summit tries to bring together political leaders who can translate sustainable development into policy, corporate leaders and executives who can translate it into investment choices, and researchers and academics who can bring the knowledge, analysis and technology to allow corporates and governments to pursue sustainable development and people involved in civil society organizations to connect people with leaders who have the power."
>
> -Mr Nitin Desai, Chairman, Governing Council, The Energy and Resources Institute

Kumaon Vani: Located at Mukteshwar, Nainital and stationed at an altitude of more than 2,286 m, Kumaon Vani (90.4 MHz) reaches out to nearly 500 villages in Uttarakhand. Among the many community-related programmes created and broadcast by Kumaon Vani last year is the short series called 'Samvad' which focussed exclusively on maternal and child health and nutrition.

The radio station also disseminated content on education, environment and rural livelihood, apart from raising public awareness awareness on COVID-19 and human health.

Link: https://www.teriin.org/project/kumaon-vani-community-radio-904-mhz


Kumaon Vani community radio station activities

COP26 Charter of Actions: The COP26 Charter of Actions is a knowledge document prepared by TERI which assimilated questions and thematic options to advance climate action and ambition in the country and globally. The document was successful in demonstrating India's normative leadership on sustainable consumption and lifestyles, and SDG 12.

The Charter covered the themes of equity, green finance, nature-based solutions, adaptation & resilience, energy, clean transport, and business actions. The Charter was released at an official UNFCCC side event in Glasgow.

Link: https://wsds.teriin.org/2022/cop-26.php

Green budgeting: TERI along with the Asian Development Research Institute has assisted the state of Bihar in mainstreaming environment into economic decision-making by providing inputs to the process for SDG-linked green budgeting.

The practice of green budget has resulted in increased allocation for environmental activities in Bihar from INR 5,693 crores in the financial year 2020-21 to INR 7,682 crores in the financial year 2021-22.

Link: https://www.teriin.org/project/green-budgeting-state-bihar

Act4Earth: TERI launched a major initiative titled, "Act4Earth" in the valedictory session of the 21st Edition of World Sustainable Development Summit (WSDS). Building on the discussions from the Summit, this initiative will seek to continuously engage with stakeholders across the board on issues related to sustainable development and climate action.

Link: https://wsds.teriin.org/2023/about-act4earth.php

Impact we created

The myriad Summit sessions, which included 17 plenary sessions, 28 thematic tracks and 10 e-expo booths were driven by 104 plenary speakers and 223 thematic track speakers, witnessed in-depth deliberations on issues covering climate change, sustainable consumption and production, energy and resource security, resilience, and the global commons. The Summit was successful in mobilizing leadership at the highest political levels. The Summit has a mix of stakeholders with enhanced voices of women and youth.

Among its peer group in India, TERI is the topmost organization in terms of social media outreach. TERI uses LinkedIn, Twitter, Instagram, Facebook, and YouTube to share impactful messages and activities.

Outreach that excludes social media translates to losing out on crucial platforms that connect with a larger network of stakeholders.

Social media performance of TERI FY 2021/22

Platform	1-Apr-21	31-Mar-22	Increase
LinkedIn	41,872	57,396	15,524
Twitter	19,188	21,587	2,399
Instagram	1,787	2,350	563
Facebook	35,601	35,938	337
YouTube	56,260	74,689	18,429

Media analytics FY 2021/22

Activity	Total
Interviews	209
News Stories	2470
Op-eds	120
Press Releases	496

Events statistics FY 2021-22

Webinars and virtual events	177
In-person events	36

Several films/videos and other audiovisual content were produced in FY 2021-22.

Several webinars and events were live streamed on the YouTube channel - https://www.youtube.com/teri

Films and Videos

Film / Video	YouTube link
Ag-DSM: Transforming Agriculture, Improving Lives- A case study on utility led Sustainable Agri. DSM	https://youtu.be/CoKEnN6uI1Q
Small Efforts, Big Gains: A film on Demand Side Management	https://youtu.be/z3rVTVNseAk
TADOX: TERI Advanced Oxidation Technology for Wastewater Treatment and Reuse	https://youtu.be/fgpBa1_Atyc
TERI: The best way to predict the future is to create it	https://youtu.be/k98HJvm3Zis
The Green School Project 'Phase-III' film: A TERI and Tata Steel Initiative	https://youtu.be/y2F7DqPCyas
Matters of Particulate Matter: An Air Pollution Education Initiative by TERI	https://youtu.be/3Tr2638Hl2w
Battery Energy Storage Systems: Enable Smooth Transition of India's Power Sector	https://youtu.be/UgLLW5ro0pw
Farming the Sun: Towards Decentralized Applications involving Rural Users	https://youtu.be/gV5H8s3qpWw
Changing Course: Direct Benefit Transfer for Electricity and Sustainable Agriculture Practices	https://youtu.be/vS3lUpBTN28

Podcasts

Podcast	YouTube link
नीला समुद्र और कूड़े का ढेर	https://youtu.be/WHBFry9MZIE
नेट–जीरोः भारत के वादे और चुनौतियां	https://youtu.be/TxJ3D_L2d_U
बढ़ते प्रदूषण के खिलाफ़ ग्रीन बिल्डिंग मूवमेंट	https://youtu.be/LiBh54ohZeo
वो कार्बन जो जलवायु परिवर्तन से लड़ने के लिए है ज़रूरी	https://youtu.be/FxaL56-sfDw

COP26 Charter of Actions was launched in Glasgow at an official UNFCCC side event

> "It is my pleasure to address you all at the Inaugural Session of the World Sustainable Development Summit 2022. The Summit has a legacy of over two decades. It is an annual flagship event by TERI for discussions on climate action and sustainable development. The theme for this year's event is very timely- towards a resilient planet ensuring a sustainable and equitable future."
>
> - Shri Bhupender Yadav, Hon'ble Minister for Environment, Forest & Climate Change

घर का कूड़ा – करें रीसायकल, रीयूज़, रिड्यूज़ (आपका कूड़ा, आपका खज़ाना)	https://youtu.be/OGMWLvrXQKg
आपके कूड़ेदान में रखा है "काला सोना" (आपका कूड़ा, आपका खज़ाना)	https://youtu.be/HSK9k3Qfgwc
कूड़े के ढेर पर चमकते आशियाने (आपका कूड़ा, आपका खज़ाना)	https://youtu.be/gKkejLmk9Us

Knowledge Building and Dissemination

COP26 Charter of Actions: The COP26 Charter of Actions is a knowledge document prepared by The Energy and Resources Institute which assimilated questions and thematic options to advance climate action and ambition in the country and globally. The document, prepared with inputs from stakeholders, was successful in demonstrating India's normative leadership on sustainable consumption and lifestyles, and SDG 12. The Charter was released at an official UNFCCC side event in Glasgow.

> "You have to take everyone with you and also understand their problems and be more caring towards their own colleagues and their families. These virtues are very much ingrained in femininity; thus, the world looks up to its phenomenal women for an effective and creative response to environmental issues that the world is facing today, and to contribute to saving our planet and ensuring that we hand over a livable and safe world to our future generations."
>
> - Dr Vibha Dhawan, Director General, The Energy and Resources Institute

WORLD SUSTAINABLE DEVELOPMENT SUMMIT 2022

TOWARDS A RESILIENT PLANET: ENSURING A SUSTAINABLE AND EQUITABLE FUTURE

February 16-18, 2022

ACT4EARTH MANIFESTO

Presented at WSDS 2022 Valedictory Session

Through the 21st Edition of the World Sustainable Development Summit, The Energy and Resources Institute brought together stakeholders including representatives from international organizations, government, business & industry, research & academia, civil society and youth to deliberate on the modus operandi required for ensuring equitable responses to protect our planet through sustainable consumption and production, energy & resource security, climate justice, and the protection of global commons.

We pledge to Act for Earth by:

- Reinvigorating current multilateral systems by ensuring that climate negotiations and other norm-setting bodies are informed by principles of equity and climate justice, as well as with perspectives from developing countries to drive national and international action.
- Developing multi-level and poly-centric approaches to govern and protect our global commons, which is inclusive of all those who use and depend on these commons, including non-human species.
- Inviting stakeholders to generating financial capital and building capacities for developing green technologies, which helps in inclusive clean energy transitions.
- Avoiding wasteful consumption and promoting efficiency in production patterns, by raising awareness and promoting responsible practices among governments, businesses, and consumers.
- Advocating for paradigm shifts in the global narrative, which decouples the economic growth from environmental degradation.
- Critically examining the dominant narratives on traditional and non-traditional security to advance inclusive, concerted, coherent and effective efforts on sustainable development and climate action.
- Calling upon the global community to bridge the gap between mitigation and adaptation through effective means of implementation, including climate finance, innovation, and capacity building.
- Ensuring policy coherence through mainstreaming sustainable development into economic policy, including through SDGs-linked budgeting processes.
- Communicating issues related to climate change and sustainable development to all stakeholders effectively, through a balanced approach which instils hope, without losing our sight on the gravity of the climate change and limits to growth.

WSDS knowledge creation and dissemination: The Summit has a strong knowledge creation and dissemination component linked with it through outputs such as Summit Overview Document, Act4Earth Manifesto & Strategy Paper, and Daily Summit Bulletins. The Summit saw the dissemination of TERI and TERI Alumni Association outputs as well.

COP26 Charter of Actions: **https://wsds.teriin.org/assets/pdf/cop26-charter-book-pdf.pdf**

Summit Overview Document: **https://wsds.teriin.org/2022/assets/pdf/WSDS_Summary_OVERVIEW_2022_LR.pdf**

WSDS Daily Bulletins: **https://wsds.teriin.org/2022/news-pressrelease.php?type=bulletin**

WSDS Special Issue of TerraGreen: **https://wsds.teriin.org/2022/assets/pdf/WSDS_Summary_OVERVIEW_2022_LR.pdf**

Act4Earth Manifesto: **https://wsds.teriin.org/2022/act4earth-manifesto.php**

Partnerships and Networks

SDO Programme could successfully mobilize support from the ministries as well as multiple bi-lateral and multi-lateral agencies for WSDS, the flagship event of TERI.

Some of our supporters for WSDS 2022 and Outreach Partners:

- Bloomberg Philanthropies [Star Partner]
- Tata Cleantech Capital [Premier Partner]
- The Rockefeller Foundation [Premier Partner]
- IFAT India
- Kaizzen, Natural Resources Defense Council
- Outlook Group
- POP Movement
- United Nations International Children's Emergency Fund – UNICEF, and
- the World Sustainable Development Forum

WSDS Partners: **https://wsds.teriin.org/2022/partners.php**

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Environment Education and Awareness

Environment Education and Awareness (EEA) Division at TERI believes that an environmentally conscious society can be created if youth are empowered with sufficient knowledge, skills, and appropriate attitude and values.

EEA's work enables meeting SDG 4.7 through environmental awareness programmes, meetings, workshops and sensitization sessions with children, youth, educators, and adjoining communities on environmental and sustainable development issues.

EEA has its presence across the regional centres—Goa, Guwahati, and SRC

Our Accomplishments

Overall, ten projects were designed and implemented PAN India on issues related to Environment and Sustainable Development (ESD), particularly behavioural change related to the following:

- Environmental issues
- Health
- Climate change
- Waste management
- Marine pollution

> "India and the European Union are natural partners in development and have an abidable interest in climate action and sustainability."
>
> -Mr Manjeev Puri, Former Ambassador and Distinguished Fellow, TERI

Approach and innovation

EEA periodically brings out bulletins, monographs, workbooks, publications, research papers, worksheets, manuals, films, and other IEC materials.

Keynote Address via video message by H.E. Mr Bhupendra Yadav, Union Minister, Ministry of Environment, Forest and Climate Change, Government of India during YCC 2021

'Youth, Science and Climate Action' session during the visit of H.E. Mr Frans Timmermans, Executive Vice-President, European Commission

The ultimate objective is to strengthen and promote quality education (SDG 4), which is an enabler to achieving the 17 SDGs.

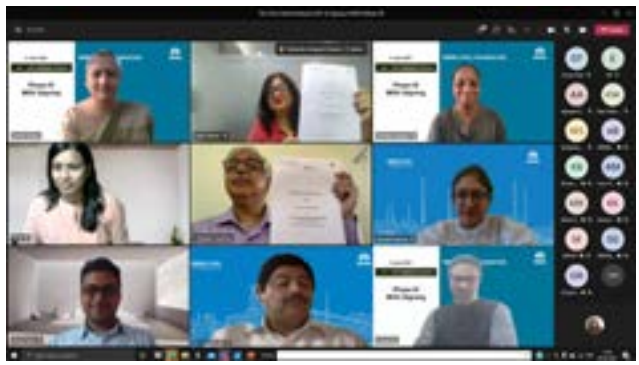
Flagship events

Special interactions with youth were organized to highlight their role in global efforts to combat the impact of climate change.

- Special Youth Plenary organized under TERI's flagship global summit, titled "Intergenerational conversations

towards systemic transformations for achieving Climate Justice" (https://wsds.teriin.org/2022/intergenerational-conversations-towards-systematic.php)

- Launch of Reclaiming the Blue Planet by H.E. Marten van den Berg, Ambassador to The Netherlands in New Delhi and Dr Vibha Dhawan, Director General, TERI in Nov 2021
- The signing of MoU with Tata Steel Foundation for The Green School – Phase IV in June 2021
- Session on Education for Sustainable Development (ESD) Beyond Boundaries as part of POP Movement in Partnership with TERI and SDSN South Asia and SDSN Youth in June, 2021



Signing of MoU with Tata Steel Foundation for The Green School – Phase IV

Impact we created

EEA has reached out to nearly 69,140 students directly in India and has also been working on **community campaigns** with various stakeholders, including government, corporates, and communities.

The **'Green Buddy programme'** as part of Phase IV of the Green school project—A Tata Steel Foundation & TERI initiative enabled students' engagement in various activities.

The flagship programme **'Green Olympiad' (GO)** was completely digitalized where 'Green Skills' was added as a new subject and was well accepted by the schools. The second cycle of **GO4Youth** targeting undergraduate and postgraduate students was done digitally.

A 'youth working document' from an Indian youth perspective was developed as part of the **Changemakers for Climate Action (CCA) initiative** of the Embassy of Italy and TERI, which was presented during the pre-COP youth event in Milan in September 2021.

Youth Declaration on Climate Action and Youth Pledge was read at international platforms such as WSDS and Adaptation Futures 2020. This led youth to voice their opinions and engage in science-based discussions on the most relevant climate change issues.

A national communication strategy was developed to combat plastic and non-biodegradable waste entering the marine environment

As part of 'Promoting Science & Health Communication through Outreach and Capacity Building of School Students and Linked Communities', approximately 20,000 students and teachers were reached out to with science and health workshops and activities that strengthened awareness and promoted adoption of best practices.

Brought together youth to voice their opinions and discuss opportunities in the domain of climate action through different climate action related programmes like Changemakers for Climate Action (CCA); **Youth Climate Conclave (YCC)**—an initiative of the Delegation of the European Union to India, together with GIZ India, CEEW, and TERI.

Evaluation of the implementation and impact of the **Swachh Bharat Mission-Grameen (SBM-G)** and **Jal Jeevan Mission (JJM)** Scheme has been carried out in select districts of Karnataka, which can guide future policies and action.

An **Indo – Dutch wastewater programme** imparted training, enhanced knowledge, built capacity and facilitated action to increase wastewater use to meet increasing water demand for health and sanitation along the Baraphulla drain in Delhi among school students and teachers.

Created sensitization through various activities, competitions, and interactions with subject experts on air pollution, like webinars on **Health impacts of air pollution** for students from Lucknow, Kanpur, Pune, and Nashik. More than 330 students benefited from these events and adopted clean air measures in their school premises.

Launch of 'Reclaiming the Blue Planet' by H.E. Mr Marten van den Berg, Ambassador to The Netherlands

> "Water is key in the Indo-Dutch collaboration. India has a rich history of water conservation which we need to learn from. We have to change our behaviour towards the water, which can only happen if we learn about the issues around it. Given the project's success, an initiative like 'Live with Water' should be carried forward."
>
> -H.E. Marten van den Berg, Ambassador to The Netherlands

Knowledge Building and Dissemination

EEA contributed to a wide range of publications on key themes such as water, green school, forest and biodiversity conservation, water pollution, energy, waste water and reuse, waste management, etc.

1. NCERT publication (2022)- Water: Every Drop Counts. An Activity Book to Foster Water Conservation, directed at Primary, Upper Primary, and Secondary Levels. A Ministry of Education initiative under the Jal Shakti Abhiyan, GOI. ISBN 978-81-949859-8-3 – Livleen K Kahlon, Neha, Shabana Kazi, Saltanat Kazi, Taru Mehta and Monmi Barua
2. Siddique, G., Siddique, Z.F., Kahlon, L. 2022. Significance of Social Systems in Forest and Biodiversity Conservation: Experiences from Jangal Mahals of West Bengal, India. In: Conservation, Management, and Monitoring of Forest Resources in India. Springer, Cham. https://doi.org/10.1007/978-3-030-98233-1_5
3. Neha and Arun Kansal (2022). Acceptability of reclaimed municipal wastewater in cities: evidence from India's National Capital Region" Journal of Water Policy Vol 24 No 1, 212 DOI: 10.2166/wp.2021.197
4. Learn, Investigate and Experiment: Educational Initiative to Engage Students to Promote Reuse of Reclaimed Water. Article. Terragreen (Vol 14, Issue 11, February 2022)- Neha, Saltanat Kazi, and Monmi Barua

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TERI Press

TERI Press, the publishing arm of TERI, is one of India's prominent publishers in the areas of environment, energy, and sustainable development. The Press publishes books, journals, and magazines on these topics at all levels.

TERI Press, in its endeavour to bring greater ecological awareness, has an extensive range of print publications; widely accessible e-books; and sophisticated, interactive e-learning products that cater to every type of reader and knowledge requirement on diverse areas of the environment.

We work with academics across the globe to produce quality content and materials and contribute significantly towards enhancing learning outcomes of the students.

Our Accomplishments

Number and nature of projects

With close to 400 published titles over the years, TERI Press has been a valuable source for filling the learning gap on environment and sustainability.

Book launch - 'Pollution Solutions'

We also provide support and assistance to all programmes for their various publication needs on a wide range of projects.

TERI Press also conceptualizes customized knowledge resources, based on the needs and assessments of the target group. This includes undertaking environment-related projects to encourage an active social connect with the environment.

With every carefully chosen and published title, quality has been the single major idea that drives TERI publications.

TERI Press books and learning resources create a lasting impression and aim to make a positive difference. During 2021/22, while the world continued its path of Covid-19 recovery, TERI Press continued disseminating relevant content to its readers via both analogue and digital platforms.

Given here is the snapshot of some our well-acclaimed publications.

TERI Information Digest on Energy and Environment (TIDEE)

It aims to keep policymakers, scientists, and technologists abreast of the latest developments in the fields of energy, local and global environment, and sustainable development.

Myccorrhiza

This newsletter aims to keep policymakers, scientists, and technologists abreast of the latest developments in the fields of energy, local and global environment, and sustainable development.

Electronic Newsletter on Renewable Energy and Environment (eNREE)

Beneficial for policymakers, researchers, consultants, academicians, and students engaged in the area of renewable energy and environment.

TerraGreen

TERI's flagship digital magazine that deals with issues related to sustainable development, environment, and energy.

Energy Future

It aims to educate and inform you about the wide world of energy: its history, its future, how the energy industry works, how it has affected the world and how is continues to affect you and me.

World Digital Libraries (WDL)

WDL is an international peer-reviewed biannual journal, that seeks quality research papers that present original theoretical approaches.

Journal of Resources, Energy, and Development (JREaD)

It provides a forum for comprehensive investigation, analysis, and review of subjects in the fields of energy, environment, and natural resource management that confront decision-makers, planners, consultants, politicians, and researchers.

TERI Energy & Environment Data Diary and Yearbook (TEDDY)

It is the only comprehensive energy and environment yearbook in India that provides updated information on the energy supply sectors (coal and lignite, petroleum and natural gas, power, and renewable energy sources), energy demand sectors (agriculture, industry, transport, household, buildings), and environment (local and global).

Sustainability and Engagement with Businesses

The **Council for Business Sustainability** undertakes policy advocacy through thought leadership reports and industry dialogues; and builds capacity through trainings, learning visits, webinars, conferences, etc. Concurrently, the **Corporate Social Responsibility** Division undertakes various development-led initiatives for social development and creates opportunities for businesses. Together these divisions help facilitate a sustainable future for India's industries.

Council for Business Sustainability

The 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, the Council recognizes and promotes sustainability leadership practices. Member companies of the Council include public and private sector – including MNCs representing various industry sectors, sizes and geographies. Activities of the Council are governed by an Executive Committee from amongst member companies.

TERI's CBS engages with the core issue of what businesses must do to lead in and shape sustainability.

- The Council co-creates business solutions with member companies to address national sustainability challenges;
- It curates common interest forums of member companies with the participation of board members and Chief Sustainability Officers;
- Undertakes policy advocacy through Thought Leadership reports and industry dialogues;
- 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 showcasing best practices in national and international forums.

> "Sixty-five per cent of Global GDP has showcased net-zero commitment. Various sectors who have committed to net-zero have also come up with their action plan. Awareness on green products and green procurement policies, like labeling, etc., needs to be promoted. Industry can play a crucial role in promoting captive solar plants, e-mobility like electric trucks and electric vehicles. Now is the time to act."
>
> -Mr Mahendra Singhi, Managing Director & CEO, Dalmia Cement (Bharat) Ltd

Meeting with Kerala Transport Secretary

The 2021/22 year witnessed an unprecedented situation of the growing concerns over COVID-19. The engagements with the businesses and member companies of our Council range from diverse webinar sessions and sustainability assessments to organizing the India Sustainability Leadership Summit.

Undoubtedly, the COVID-19 crisis calls for urgent actions by individuals, governments and businesses to shape a better, resilient and sustainable world in the future. Amidst the varied response strategies to the pandemic, 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. It intends to enable businesses, civil society and government to come together to garner support and accelerate actions.

Larger goals and the context

The potential for significant and sophisticated policy advocacy is strong, and TERI's partnership with the **We Mean Business Coalition** offers the resources needed to super-charge these efforts. The foundational goal of this partnership is to accelerate the ambition loop in India and contribute to the country; thus, strengthening its Nationally Determined Contributions (NDCs), putting forward an ambitious long-term strategy and strengthening domestic policies in key sectors to accelerate emissions reductions.

During the year 2021/22, a compelling narrative for India to consider and enhance its climate ambition through a robust LTS framework and monitorable NDCs was built. Through continuous engagements with businesses and policymakers, it is established that businesses are crucial partners in implementing NDCs and lending predictability to India's long-term strategy and policy making.

During the year, through continuous interventions with leadership team of businesses and policy- makers, TERI has showcased strong leadership is crucial to strengthen the ambition loop. These interventions motivated Indian businesses to come forward and commit to climate action.

The new and ambitious climate announcements of India at COP 26 and net-zero commitment by 2070 further aided in building a positive impact and encouraging Indian businesses to commit to climate action, align their goals with India's NDCs and accelerate their emission reduction targets.

Building on from TERI's assessments for electricity sector transition in India, we are excited to take forward the industry transition agenda. A coalition of leading market players from the Indian industry has been put in place under an **'Industry Charter for Near Zero Emissions Ambition by 2050'.** This Charter emerged as an important step for the Indian industry to voluntarily commit themself to decarbonisation measures and to work together in key thematic areas that can make a 'zero carbon' future, a reality for India. The existing Charter Signatories unanimously expressed their intent to make their companies exemplars of low or zero carbon technology solutions within their sectors, and gradually bring more heavy industry sectors into the fold of the Charter.

By means of various policy products such as **Think Pieces**, **Policy Briefs** and **Discussion Papers**, TERI provides high quality multidisciplinary insights on SDGs. This strengthens its engagement with stakeholders in the government and business sectors to promote integrated thinking on sectoral and multi-sectoral national policies in the context of the SDGs.

CEO Roundtable, WSDS 2022

Through its ongoing partnership with the **National Foundation for Corporate Governance (NFCG)**, Ministry of Corporate Affairs, Government of India, TERI aims to augment and accelerate business action on SDGs in India.

Our convenings with CEOs and CXOs at TERI's annual **World Sustainable Development Summit 2022** revealed the urgency of actions on sustainable development. The discussions pointed out that it is time now that we exhibit our intentions through putting together the business plans, investment plans and design lighthouse projects that articulate a narrative on how the future India would be.

> "Business, government, investors and civil society are key stakeholders to drive decarbonisation in India. Several corporations are committing to science-based targets. 27% of global emissions are contributing by industrial sectors. Material circularity would be inevitable mechanism to decarbonise hard to abate sectors."
>
> - Ms Sophie Punte, Managing Director of Policy, We Mean Business Coalition

Our Accomplishments

- The engagements with industry representatives from steel and cement sectors have increased by building a narrative on importance of technological innovation and low carbon industry transition – with the steel sector representing 45% of market share and cement sector representing more than 42% of market share. Through a series of consultations held with representatives of Indian heavy industries, a set of recommendations on financing the industry transitions was published.
- Industry charter on commitment to Near Zero Emissions Ambition by 2050 was launched during New York Climate Week, 2020 with 6 signatory CEOs which increased to 32 CEOs on-board as of March 2022.

Webinar for Green Steel through Hydrogen Direct Reduction

- A Post-COP 26 debriefing session was held with Secretary, Ministry of Power on 1st December, 2021, which discussed the importance of C&I sector as a stakeholder in achieving India's renewable energy commitments and key challenges for bringing renewables to the core of the power mix. The recommendations to accelerate India's renewable targets by 2030 were recorded by representatives of Ministry of Power.
- During the year, we garnered support from 32 Indian CEO's for the Industry Charter for Near Zero Emissions by 2050, along with engagements with businesses and policymakers on raising climate ambition.
- We further redefined the ways and means of interactions and assessments for the 2020 edition of the F&S-TERI Sustainability 4.0 Awards. We – along with our partner Frost & Sullivan – assist organizations to unearth the environmental, social and governance risks, leverage onto the opportunities, enable them to benchmark their performance, and reward them for their accomplishments in embedding sustainability in their business model.
- We completed the research study on "Enhancing the role of businesses towards achieving the SDGs in India" as part of grant by the National Foundation of Corporate Governance (NFCG). The report underscores the need and relevance of SDGs to enhance and accelerate business action on sustainability in today's time.
- 'India Sustainability Leadership Summit', which is the annual convening by TERI for the businesses, was held virtually on 7th January, 2021. This event was held in partnership with Frost & Sullivan, with an intent to enhance awareness on business models, tools, technologies, solutions and approaches followed by industry leaders towards building sustainable economies.

> "There is growing appreciation that Sustainability is now central to core business objectives of any Enterprise. This calls for moving 'sustainability' from the generic 'check-the-box' approach to a strategic seat in the boardroom. Progressive businesses are increasingly becoming aware of the interconnections of environmental, social and economic issues. As more corporates understand the dynamics of this interdependence, sustainability considerations will become an integral part of commercial normality. TERI CBS engages with the core issue of what businesses must do to shape and lead in sustainability."
>
> - Mr R Mukundan, Managing Director, Tata Chemicals Ltd

Inspirational Evidences

- To act as a catalyst to accelerate Renewable Energy deployment within the Commercial and Industrial (C&I) sector, which would facilitate India Incorporation's transition to RE in alignment with the national climate commitments a set of indices were developed. **PRAMAAN (Portal for**

Renewable Energy Action Assessment Metrics) rating lays emphasis on clean energy transition for organizations to reduce their power procurement costs, adhere to legislation, and increase sustainability.

- PRAMAAN provides a set of indicators for an organization to assess its progress in moving towards a low-carbon future and can be used as a framework to prioritize electricity options, assess risks, identify opportunities, set targets, and develop a sustainable energy road map. All commercial and industrial entities – including medium, small and micro enterprises (MSMEs), large corporates who are interested in knowing their RE transition progress and readiness – can participate in the **PRAMAAN rating.** Organizations will be evaluated on two broad parameters: RE progress headway and RE transition readiness, and six sub-parameters.
- **Pilot-testing** of the PRAMAAN methodology was conducted **with 22 Indian C&I sector organizations**. It is expected that the results of these testing along with feedback from the Indian industries will be incorporated to finalize the methodology.

Knowledge Building and Dissemination

- 7 high-level interventions strengthening engagement between leading businesses and policymakers on corporate action on climate change.
- 2 policy briefing documents published on the role of corporates in enhancing NDC ambition
- Strong India business presence at COP26
- 7 relevant central/ state-level departments engaged for advocacy on corporate RE procurement framework
- 2 policy briefing document citing growing business momentum and illustrating the business case for Industry Transitions in India published
- 2 convened interactions of leadership teams of businesses towards identifying viable solutions for the electrification of commercial fleets including meetings with key Government officials in transport sector and relevant ministries and departments

> "To decarbonise the global economy, we need to scale clean energy provisions. There are fundamental levers which includes electrification, use of hydrogen, bio resources and CCUS which will form the foundation of the decarbonization. Massive clean electrification is the bedrock of the global economy. In India, there is massive decline in solar costs. Policy prescriptions can enable massive build-up of speed of solar build outs."
>
> - Ms Ita Kettleborough, Deputy Director, Energy Transitions Commission

Details on Knowledge Building; Partnerships and Networks can be viewed via the following URLs:

[1] https://www.teriin.org/sites/default/files/files/Partnerships_and_Networks_List.pdf

[2] https://www.teriin.org/sites/default/files/files/Knowledge_Contribution_List.pdf

Corporate Social Responsibility

Thematic focus – a bird's eye view

The CSR concept at TERI is driven by 'Gandhian' thought of Trusteeship model, benefitting the most needy and vulnerable segment of the society. The CSR work at TERI is driven by Companies Act 2013, as per Section 135 and focusing on Schedule VII's thematic activities.

TERI's goal is to emerge as one of the best solutions provider in CSR and Sustainability space: integrating triple goals of people, planet and profit. With a dedicated group on CSR, TERI has devised an overall strategy to develop capacity for CSR and Sustainability programs for exploring the possibility of collaboration with all stakeholders – which include companies, Government, Foundations, social entities, academia and community. In this regard, detailed thematic areas at TERI have been identified and drawn, based on the requirement of the CSR Act and capacity of the organization. The work is in alignment with achieving multiple SDGs.

CSR at TERI is majorly focused towards structuring and implementing projects, generating tangible outputs and knowledge dissemination on the following themes:

- Environment Sustainability
- Energy Access and Livelihoods
- Rural and Community Development
- Water and Sanitation
- Integrated Model Village Development
- Project Design, Baseline Studies & Impact Assessment

CSR website at TERI: **https://www.teriin.org/teri-corporate-social-responsibility**

Our Accomplishments

The CSR team at TERI has been involved in more than 100 projects till date, with a pan-India approach. These projects are mostly focused on integrated and sustainable development inclusive of environmental, social and economic sustainability.

> "The CSR and Sustainability Division designs and implements solutions through partnerships to address social and environmental challenges by providing livelihood solutions for communities."
>
> - Dr Asha Ram Sihag, Distinguished Fellow

Every year the team manages 8-10 CSR projects involving new and upcoming thematic area and sectors in the sustainability space. In the current reporting year, the CSR team is dedicatedly working on 7 projects in the states of Jharkhand, Haryana and Rajasthan covering different and multiple-level themes, sectors and stakeholders, while multiple projects are in transition for materialization

Approach and innovation

CSR team follows both desk-based and field-based approaches for executing its projects and assignments. Integrated development approach is being adopted for structuring and implementing most of its projects. The major focus of the intervention is planned on the basis of a need assessment in the respective community and its feasibility for smooth running.

The projects deploy relevant and required technologies on-ground. The team is rigorously involved in piloting new technologies on-ground and assessing its feasibility, replicability and scalability.

Further, the team has also adopted an innovative approach to interlink the CSR project of organizations with climate change scenario creating

a bridge between the activities and their contribution to climate change/climate action.

Inspirational Evidences

Success stories

- **Accessibility to surface water:** In the state of Jharkhand (Dhanbad), the area being a hub of coal mines, groundwater quality was degraded along with scarcity of surface water. The intervention of pond rejuvenation project under the project 'Integrated development of community and schools for environmental sustainability (funded by Container Corporation of India Limited)' led to increased accessibility of surface water to around 5 villages along with recharge of groundwater. This resolved the issue of community suffering from water scarcity issue in their region.

Water conservation through pond rejuvenation

- **Increased livelihood of SHGs:** In Baghmara block (Jharkhand), the project provided the self-help groups (SHGs) with livelihood generation and enhancement training on 'ketchup making' to become independent and self-sufficient (project- Integrated development of community and schools for environmental sustainability, funded by Container Corporation of India Limited).

Ketchup-making training session for the SHGs

- **Introduction of Digital Learning in rural schools:** Under the project 'Integrated development of School and Community' funded by PNB Gilts Ltd, provision of digital learning centre along with computer trainer at the school wherein students lacked computer-led education, led to a great improvement in the education avenue of the students at rural school in Rewari, Haryana.

Impact we created

The beneficiaries express their satisfaction on receiving the much required interventions aligned with their needs in their areas and promise to sustain the same.

Upon receiving the required facilities, the beneficiaries along with the government recognized the team's efforts and hence, the State Cleanliness Award was given to the school in Dhanbad (Jharkhand) under the project: Integrated development of community and schools for environmental sustainability, funded by Container Corporation of India Limited.

CSR team has impacted approximately 12,000 beneficiaries under each project in the current year. These beneficiaries are community members and school children in the backward and less privileged areas of the states.

Enhancement of quality life at schools: Provision of sanitation infrastructure and clean drinking water systems at 5 schools in Dhanbad district of Jharkhand, led to an enhancement of quality life for students enrolled in these schools along with increased attendance and comfortable atmosphere of learning.

Drinking water and sanitation facility developed in schools

Knowledge Building and Dissemination

The team continuously engages in assessing challenges and opportunities for environmental and social sustainability projects and initiatives. The team is an active participant in different state and national level workshops and conferences. Apart from these workshops and events, the team has 3 publications and 1 article (in progress) in the current year.

The CSR team has anchored an 'ICC-TERI centre of excellence for CSR and Sustainability' in partnership with Indian Chamber of Commerce (ICC). The ICC – TERI Centre of Excellence (CoE) is a joint endeavour to devise solutions in an inclusive and holistic manner for all stakeholders. The Centre of Excellence envisions creating a knowledge platform, engaging with Corporates, Government, NGO's and various other stakeholders in CSR domain for achieving the national and global goals focusing on the Sustainable Development Goals.

CoE website: **https://www.teriin.org/project/icc-teri-centre-excellence-csr-and-sustainability**

Partnerships and Networks

The TERI CSR team has been working with a number of partners to implement best practices on-ground and deploy target audience specific interventions to create maximum level of impact. These partnerships have been short, medium and long terms.

Details on Knowledge Building; Partnerships and Networks can be viewed via the following URLs:

[1] https://www.teriin.org/sites/default/files/files/Partnerships_and_Networks_List.pdf

[2] https://www.teriin.org/sites/default/files/files/Knowledge_Contribution_List.pdf

Regional Centres

Serving as bridges to propogate the organization's work throughout the nation, **Regional Centres** help establish a strong base for TERI's activites and projects at the grassroots level. They help in further diversifying and broadening the knowledge repository as well as the scope of the organization's operations.

Southern Regional Centre (SRC) – Bengaluru

The Southern Regional Centre (SRC) of TERI was set up in 1990 to conduct cutting-edge applied research activity on the rational use of energy. The Centre takes a holistic approach to sustainable energy solutions balancing environmental concerns with socio-economic realities and commercial opportunities. The SRC works with the corporate sector, governments, research institutions and multilateral agencies to identify, develop, and utilize appropriate energy solutions .

During the previous year (2021/22), the Centre successfully carried out the following projects:

Collaboration of TERI with Government of Guyana

Services Offered	Key Clients/Sectors
Carried out energy audits and verification audits as part of implementation of Perform Achieve and Trade (PAT) schemes	Cement, iron and steel, pulp and paper, power and petrochemicals
Carried out energy assessment studies	Hatti Gold Mines, Cairn Energy
Provided technical assistance	Government of the Republic of Guyana
Extended capacity building services	International Renewable Energy Agency (IRENA)
Carried out impact evaluation study	National Horticulture Mission in Karnataka
Supported start-ups and innovators on alternate packaging materials	GIZ
Evaluation of the implementation and impact of the SBM-G and JJM Scheme in select districts of Karnataka	Government of Karnataka

Performance evaluation of multi-stage water pumps for dewatering from the underground mines 2200 level feet below at Hutti Gold Mines Limited, Karnataka.

Performance evaluation of instrument air reciprocating compressors by suction air velocity method at IVL Dhunseri Polyester Company S.A.E, Ain Sokhna, Egypt.

Northern Regional Centre – Mukteshwar

About TRISHA

TRISHA (TERI's Research Initiative at Supi for Himalayan Advancement) was established at the village Supi, Mukteshwar in Nainital district of Uttarakhand in 2003. Since agriculture is the main occupation, research and extension has been largely undertaken to improve the livelihoods of local farmers through developing crop value chains for providing financial security to the marginal farmers of the Himalayan villages.

The thrust areas of TRISHA include the following:

- Fragmented and Marginal Land Holding
- Rainfed Agriculture
- Infestation of Wild Animals
- Unsustainable Farming Practices
- Less Marketing Facilities

Available facilities

TRISHA, situated at a height of 7,500 feet, is a distinct venture towards sustainable development.

TRISHA's approach and impact

TRISHA's approach encompasses a strategy for enhancing land and crop productivity by using sustainable and organic biotechnological approaches and harmonizing modern technologies and traditional knowledge.

TRISHA Farm at Supi Village, Mukteshwar

Advance Horticulture Practices at TRISHA

- It enabled the local farmers to look beyond their conventional farming system and bring about successful diversification of crops through organic inputs.
- The local farmers have been able to overcome the adverse impact of climate change by adopting cultivation of medicinal and aromatic herbs that require minimal amount of water and thereby have an assured source of income throughout the year.
- It has also helped them in developing village-based micro enterprise capability for improving their economic condition.
- With its initiatives, TERI has touched lives of more than 5000 households spread across many villages (50) across the state.
- TERI has provided farmers with high quality planting material and entered into buyback arrangement with them to provide them assured market and better returns.
- TERI has successfully created a platform for assuring economic returns by eliminating intermediaries and thus created a win-win situation for farmers and clients.

Eco-tourism

Eco-tourism is ecologically sustainable tourism with a primary focus on experiencing nature that fosters environmental and cultural understanding, appreciation and conservation. Eco-tourism has the potential to create a win-win ecosystem for the environment, business, economy, the local community and the existing socio-cultural structures.

TERI Dera Green at Mukteshwar, Nainital, Uttrakhand offers a slice of paradise. Situated amid cloud-kissed, pristine, emerald green hills of the Shivalik Range, the camp offers unparalleled luxury and relaxation, leaving you mint fresh and energized. Feast your eyes on mighty snow-clad peaks, take a walk through pine woods or relax on the meadows: and that's just the beginning!

Mukteshwar is a great vantage point for a heavenly view of the Himalayas. It offers a great view of peaks like Neelkantha, Trishul, Nandadevi, Nandaghunti and Panchuli. One can also visit Chauli ki Jaali, the Sunset Point of Mukteshwar. The unique rock formations and steep cliffs are an ideal site for rock climbing!

Community engagement activities for school students

School awareness activities on nature conservation

At the Camp, we care for the environment too, apart from getting you closer to it. The Retreat promises to leave a light ecological footprint. Each one of its structures is built so as to borrow, not snatch, from nature's resources. In true terms, students and youth in general get a chance to re-discover nature and are sensitized about environment, so that the value of 'caring for our planet' gets instilled in them. So far, TERI has conducted more than 300 ecotourism camps for schools, colleges and corporates .

As part of the programme, the Eco-tourism aims at bridging the urban and rural divide and promoting a sense of responsibility and sensitivity amongst the participants towards nature and the local community. TERI has developed herbal products by engaging local community to boost the livelihood and strengthen local economies. TERI has strengthened livelihood of the communities in the Mukteshwar region through various projects and programmes and touched the lives of many.

Western Regional Centre – Mumbai

Western Regional Centre (WRC) of TERI, established in 2006, has been working to address the niche areas of the region. The focus of the Centre lies in the areas of environment resource mapping, eco-city, food and nutrition in addition to the cross-cutting themes such as renewable energy applications. The Centre also has a research facility at Navi Mumbai's Airoli dedicated to the production of algal biofuels.

- Since its inception, the Centre has developed a strong network of stakeholders from the government and industrial sectors.
- The Centre has successfully implemented several CSR and consultancy-based projects for its clients at the regional, national, and international levels.
- Apart from the technological interventions and documentation, the Centre endorses an action-oriented approach to engage communities through training and capacity-building workshops and awareness sessions as well.

Installation of Biofloc unit at Mokhada, Palghar

Key activities carried out

Assessment of ambient air quality

- TERI has conducted an assessment of ambient air quality, for the Maharashtra Pollution Control Board, in the nearby vicinity of 10 brick kilns in Thane and Palghar district, Maharashtra.
- Baseline data related to concentrations of air pollutants emitted from brick kilns in Thane and Palghar District was generated

Plastic flux monitoring and river assessment

- WRC Mumbai carried out a study to gain fundamental knowledge about the quantity and seasonal variation of plastic waste present in these creeks and assessment of local environmental patterns such as tide, water level, flow speed, and influence of wind.
- This study was conducted for our client the Ocean Cleanup (TOC), which is a Netherlands-based not-for-profit organization.
- It created baseline data in regards to amount of plastic waster present in the targeted water bodies.

Environment reporting

- The Centre has prepared an Environmental Status Report (ESR) for the Navi Mumbai Municipal Corporation (NMMC) and MPCB for the year 2020–21. The Centre has also prepared The Air and Water Quality Status Report of Maharashtra for the year 2020/21.
- This involved identifying opportunities for mitigation measures regarding environmental issues.

Development of eco-city website

- TERI has developed this website (https://nmmc-ecocity.org/) dedicated to Navi Mumbai's Eco-City project. It is a compilation of all activities undertaken by TERI, Mumbai since its project inception (2012) in collaboration with NMMC.
- It is a broader platform for creating environmental awareness among local citizens and connecting bridge between government officials and local citizens

Nutrition security

Project	Key focus	Impact	Partner
Setting up Biofloc technology (BFT) in Palghar's Mokhada block to provide livelihood opportunities for the Tribal Community	Demonstration unit means to educate and create alternate livelihood and source of protein in daily diet.	The project was launched to set up a demonstration unit of BFT (two tanks of 12,000 litres capacity) to promote optimum water utilization and encourage the tribal women and youth to take up aquaculture as a source of livelihood and protein source in the diet.	Central Institute of Fisheries Education (CIFE)
Nutritional security and immunity for women and families in Palghar district	Awareness about nutrition issues among various rural stakeholders	It helped sensitize around 500 self-help groups (SHGs)/women members of SHGs about the crucial issues of malnutrition.	National Project Construction Corporation Limited (NPCC)
Addressing the Sustainable Development Goal 6 (Safe Water and Sanitation) at Nashera Village, Palghar, Maharashtra in the COVID-19 era	Providing clean drinking water source and alternate source of income	The intervention addressed the problem of acute water scarcity, particularly in the summer months.	Collaboration between TERI and Water User Association (WUA)—comprising 8 members, including Gram Panchayat, faculty of Primary School, and village representatives.

Inauguration of Water ATM

Training and sensitization of more than 3000 SHG representatives through a series of 80 workshops (August 2021 to February 2022).

Two dedicated WhatsApp groups titled 'Suposhan-TERI NPCC' for effective communication with more than 350 tribal beneficiaries.

Our achievements

TERI has developed sets of resource materials for conducting training workshops:

a) Resource material for trainers

b) Reference material for tribal communities

c) Storyboards included short stories depicting local characters providing information on nutrition and food fortification.

d) The audio-video messages created by the nutrition experts on thematic areas, and the videos (3–5 minutes) by the students illustrating the recipe using locally available ingredients (https://youtube.com/channel/UCP1TrlVomyY1_b1FhulNMtg)

e) Grand Finale – Nutrient Recipe Competition: An award ceremony was conducted on March 7, 2022, on the eve of International Women's Day.

North Eastern Regional Centre – Assam

Key Focus Areas

The research and development activities of the North Eastern Regional Centre revolve around wastewater treatment, water quality improvement, waste management, improvement of livelihood through adoption of location-specific, sustainable land-based activities, rural development, production of quality planting materials and demonstration and extension-oriented activities.

TERI - NERC Office

Projects	Key Focus	Impact	Partner
Enhanced carbonate precipitation of ureolytic and nitrifying microbe treated rubber wastewater	Exploration and characterization of ureolytic and nitrifying microalgae, remediation of rubber wastewater utilizing ureolytic and nitrifying microalgae, carbonate precipitation of bioremediated rubber wastewater.	Screened 23 micro-algal strains of Chlorella, Chlorococcum and Microcystis for urea utilization. The freshwater species demonstrated the possibility of growing in rubber wastewater, reaching high biomass production and nutrient removal.	Department of Biotechnology, Govt. of India
Banana fibre extraction by mycogenic pectinase and surface modification through laccase enzyme	Optimization of pectinase and laccase enzyme producing fungal strains and standardization of their production and enzymatic processing parameters for high yield of quality banana fibre.	Seventeen fungal strains have been isolated of which nine isolates showed Pectinase activity, which may be used for enzymatic retting and processing of banana fibre.	Department of Biotechnology, Govt. of India
Bio-based post-harvest treatment optimization for ripening of banana fruits	Exploration and optimization of plant-based processing technology for ripening of banana.	Explored natural inducers, viz., Sonaru *(Cassia fistula)*, Venna (Castor), *Caesalpinia pulcherrima* and found encouraging response for induced ripening of three banana cultivars of Assam, viz., Malbhog, Cheeni champa, and Jahaji.	Assam Science Technology and Environment Council (ASTEC), Govt. of Assam

Projects	Key Focus	Impact	Partner
Raj Bhavan Assam a Zero waste campus in partnership with TERI, North Eastern Regional Centre	Assessment of solid and liquid waste generation, gap analysis and formulation and implementation of standard waste management procedure for achieving a zero waste campus in Raj Bhavan, Assam.	Developed reed beds for black and grey water treatment, material recovery facility (MRF) for recycling of materials and production of compost from the kitchen and garden wastes.	Raj Bhavan, Assam
Water quality improvement of Dighalipukhuri, Guwahati, Assam	Improvement in water quality of Dighalipukhuri to reduce and placate microalgal bloom and floating biomass accumulation on the water body.	Enhancement of oxygenation and nutrient remedial process for reduction of external nutrient load along with reduction of internal nutrient build-up. Development of reed bed for effluent treatment and artificial floating island for water column oxygenation, entrap suspended solids, dissolved nutrient removal, and enhance microbial activity in root zone water column.	Assam Tourism Development Corporation Ltd, Govt. of Assam
Implementation Support Agency (ISA) under Jal Jeevan Mission (JJM) Project under Public Health Engineering Department, Assam	Awareness generation, baseline survey, Participatory Rural Appraisal (PRA), need assessment, capacity building of the key stakeholders; handholding support to Gram Panchayat and subcommittee, preparation, approval, and submission of Village Action Plans (VAPs),	Constituted various committees as per guideline, opening of bank accounts of the committees, organizing Gram Sabha and meetings of sub-committees, Participatory Rural Appraisal (PRA) for community mobilization and need assessment, preparation, and submission of 173 Village Action Plan (VAP).	Public Health Engineering Department (PHED), Hailakandi, Karimganj, Silchar I and Silchar II Divisions, Govt. of Assam
Inventorization, molecular identification and characterization of Garcinia species from Northeastern India for isolation of polyisoprenylated benzophenones as taxol mimics	Inventorization and taxonomic assessment of Garcinia species from Northeastern India and their molecular identification through DNA barcoding.	Explored 10 species and 4 varieties of Garcinia from 14 districts of Assam and 2 districts of Meghalaya and isolated genomic DNAs from 13 species.	Department of Biotechnology, Govt. of India

Projects	Key Focus	Impact	Partner
Cultivation of packing leaves plant for livelihood enhancement of ST communities and promote packing leaves as substitutes for plastics in Meghalaya.	Awareness generation on cultivation of packing leaf plant for livelihood generation and use of leaf as substitute of plastics.	Fifty-four ha area brought under cultivation of packing leaves plant and generated additional income from the cultivation. Value-added products developed from the plant parts of the packing leaf plant. One hundred thirty-two ST beneficiaries have been benefitted from this project.	National Mission on Himalayan Studies, Ministry of Environment, Forest and Climate Change, Govt. of India
Preservation and Protection of Traditional Knowledge: Documentation Initiatives in North-East, India	Identification, documentation, preservation, safeguarding and promoting the traditional knowledge that existed and are still practiced at the community level.	The project is at initial stage and impacts are yet to come.	North-Eastern Council Secretariat, Govt. of India

Innovations

- The Centre has initiated a process of documenting traditional knowledge base of the traditional healers of Meghalaya, which may guide future policies and action.
- The centre has initiated the activities related to inventorization and taxonomic assessment of Garcinia species from Northeastern India and their molecular identification through DNA barcoding.
- A Food Testing Laboratory – partially funded by the Ministry of Food Processing Industries (MoFPI), Government of India, has been set up at the Centre to cater to the food safety concerns of consumers and to regulate the quality of food products from the producers, sellers, and entrepreneurs from across the eight Northeastern states. The laboratory has been accredited as NABL testing lab for testing of Packaged Drinking Water (As per IS: 14543) for some Chemical parameters from June 1, 2022.

Food Testing Laboratory

Western Regional Centre – Goa

TERI's Goa Centre, established in 1996, works on conserving coastal ecosystems through sustainable development and community-based resource management programmes. The Centre is also engaged in research that focuses on a variety of sectors, such as biodiversity, aquaculture and training, coastal resource management and water technologies.

Available facilities

TERI's Goa Centre is home to multiple aquaculture set-ups, in conjunction with the Centre of Excellence project to design fish feed. Other facilities include the solar dryer, grinder-feed pelletizer, Kitchen garden, and TERI Coastal Education Hub. The Hub is a platform for disseminating ecological knowledge especially on the conservation of our coastal ecosystems and resources to schools/colleges and youth across state and at national level. Details about the centre and its work may be sourced from **https://www.teriin.org/project/teri-coastal-education-hub.**

Coastal Ecology and Marine Resources Centre (CEMRC)

The thrust areas of the CEMRC include the following:

- Coastal Resources and Ecosystem Management
- Biodiversity Mapping
- Blue Economy
- Aquaculture and Training

TERI Coastal Education Hub

Innovations

Under TERI-DBT Centre of Excellence, the work package dealing with **development of artificial fish feed** using de-oiled algae has been initiated and tested.

The experimental work has established that local ingredients like wheat bran and ground nut oil cake, in conjunction with deoiled algae to constitute superior feed ingredients to form an effective fish feed.

Compositional analyses have also shown prepared feeds to be very rich in protein, essential to growth of fish.

Small to large test set-ups are established for trail runs of **aquafeed formulation** with various combinations of ingredients in experimental feed diets for fish.

Further, in step with commercializing, the prepared fish feed product **"AquDalgae"** is in the process of being registered with the **Coastal Aquaculture Authority (CAA)**.

Training courses for entrepreneurship development and women empowerment are undertaken at the TERI Coastal Education Hub for diversification and development of new pathways in livelihood generation.

Water technology

The thrust areas are as follows:

- River bank filtration (RBF) technology
- Watershed management
- Groundwater exploration studies
- Hydrological modelling and activities

TERI has been working since 2007 with the University of Rhode Island to illustrate RBF projects across southern India.

The RBF technology forces the polluted water in a river to travel to the RBF well through riverbed sediments, which leads to the removal of contaminants such as bacteria and heavy metals by the combination of biological, physical, and chemical processes.

Solar-powered RBF well at Navelim, Goa

Accomplishments and Impacts Created

Project	Key Focus	Impact	Partner
Off the grid sensor-controlled irrigation using bank filtration technology	The objective was to provide clean water to farmers for irrigation, the first-of-its-kind in the region to demonstrate the sensor-controlled irrigation system implemented by NIT Goa.	Crop yield and crop quality enhanced resulting in higher market value of sold crops, reduced labour use and thereby labour cost. Also, reduction in wastage of water and electricity, time-saving particularly for small and marginal women who could now diversify income, easy operation as rainpipe irrigation system is user friendly and flexible compared to drip irrigation.	Demand Driven Mission—Water Technology Initiative by the Department of Science and Technology, Government of India
Expansion of the Indo-German Competence Centre for Riverbank Filtration—CCRBF	Aims to strengthen the cooperation in education and research between Germany and India in sustainable water resources management	The focus is on demonstrations of natural treatment techniques of riverbank filtration (RBF), managed aquifer recharge (MAR), and constructed wetlands (CW) in select locations in India.	German Federal Ministry of Education and Research (BMBF)
Watershed development project with pre-capacity building phase and implementation phase	The project aims to provide communities with resources relating to sound watershed management practices, to conserve, improve and protect their resources through comprehensive watershed management, thus sustaining a good quality of life.	Management of natural resources, improved management of farm production system and creation of sustained livelihood opportunities for the rural community and demonstrations of climate proofing interventions.	NABARD, Goa

Knowledge Building and Dissemination

On the basis of the ongoing research and innovations, the team made an effort to consolidate the learning, shared key findings and accumulated knowledge through publications and presentations in public fora.

Solar-powered lake bank filtration at Chaudder lake, Cortalim, Goa

Demonstration of solar salt production at a salt pan TERI Coastal Education Hub

Details on Knowledge Building; Partnerships and Networks can be viewed via the following URLs:

[1] https://www.teriin.org/sites/default/files/files/Partnerships_and_Networks_List.pdf

Support Units and Infrastructure Facilities

Support Units aid this organization to continue its work on climate resilience, renewable energy technologies, participatory forest management, and knowledge generation. They ensure smooth and timely managment of work throughout TERI and help it emerge as a premier think tank. TERI's infrastructure facilities are instrumental in facilitating its research work. Equipped with the best and latest advancements, these facilities help the prgammes in making their various initiates a success.

Information Technology and Services

TERI offers state-of-the-art IT infrastructure, latest communication platforms, and smart applications across the organization. The communication networks, unified communication tools and network security enabled collaboration is done across TERI's offices and centres through instant messaging, web conferencing and videoconferencing, and for researchers on the move to remain connected.

IT services portfolio provides customized applications/portals for researchers and professionals. The driving objective is to provide secure access to IT applications and services from anywhere, anytime, on any device to everyone. It is also aimed to make IT services flexible enough to change as per the need of the business and as well as of end users.

Keeping up with the latest IT standards, IT infra team is also moving towards cloud-based architecture. Most of TERI's websites/applications are hosted on cloud environment; this is done to ensure maximum uptime of our websites and other services.

Our Accomplishments

Some of the critical projects IT division has undertaken in the last financial year are given below, which also manifest its cross-cutting role and engagement in wide range of green initiatives:

- **WSDS 2022 (Website and Virtual platform vendor integration, EDMS)**
  Link: https://wsds.teriin.org/2022/
- **Green Olympiad Online Examination**
  Link: https://www.teriin.org/olympiad/
- **Adaptation Futures Conference**
  Link: http://adaptationfutures2020.in/
- **World Wind Energy Conference Website & Abstract Submission and Review portal**
  Link: https://wwec2021.org/
- **TERI IWA Water Sustainable Awards (Website, Registration Process & Admin Panel)**
  Link: https://wsa.teriin.org/
- **Eco City website**
  Link: https://nmmc-ecocity.org/
- **Science Education and Health Awareness Tool**
  Link: https://sehat-knowledgehub.org/public/index.php
- **Digital Library on Green Mobility**
  Link: https://greenmobility-library.org/public/index.php
- **Dr R K Pachuari**
  Link: https://rkp.teriin.org/public/index.php
- **The TERI-Deakin Nano-biotechnology Centre or TDNBC**
  Link: https://tdnbc.teriin.org/index.php

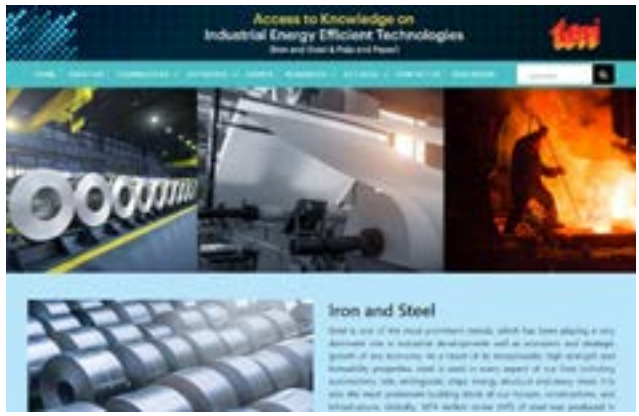
Knowledge Resource Centre

Knowledge creation and dissemination is the core of Knowledge Resource Centre (KRC) activities. KRC supports TERI's research activities on energy, environment, and sustainable development through – automated library system, knowledge management system, skill development and managing innovative knowledge services and products. KRC caters to the knowledge needs of TERI researchers. It disseminates innovative knowledge-based products and services using ICT tools.

Library and knowledge management

Knowledge services are provided using physical and e-resources. KRC is engaged in multi-stakeholder research projects, data analysis, developing international and national-level networking. It also conducts capacity-building programmes for researchers.

KRC is engaged in web content and database development – bringing out peer-reviewed publications and knowledge products. It maintains a state-of-the-art knowledge management system which captures and disseminates TERI's learning insights and research data.



Specialized information centres

KRC has set up several specialized information centres on thematic areas -

- Transport
- Renewable energy
- Climate change
- Mycorrhiza and agriculture

These centres also maintain websites and provide online knowledge services to stakeholders.

Knowledge sharing and collaboration

KRC executed several knowledge-based activities –

- Development of Digital Repository of S&T publications available at http://digitalrepository-nstmis-dst.org
- National Survey on Resources Devoted to S&T Activities to capture pan-India R&D data
- Development of Digital Library on Green Mobility (DLGM) available at https://greenmobility-library.org under the India component of GIZ's NDC Transport Initiative for Asia project
- Develop platform to provide access to Energy Efficiency Technology Information for Indian Industries available at <https://ieetech.org>

KRC in collaboration with TERI North-East Centre has carried out a detailed study to assess impact of research projects on different sectors in North East region, supported by the Ministry of Development of North Eastern Region.
Besides this, KRC has also developed digital library strategy, layout/architecture and guidance for Centre for Catalyzing Change.

It has collaborated with several national and international libraries for resources sharing; and academic bodies and NGOs for skill development purpose.

Training and skill development

The KRC hosts the ENVIS Resource Partner on Renewable Energy and Climate Change (http://terienvis.nic.in) which works relentlessly towards knowledge creation and dissemination for education, awareness and inputs to policy-making.

The Centre organizes workshops, awareness programmes, skill development trainings, and conducts environmental surveys.

Under the Green Skill Development Programme (GSDP) of the MoEFCC, the ENVIS Resource Partner imparted 25 residential technical trainings on solar energy applications and waste management sectors engaging rural youths from different Indian States on to develop skills and livelihood generation.

KRC has also conducted a series of online Women Entrepreneurship Development Programmes under DST, Government of India.

Green Skill Development programme

Our Accomplishments

Number and nature of projects

Overall, 16 projects were executed that focused on –

- Digital library development
- Knowledge curation, analysis and strategic support
- training and skill development
- knowledge dissemination using online media
- KRC maintains knowledge platforms on climate change, sustainable transportation, renewable energy, etc. This entails bringing multiple agencies together that benefits diverse stakeholders to improve knowledge, conduct research and provide policy inputs.
- KRC fulfils it's role through development and dissemination of knowledge services and products to support integrated decision-making and research towards reducing carbon footprint.

> "In this era of information explosion, knowledge creation and dissemination are vital to the innovation and growth of an organization."
>
> -Mr K Ramanathan, Distinguished Fellow, TERI

Bi-annually published journal, WDL

Impact we created

Over 450 students have been trained under Green Skill Development Programmes and 49% of them are engaged in industries in various capacities or initiated own business.

Online knowledge platforms and contents developed by us have been used by over 7500 diverse stakeholders for carrying out research, decision-making and developing collaborations with others.

90 women students were trained online to develop entrepreneurship aptitude, 9 of them have already started own start-ups.

Knowledge Building and Dissemination

KRC has been in the forefront of knowledge creation through acquisition, organization, dissemination of knowledge resources and providing value added services on energy and environment topics.

Green Skill Development programme to Sustain and Enhance Technical knowledge in Solar Energy and Rural Technology systems

Contribution to knowledge building

- 3 publications
- 8 presentations
- 8 webinars/workshops

Partnerships and Networks

- Most of the funding and support have been received from the government sector comprising Ministry of Environment, Forests and Climate Change; Department of Science and Technology; Department of Scientific and Industrial Research; and Ministry of Development of North Eastern Region, Government of India.
- Partnership with Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH has resulted in the development of Digital Library on Green Mobility.
- Partnership developed with multiple academic institutions and NGOs resulted in successful conduction of skill development programmes in different Indian States.

Details on Knowledge Building; Partnerships and Networks can be viewed via the following URLs:

[1] https://www.teriin.org/sites/default/files/files/Partnerships_and_Networks_List.pdf

[2] https://www.teriin.org/sites/default/files/files/Knowledge_Contribution_List.pdf

Project Management Unit

One-hundred fifty projects are the mainstay of TERI. At any given time, more than 300 projects, ranging from research to implementation, would be underway.

The Project Management Unit (PMU) is the institute's central hub and the objective of this Unit is to efficiently manage the projects—from their inception through to their conclusion. The PMU's key responsibilities include:

- Identifying funding opportunities and areas of dissemination and coordination
- Facilitation for the preparation and submission of bids
- Team and relationship management, including the ongoing communication of duties and responsibilities within the project teams
- Ensuring a timely delivery of all contractual obligations Interim, mid-term, and project completion reporting
- Contract administration and budget control
- Quality control
- Facilitating effective utilization of resources
- Generation of MIS reports
- Maintenance of knowledge repository

TERI's PMU uses sound project management techniques and customized software tools to facilitate deliverables on time and within strict quality guidelines, thereby ensuring that the desired outcomes of the projects are met. It also ensures that all the projects are well documented and catalogued in TERI's knowledge repository.

Human Resources Division

The Human Resources Division has been instrumental in facilitating learning and development initiatives for staff to keep them in sync with the changing business environment. It aims to engage the workforce to ensure a growth enabling, progressive working environment, which facilitates the realization of the vision and mission of TERI.

We give high attention on employee wellness programmes that focus on training and guiding our employees towards living a healthy lifestyle and enhancing their productivity at work.

Human Capital

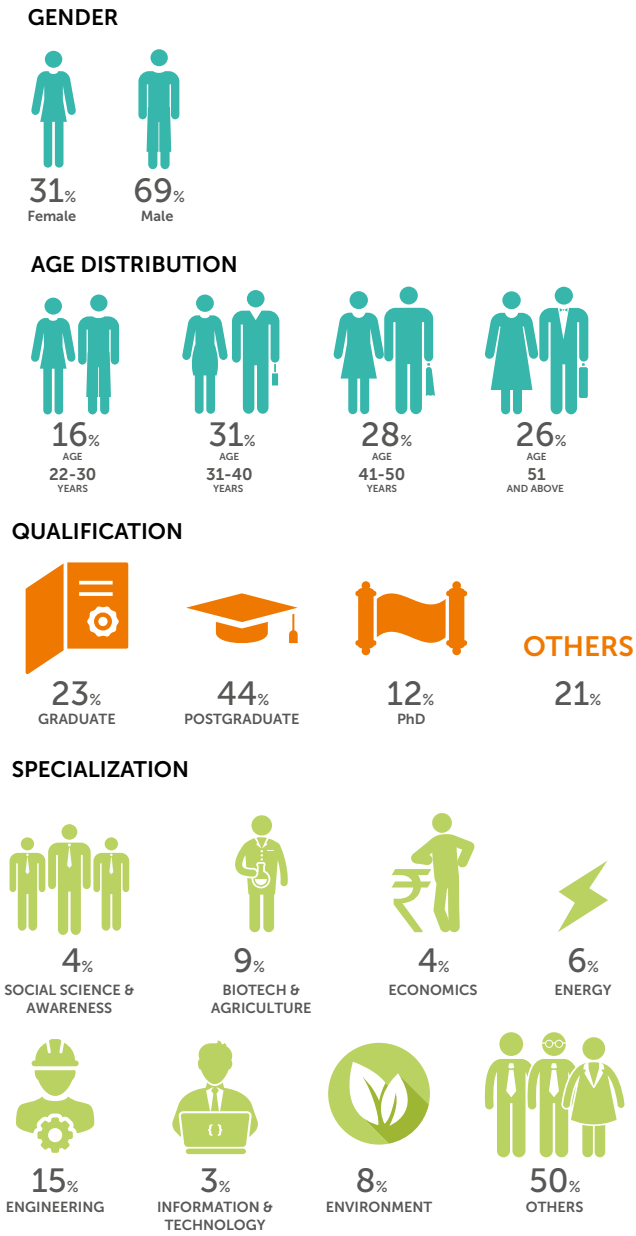
At TERI, we consider all TERI-ers to be of utmost value and the key pool that contributes towards our shared goal.

TERI fosters a culture, which respects diversity in age, gender, and education, and realizes that each individual is unique and that each one brings a fresh perspective and their own skill sets to the table, which in turn helps TERI build a collaborative culture.

Our strength lies in the diversity of our people and we respect the fact that their different views and ideas help us stimulate our minds intellectually.

TERI encourages its researchers to work in a cross-functional manner because it values interdisciplinary approach: the exchange of proven ideas and practices.

A concerted effort in thought and action leads to the desired outcome, which in turn enhances the trust level among our valued partners and stakeholders.



Administrative Services

The Mission of the Administrative Services of TERI is to ensure that research in TERI is carried out smoothly. In doing so, it provides the necessary administrative and maintenance support services to all the facilities located at the TERI headquarters at the India Habitat Centre; its regional centres located at Bengaluru, Goa, Guwahati, and Mumbai; and the campuses at TERI Gram in Gurugram and TERI Himalayan Centre in Mukteshwar, Uttarakhand.

Internship opportunities facilitated by the Human Resources give TERI first pickings of the crème de la crème of the pool of fresh graduates from the best of institutes in the country who assist researchers on various research projects.

Our employee-friendly policies for higher studies provide an opportunity to researchers to pursue PhD programmes from the top universities across the globe.

At TERI we give utmost importance to the topic of diversity and sensitivity towards issues of harassment at the workplace.

We aim at providing cross-divisional work and career opportunities to professionals to contribute to and gain knowledge and expertise in areas other than their primary research area, thereby improving interdisciplinary capabilities and offerings to the sustainable world.

We give high attention on employee wellness programmes that focus on training and guiding our employees towards living a healthy lifestyle and enhancing their productivity at work. TERI, through administrative services, encourages a culture and environment that is transparent and enhances employee engagement.

It maintains and runs all amenities and utilities meeting international standards. TERI's Quality Management System (QMS) is certified as per ISO 9001:2015 standards, its Health and Safety Management System as per ISO 45001:2018, and its Environment Management System as per ISO 14001:2015.

We also looks after The RETREAT (Resources Efficient TERI RETREAT for Environmental Awareness and Training). The RETREAT centre is a training and conference facility at TERI Gram. The facility provides a unique experience of doing things in an unconventional yet viable way.

TERI's growing reach and visibility make it an integral part of the itineraries of many international dignitaries and delegates, including Heads of Governments.

Infrastructure Facilities

TERI requires state-of-the-art, modern, and vital infrastructure facilities, which are instrumental in facilitating research and development on a large scale. TERI has developed a host of infrastructure facilities, across the length and breadth of the country, which continued to propel the Institute through a tough time during the Covid-19 pandemic and steered us towards greater success in the year 2021/22.

CMCC Germplasm Bank

The Centre for Mycorrhizal Culture Collection is stepping into its second- generation level with an objective of supplying well-characterized mycorrhizal cultures to researchers and industry. The Bank has three temperature-controlled greenhouses at Gual Pahari which house 2,800 isolates of Arbuscular Mycorrhizal Fungi (AMF) and 285 cultures of Ectomycorrhizal Fungi (EMF) collected from different soil types from India and around the globe. Our molecular biology and biochemical labs are equipped with avant-garde equipment which aid in characterizing each isolate and help in generating an information database which is available on the CMCC website (http://mycorrhizae.org.in/cmcc/).

Solar Smart mini-grid facility

TERI has established solar hybrid smart min-grid at its Gual Pahari campus. The mini-grid has inhouse developed controller for load scheduling and load & grid management including prioritizing of solar PV utilisation.

Mass Production Technology

In vitro mass production technology produces viable, healthy, genetically pure, and high-quality mycorrhizal propagules without any pathogenic contamination in a sterile environment.

DNA Fingerprinting and Molecular Breeding Lab

The DNA fingerprinting facility is a state-of-the art laboratory for varietal identification, mapping of genetic diversity, and marker assisted breeding. The facility harbours a LICOR 4300 DNA analyser and other molecular biology-related equipment. The facility is being used for providing DNA fingerprinting services to state horticulture departments and genotyping services to plant breeders for their breeding programmes.

Plant Genetic Transformation and Functional Genomics Laboratory

This laboratory has all the basic equipment such as Real Time–PCR, gel electrophoresis systems, and plant culture room. It works on developing genetically modified plants for better quality and productivity under changing environments.

Micropropagation Technology Park

Complete with infrastructural facilities ranging from modern laboratories and greenhouses to nurseries that are required for mass production of tissue-cultured plants, the facility has an annual production capacity of over two million plants.

Herbal Garden at Supi

The herbal garden is home to more than 60 different varieties of fresh and dry exotic vegetables, fruits, and herbs such as Broccoli, Pockchoy, Kiwi, Plum, Parsley, Rosemary, Thyme, Oregano, and Peppermint.

TERI–Deakin Nanobiotechnology Research Centre

The Centre bridges the gap between industry and academia through research and collaboration of leading international experts to generate effective solutions for a sustainable future. This Centre is working towards a greener and more advanced use of nanotechnology for resolving challenges in agriculture, biofuel production, and biomedical issues through nanoparticles, nano-biosensors, nanocarrier-formulations, nanodelivery of agrochemicals, and seed coating formulations (details available at: http://tdnbc.teriin.org).

Fermentation Technology and Research Centre

The Centre is a state-of-the-art fermentation with a pilot-scale platform to carry out studies. It has a series of fermenters of working volume ranging from 3.5 litres to 13,000 litres. Apart from mass-scale production of indigenously developed oil degrading bacterial cultures, the facility has capacity to carry out research on anaerobic fermentation processes in pilot and large industrial scale.

Microbial Biotechnology Laboratory

The Laboratory is an experimentation facility for the exploration of microbial diversity to provide biotechnological solutions in the field of environmental protection and sustainability, especially in the sector of oil and gas. The facility has state-of-the-art set ups for petrochemicals, petroleum microbiology, petroleum hydrocarbons, and molecular biology. with automated facility and real-time PCR systems. Infrastructure for both aerobic and anaerobic microbiology facility is also available. The laboratory is supported by analytical facility that is equipped with Gas Chromatography, High Performance Liquid Chromatography, Gas Chromatography-Mass Spectrometry, GC-headspace systems with other requisite instrumentations.

Supercomputer to Enhance Climate Modelling Capabilities

TERI has a well-equipped climate modelling infrastructure, which consists of a supercomputer with a peak performance of 12TeraFLOPs - to carry out the climate simulations at various spatial and temporal scales with varying global and regional horizontal resolutions. High end servers are also present for running impact models at ultra-high resolutions. TERI's research in climate science and associated modelling spans a whole range of activities beginning with the understanding of the climate system through the use of state-of-art modelling tools like Global Climate Models viz. CCSM, CESM and NorESM; Regional Climate Models viz. PRECIS, WRF and COAWST and impact models viz. ADCIRC (for storm surges and coastal inundation), MIKE-11 (for inland flooding), SWAT (for water resources), DSSAT (for agriculture), and DIVA (for coastal zones).

TERI Water Laboratory

Recognized and certified under the Environment (Protection) Act of 1986 by the Ministry of Environment and Forest (now, Ministry of Environment, Forest and Climate Change), Government of India, the laboratory is equipped with field sampling, monitoring equipment, and analytical instruments. The laboratory provides multi-disciplinary water quality and quantity monitoring, testing, and related services.

TRISHA

TERI's Himalayan Centre at Latey Bunga exemplifies 'ideal' green environment. It is a symbol of optimum use of natural resources such as solar and other forms of renewable energy.

Himalayan Centre at Latey Bunga

TERI's Research Facility in Bengaluru

The TERI Southern Regional Centre building is a judicious blend of technology and tradition that promotes energy efficiency and sustainable development. The centre has a state-of-the-art environmental laboratory at Bengaluru office, which includes:

- Sophisticated instrumentation, such as atomic force microscopy and FTIR spectroscopy;
- Polymer-processing equipment such as Dynisco table top twin screw extruder, Microwave reactor, Brabender plastic order, and compression moulding;
- Testing instruments such as Extensometer, EMI shielding analyzer, Delta mode systems, and Specific gravity tester.

Knowledge Resource Centre

The TERI library houses a wide array of resources on energy, environment, and sustainable development—from books, journals, and papers to the world's leading academic databases. A book digitization scanner — Bookeye 4 — is installed in the Library and Information Centre.

TERI Gram

TERI Gram is located on the outskirts of Delhi. It is a sustainable habitat consisting of residential as well as conference facilities, powered by a specially designed renewable energy system to meet its energy requirements.

Test Bed Facility, Gual Pahari

TERI and Somfy India Private Limited have partnered to set up a Test Bed Facility at Gual Pahari in the year 2015/16. The main objective of setting up this facility is to derive the benefits of Somfy Roller Blinds in test building.

TADOX® Wastewater Treatment Plant

TERI Advanced Oxidation Technology (TADOX) for the treatment of industrial and municipal wastewater is currently being demonstrated at TRL-7 with a wastewater treatment plant of 10 KLD (10,000 L per day) capacity. The USP of this technology is that it can treat in few hours and bypass any kind of biological treatment and directly utilizes Advanced Oxidation Nanotechnology for the treatment of sewage and mixed effluents from the campus.

Mahindra Centre for Excellence

A joint research initiative of Mahindra Lifespace Developers Ltd (MLDL) and TERI, the vision of the Mahindra-TERI Centre of Excellence (MTCoE) for Sustainable Habitats is to foster sustainability by developing innovative and resource-efficient solutions tailored to the Indian building sector and climate.

MTCoE Lab

The CoE, inaugurated as a SVAGRIHA 5-star rated facility, has received accreditation from National Accreditation Board for Testing and Calibration Laboratories (NABL) for testing the thermal properties of building materials. It is equipped with a one-of-its-kind 'Guarded Hot Box', that was fabricated under the close guidance of TERI researchers. The facility has a 'Sky Scanner' installed to monitor the sky conditions of Gurugram city. The findings of the study would throw light on the impacts of climate change and provide a fresh perspective on the way we design buildings today. The water sustainability city-level assessment, building-level water audits, and a web-based tool are likely to generate awareness among relevant stakeholders, mitigate potential risks, and ensure efficient water management at micro and macro levels. A web-based EcoNiwas Samhita Design aider tool has been developed to ease the implementation of the residential building code at the design level. To know more about the CoE, please visit the website Mahindra-TERI Centre of Excellence (mahindratericoe.com).

TERI Food Testing Laboratory at NERC

The Food Testing Laboratory partially funded by the Ministry of Food Processing Industries (MoFPI) has been developed for testing of packaged water, food, and beverages for determining chemical, microbial and elemental parameters. The Laboratory has been accredited as NABL testing lab for testing of Packaged Drinking Water (As per IS: 14543) for some chemical parameters from 1st June 2022. Apart from the scopes for ensuring food safety, in due course of time nutritional profiling and GMO testing will also be included in the scope of services of this lab.

Financial Summary

INFLOWS (₹ in Lakh)

97.85%
₹12,792.63
INCOME FROM PROJECTS

0.80%
₹104.73
INCOME FROM INVESTMENTS

0.52%
₹67.37
SALE OF PUBLICATIONS

0.83%
₹108.93
INCOME FROM OTHERS

TOTAL **100%** (₹13073.66)

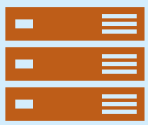
OUTFLOWS (₹ in Lakh)

52.71%
₹6613.06
SALARIES

1.73%
₹216.71
EQUIPMENT

35.76%
₹4486.42
RESEARCH MATERIAL, TRAVEL

5.62%
₹704.93
RENTAL,UTILITIES, INFRASTRUCTURE AND MAINTENANCE



4.18%
₹524.26
ADMINISTRATIVE EXPENSES

TOTAL **100%** (₹12,545.38)

About TERI

A dynamic and flexible organization with a global vision and a local focus, TERI was established in 1974, with initial focus on documentation and information dissemination. Research activities, initiated towards the end of 1982, were rooted in TERI's firm conviction that efficient utilization of energy and sustainable use of natural resources would propel the process of development.

All activities in TERI, the largest developing-country institution working towards sustainability, move from formulating local and national-level strategies to shaping global solutions to critical issues.

Buoyed by more than 47 years of excellence in research and innovation, TERI is now poised for future growth, driven by a global vision and outreach, with a philosophy that assigns primacy to enterprise in government, industry, and individual actions.

The Energy and Resources Institute
Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi – 110 003
Tel. 2468 2100 or 2468 2111, Fax 2468 2144 or 2468 2145
India +91 • Delhi (0)11
Website: www.teriin.org

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