The Energy and Resources Institute

INTRODUCING TERI

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TERI is one of the largest institutions of its kind in the world. It contributes to the society thorough its cutting-edge research in the field of biotechnology, development of renewable energy technologies, innovative solutions in the water and forestry sector, design and rating of buildings for their carbon footprint and resource use efficiency, and a range of policy-based research for corporates and government agencies on issues such as climate change and other subjects at the local, national, and international level.

As a philosophy, TERI prefers implementing solutions at the grassroots level in order to develop models of sustainable solutions in the fields of energy access, protection of the environment, and conservation of natural resources.

With over 1,000 youthful and dynamic professionals from diverse disciplines, the staff brings into their work, vigour, vitality, and vision that symbolize the future of India as well as many other countries of the world. This organization receives no regular grants from any single source and generates all its resources through its own initiative, which encourages the spirit of entrepreneurship and motivates development of creative solutions and innovation in everything that the Institute pursues.

This organization emphasizes innovation and learning as essential for finding solutions to the complex environmental and social problems that the world is facing today in the fields of energy, sustainability, and the global commons. TERI attempts to anticipate the problems so that solutions can be devised before being overwhelmed by the daunting challenges faced by the present world. The organization deeply emphasizes capacity building to see that knowledge once created and applied can be adapted and reapplied by one and all on a wide scale. The following pages provide a brief description of TERI and its activities, which would be adequate for introducing to its readers an organization that lives and functions in the realities of the twenty-first century.

Dr Ajay Mathur
Director General, TERI

INTRODUCTION

TERI has state-of-the-art research laboratories, yet it is more than a research outfit; it routinely interacts with the government on key policy issues, yet is more than a think-tank; it has developed power-generating systems capable of supplying 10–100 kilowatts of power, yet it is more than an engineering institute; it has worked with affluent communities as well as in slums, in very large cities and in remote villages, among factory workers and farmers, yet it is more than an NGO; it publishes journals and books and makes films, yet it is more than a publisher and film-maker; it deploys its professional expertise to undertake contract research, yet it is more than a consulting firm. A dynamic and flexible not-for-profit organization with a global vision and a local focus, TERI is deeply committed to every aspect of sustainable development.

From providing environment-friendly solutions to rural energy problems to analysing strategic issues in energy security to tackling issues of global climate change across continents and advancing solutions to growing urban transport and air pollution problems, TERI's activities range from formulating local- and national-level strategies to suggesting global solutions to critical energy and environmental issues providing benefits to society. With over 1,000 employees drawn from diverse disciplines, the Institute's work is supported by ministries and departments of the government, various bilateral and multilateral organizations, and corporations of repute.

Buoyed by more than 35 years of excellence in research and innovation, TERI is poised for future growth with a philosophy that assigns primacy to sustainable development and environmental governance.

ORIGIN

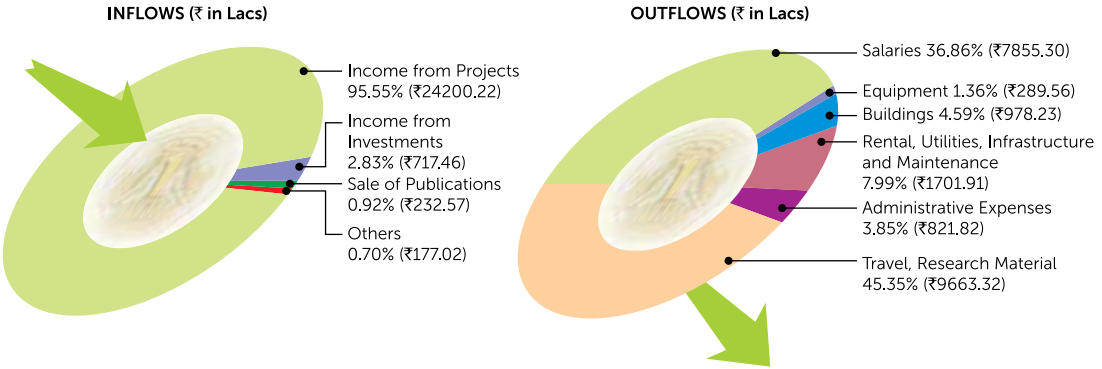
The origins of TERI lie in Mithapur, in a remote corner of the north-western state of Gujarat in India, where a visionary chemical engineer was concerned about the enormous amounts of energy his factory spent on desalination—fresh potable water is scarce in those salty plains—and on making caustic soda from salt. This visionary was Mr Darbari Seth of Tata Chemicals who appreciated the importance of energy as a resource and envisaged an institute 'to tackle and deal with the immense and acute problems that mankind is likely to face in the years ahead on account of the gradual depletion of the Earth's finite energy resources that are largely non-renewable, and the existing methods of their use, which are polluting'. The idea instantly appealed to Mr JRD Tata, Chairman of the Tata Group, a great visionary himself and a staunch supporter of scientific research, and TERI was duly established in Delhi in 1974, as the 'Tata Energy Research Institute'. As the scope of its activities widened over time, it was renamed 'The Energy and Resources Institute' in 2003.

TERI began its operations in Mumbai in Bombay House, headquarters of the house of Tatas, India's most respected industrial house. In its first decade, its approach was to support deserving research projects on renewable energy. TERI also set up a documentation and information centre, which began publishing Indian Energy Abstracts, and a small field station in Puducherry (formerly Pondicherry) to undertake research on renewable energy. In 1984, it moved to Delhi and began its own research. The first project it took up was to develop an energy model for India. For a decade after that, keeping with TERI's conscious policy that activities must precede brick and mortar, the Institute operated out of rented premises. In 1993, it came into its own as it moved into the Darbari Seth Block of India Habitat Centre complex situated at Lodhi Road, New Delhi.

FINANCES

In the year 1974, TERI's founding fathers had set aside a corpus of Rs 35 million; now more than 35 years later, research programmes and projects in TERI itself contribute much more, amounting to almost 95 per cent of TERI's income. In the financial year ending in March 2016, income from investments accounted for 2.83 per cent, sale of publications and other miscellaneous sources fetched 0.92 per cent and 0.70 per cent, respectively.

A major part of TERI's income flows into the Institute in the form of funds and research grants from multilateral and bilateral organizations, national and international banks and financial institutions, government agencies, grant-making bodies, and international academic institutions. TERI prides itself being a financially independent institute.



* Please note that the figure mentioned against the inflows and outflows (₹ in Lacs) are unaudited

ACCOMPLISHMENTS

In over 30 years of existence, TERI has completed more than 3,500 projects. Their outcomes have been as varied as the fields they covered, as can be seen in the following miscellany.

Policy to Ensure a Greener India

Nationally, TERI's influence on government policy making is evident as the Institute has been active in drafting major policy documents—the National Environmental Policy for the Ministry of Environment and Forests (now Ministry of Environment, Forest and Climate Change). The Institute's determined pursuit of an integrated energy policy for the country is showing results—the Government of India has resolved to address the matter in earnest and has fully endorsed the holistic approach advocated by TERI, which focusses on rural energy access instead of rural electrification. TERI worked closely with the XIII Finance Commission of India to see how environment, ecology, and climate change concerns could be integrated in the Indian fiscal federalism framework, and it is encouraging that successive Finance Commissions have explicitly linked fiscal transfers from the centre to states' performance on these issues.

TERI has also played a key role in providing inputs to India's Integrated Energy Policy, formulating the National Action Plan on Climate Change, and, has been actively engaged in the policy discourse on vehicular standards and air pollution.

TERI has also facilitated policy visions and narratives by preparing green growth roadmaps for Himachal Pradesh and Punjab. With support from the Department of Environment, Government of Punjab, it has facilitated the first multi-departmental deliberations on green budgeting in India.

Resource Efficiency

The Institute has also been working on geo-political issues and challenges of accessing energy and other resources from global markets, including the potential restrictions on exports in resource-rich countries in an environment of increased resource nationalism, and the

possible socio-economic impacts of such restrictions. TERI has worked on trade and investment issues in this context wherein it blended quantitative modelling with qualitative analysis. In a resources constrained world, resources efficiency and use of secondary resources, as well as minimization of waste assume crucial significance. TERI has been conducting research in these areas and has also initiated pilot projects in select industrial units. In an environment of enhanced global terrorism, security threats to resources and environment have gained significant relevance and hence this has become one of the recent additions to our research interest. In all these, technology plays a crucial role, and hence access to technology, innovation, and intellectual property rights have also been part of our research activities.

Crusading against Climate Change

In its capacity as a research institute working on climate change from a developing country perspective, TERI has organized various events to raise awareness on this critical issue. It has been playing a major role at a subsequent Conference of the Parties (CoP) to the UN Framework Convention on Climate Change (UNFCCC). TERI has taken a lead in projecting its research activities related to climate change by participating in key side events and discussions and holding exhibitions at designated booths.

The Institute has undertaken research to design policies in the face of a rapidly changing and uncertain future, and is exploring the role of market mechanisms as the urgency for adaptation to climate change increases. On the scientific front, it has acquired supercomputing facility to enable modelling activities wherein both global and regional climate models are being run to generate climate projections. It has successfully installed an Earth System Model at its supercomputing facility in collaboration with the Bjerkness Centre on Climate Research, Norway.

Ensuring Energy Access

TERI's efforts to develop clean lighting and cooking solutions has impacted the lives of nearly 4.5 million people with poor or no access to energy services, across 24 states in India and 13 countries in South Asia and Africa. Several decentralized solar lighting options and improved cooking technologies have been designed and developed to suit

cultural and geographical contexts, in addition to facilitating the creation of more than 200 energy enterprises that have enabled nearly 250,000 households to access and adopt these technologies.

Through its global flagship campaign, Lighting a Billion Lives (LaBL), TERI is making concerted efforts towards addressing the challenge of providing clean lighting to energy-starved populations by adopting a localized bottom-up approach. The campaign operates on an enterprise-based model of energy service delivery, where the dissemination and distribution of clean technologies is promoted by incentivizing energy enterprises to ensure service quality and by facilitating micro-lending by rural banks to maintain the sustainability of interventions. TERI's efforts have not only succeeded in piloting innovative technologies and private sector-led business models, but have also increased community awareness and demand for clean energy products and services.

In another interesting project with Humboldt University, TERI initiated a pilot project to explore the viability of a community-based cooperative solution to enable the switch to LPG. This initiative suggested that social capital in cities can be effectively used to support development programmes. TERI has also been associated with alternative cooking technologies, such as improved

(biomass-fuelled) cook stoves (ICs) and biogas for the last 20 years. While there are multiple alternative cooking technologies available (most notably LPG), TERI has focussed on research and development of ICs for two reasons: (i) the percentage of biomass energy within the total share of different energy sources is set to increase from 10 per cent to 30 per cent by 2050 according to the International Energy Agency, and (ii) since biomass is largely produced and consumed locally, it does not require the establishment of elaborate and expensive supply chains (unlike LPG or kerosene). In the clean cooking realm, TERI's activities also include assessment studies of indoor air quality in households using traditional stoves, research on user requirements for an alternative cooking technology, evaluation of commercially available stove models, research and development of prototype cookstoves with improved thermal

efficiency, creating awareness amongst rural communities to switch to cleaner cooking technologies, conducting extensive user trials of such developed stoves, and customization of technology based on user feedback. Based on these assessments, TERI has developed a low cost improved cookstove at 40 per cent lower cost than a commercial model with comparable performance.

Regional Knowledge Hub for Water and Climate Change Adaptation in South Asia

TERI has been actively involved in understanding the intricate nexus between water, energy, and climate change, and its implications. In 2009, the Asia-Pacific Water Forum endorsed TERI as the Regional Knowledge Hub for Water and Climate Change Adaptation in South Asia. One of the main aims of this knowledge hub is to encourage and facilitate knowledge-sharing on a wide range of issues related to water and climate change. For this purpose, a web portal was established and launched in February 2010. The portal is accessible at <www.waterknowledgehub.org>. In addition to the above, the Water Resources and Forestry Division of TERI has been recognized as a National Key Resource Centre for rural drinking water and sanitation by the Ministry of Drinking Water and Sanitation, Government of India.

TERI's Glacier Research Programme

Since 2009–10, TERI's Glacier Research Programme, through its glacier monitoring observatories at Kolahoi

Glacier and East Rathong Glacier, has conducted several experiments to measure the melting of ice, accumulation of snow, changes in snow density, discharge from pro-glacial streams, and measurement of black carbon concentrations. With special emphasis on the Himalayan ecosystem and with continued research on glacial studies, many outreach activities have been successfully carried out in this area.

Developing Integrated Energy–Economy–Environment Modelling Frameworks

TERI develops and uses a suite of tools, frameworks and models to analyse the inter-linkages across sectors and resources at different levels of spatial disaggregation. Apart from an integrated national-level energy demand–supply optimization model (MARKAL), Input–Output modelling frameworks, computable general equilibrium models, air quality models, spatially disaggregated soil and water analysis models, and regionally downscaled climate models are deployed to inform policy solutions.

Energy-Efficient Technological Solutions for Small and Medium Enterprises

The organization has also been actively involved in developing and promoting energy-efficient and environment-friendly technological options for various energy-intensive Small and Medium Enterprise (SME) sub-sectors. Till date, nearly 600 SMEs have availed of TERI's services and they have been able to reduce energy consumption by more than 200,000 toe. This has also led to improvement in environmental performance and workplace conditions in these units.

Renewable Energy-Based Solutions

With a view to providing sustainable and environmentally benign solutions to diverse user groups since its inception, TERI has been engaged in development and deployment of renewable energy based solutions. These include smart micro grids and renewables based decentralized cold storage for rural areas; biomass-based solutions for micro, small, and medium enterprises as well as for power generation; solar lighting design and testing; advanced biomethanation plants for treating

organic waste; GIS-based integrated renewable energy assessment; and solar rooftop solutions. TERI was first to study solar park feasibility concept for large-scale deployment of solar power plants. TERI team also provided technical support to industries and corporates to adopt renewables and also to study market potential for their renewable energy-based products and technologies.

Designs for More Sustainable Buildings

TERI's facilities in Delhi (TERI University building), Gurugram (RETREAT), Bengaluru, Guwahati, and Mukteshwar (TRISHA) serve as models of eco-friendly design. In 2006–07, TERI's Green Rating for Integrated Habitat Assessment (GRIHA) was launched. This innovative environmental performance rating system for buildings (commercial, institutional, or residential) has been specifically developed for Indian conditions, taking into account India's prioritized national concerns, namely power, water, and waste. Some of its salient features are as follows: (i) it is among a handful of global rating systems that use qualitative and quantitative assessment criteria, based on benchmarks derived from existing national codes and standards; (ii) it evaluates the environmental

performance of a building throughout its lifecycle, thereby providing a definitive standard for what constitutes a 'green building'; (iii) it gives equal importance to non-air-conditioned buildings that rely on passive architectural systems, as it does to intermittently air-conditioned buildings and fully air-conditioned buildings; and (iv) it also attempts at reviving traditional Indian architectural systems at a time when every city is beginning to look exactly like the other in terms of the built environment. GRIHA has now become a national rating system adopted by the Government of India, and currently there are over 250 projects (10.4 million square metres) registered under GRIHA.

Key projects include the Commonwealth Games Village; Earth System and Environment Science Engineering Building; Indian Institute of Technology, Kanpur; Fortis Hospital, Delhi; and Suzlon One Earth project. ADaRSH or Association for Development and Research of Sustainable Habitats, is an independent platform (registered as a society) for the interaction on scientific and administrative issues related to sustainable habitats in the Indian context. It was founded jointly by Ministry of New and Renewable Energy (MNRE), Government of India, and The Energy and Resources Institute (TERI), New Delhi, along with experts in the fields related to sustainability of built environment from across the country. ADaRSH promotes Green Rating for Integrated Habitat Assessment (GRIHA)—the national rating system as a design and evaluation tool for green buildings and habitats.

Engaging with Developments in Nanotechnology

Gauging that nanotechnology can play a vital role in alleviating poverty and furthering sustainable development, TERI is engaged in examining various aspects of the capability needed from a developing country perspective to engage with and respond to nanotechnology developments and the governance framework needed to address the accompanying challenges and risks around this new technology.

TERI's Nanobiotechnology

Research in agriculture involves the biosynthesis of nanomaterials, nanobiosensors for disease diagnosis and pathogen detection in plants, algal nano-farming, and as well as nanopesticides and nanofertilizers. Deakin University, Australia, has complementary expertise in material and physical sciences that drove TERI to sign a memorandum of understanding (MoU) with it in November 2010, and set up the TERI–Deakin Nanobiotechnology Centre at TERI's green campus in Gurugram, Haryana.

Mycorrhiza Technology

TERI's Mycorrhiza technology, which is unique and globally the only technology producing unique multiple species product, is licensed to seven industries in India and in North America and created a niche in this area with a global edge with next generation products for agriculture and environmental application. Approximately 2 million acres of agricultural land have received benefits from this technology by improving soil health, crop productivity, and at the same time reduction of fertilizer application up to 50 per cent. Besides agriculture, immense potential in reclamation of stressed ecosystems like fly ash dumps, sites loaded with alkali chlor sludge, phsophogypsum or distillery effluents were sustainably restored.

Microbes for Efficient Recovery of Oil

With state-of-the-art fermentation facilities, TERI has successfully developed some novel technologies for the oil industry—Oilzapper and MEOR. Oilzapper is globally acknowledged for its broad implications in cleaning up oil spills and treatment of oily sludge generated by refineries. TERI is currently engaged in a mega project granted by Kuwait Oil Company (KOC) for the bioremediation of 400,000 tonnes of oil-contaminated soil. A Microbial Enhanced Oil Recovery (MEOR) technology has also achieved substantial recognition across public sector oil companies in India for enhanced oil recovery from oil reservoirs by tackling the worldwide problem of oil well stripping. TERI and ONGC have formed a joint-venture company known as the ONGC and TERI Biotech Ltd (OTBL) to implement this technology on a commercial scale.

'Oilzapper' Technology

With the state-of-art pilot scale fermentation facilities, TERI has successfully developed an indigenous sustainable bioremediation technology, 'Oilzapper' for broad scale implication in cleaning up of oil spills and treatment of oily sludge. 'Oilzapper' is a consortium of crude oil and oily sludge degrading bacteria, derived from various bacterial cultures existing in the natural environment. Nearly

70 per cent of oil refineries (ONGC, IOCL, HPCL, BPCL, Oil India Ltd, Tata Power, BG Exploration Ltd, including Reliance Petroleum) in India use TERI's Oilzapper technology. Oilzapper, has successfully treated more than 450,000 m^3 of oil contaminated soil & oily sludge that has eventually reclaimed more than 100,000 hectares of contaminated croplands, in different parts of the country. This has helped to restore more than 2,500 farmer's land that restored the livelihood of farmers. Carrying this forward, TERI is now actively engaged with clean-up of massive oil spill sites in Kuwait—the first-of-its-kind large-scale bioremediation project implemented by India's biotechnology sector.

'MEOR' Technology

Ageing of oil wells is a perpetual problem that the oil industries are facing globally. Oil wells get stripped after recovery of around 20–30 per cent of oil in place. Eventually further oil flow decreases and stops production, leaving behind more than 70 per cent of oil in place. TERI and IRS (Institute of Reservoir Studies) ONGC have developed an innovative 'Microbial Enhanced Oil Recovery' (MEOR) technology to tackle the worldwide problem of oil well stripping. MEOR technology helps in additional recovery of around 10 per cent of residual oil. MEOR technology is patented jointly by TERI &IRS ONGC and has been successfully applied in more than 110 oil wells of ONGC and Oil India Ltd.

'PDB' Technology

Production of waxy crude oil is a global serious concern for the oil producing companies. Waxy crude oil is highly viscous due to which it blocks the oil well tubings. Conventional techniques for removal of paraffin/wax deposition in the oil well tubing/oil pipelines are highly expensive and plagued with other associated problems. TERI and IRS (Institute of Reservoir Studies) ONGC have developed and commercialized a microbial based, cost effective sustainable technology for prevention of paraffin/wax deposition in oil well tubing/oil pipelines. This technology helps in increasing the oil production and has been successfully applied to prevent paraffin/wax deposition in 485 oil wells of ONGC and Oil India.

'Biohydrogen' production (Clean energy) Technology

Fast depletion of conventional fossil fuel reserves along with the global concern for energy supply security have drawn global R&D efforts towards alternative energy generation from renewable resources. With a converging desire to combat climate change and to improve energy security, TERI commenced research activities on exploring

robust microbe(s) for development of process to produce clean energy forms; biohydrogen. With the aid of financial supports from HPCL (Hindustan Petroleum Corporation Ltd), Centre for High Technology, MoP&NG (Ministry of Petroleum and Natural Gas), and DBT (Department of Biotechnology), TERI researchers developed a bio based process for fermentative hydrogen production in pilot scale (1,000 litre working volume) from organic waste through dark fermentative route with the employment of robust anaerobic microbe(s) (Isolated by TERI). Further, TERI is actively engaged with development of biohydrogen production process in pilot scale by using second generation non-food competitive feed stocks; biomass based sugars.

'Bollcure' Technology

Efforts on the screening of biodiversity for bioactive molecules has led to the development of 'Bollcure' biopesticide from eucalyptus leaf extract. It is effectively used for the control of pod borer Helicoverpa armigera in cotton and chick pea. Besides having outstanding results for the control of borer it has also been found suitable for the control of other insect pest complex like Spodoptera, Diamond black moth, Cabbage looper, Silver leaf white fly, Melon aphid, Western flower thrip, Cabbage aphid, Asian Citrus Psyllid, Root knot nematode, Thrips, and Jassids, thus providing an environment friendly solution for pest control.

2,3-Butane Diol (Specialty green chemical) production Technology

Specialty chemical segment in India has been growing at a rapid pace owing to the growing key end use markets. 2,3-Butane Diol (2,3-BD) is a special chemical which has profound application as a precursor molecule for synthesis of a range of important downstream chemicals: 1,3-butadiene; butenes; methyl ethyl ketone (MEK); gamma butyrolactone; diacetyl; esters, and for use in fuel additives, textiles, polymers, synthetic rubbers & plastics. The potential global market for such molecules is more than 30 million tonnes per annum, accounting to >$40 billion in sales revenues. TERI researchers developed a microbial process for 2,3-BD production in pilot scale from commercial grade glucose by employing Enterobacter cloacae (non-pathogenic strain, isolated by TERI). This microbe is competitive to employ for industrial scale production of 2,3-BD. Current demand for 2,3-BD production is being met by employing petroleum-based feed stocks. Commercialization of the green

2.3-BD production technology, will play a pivotal role in green chemical industry.

Enhanced methane recovery from underground coal seams

With a goal to enhance energy recovery from coal bed, TERI (with the financial assistance from ONGC Energy Center) researchers developed a bioprocess for methane production from coal by employing a selected unique coal utilizing microbial consortium and exploring the budding technology for in situ stimulation of coal bed methane production in field scale in Coal Bed Methane wells in Jharia.

Enhancing Food Security

The activities of TERI also focus on developing new plant varieties with improved yield and quality attributes, thereby increasing the productivity and productive capacity of all types of land using cost-effective, eco-friendly microbial resources known as mycorrhizal fungi, and large-scale propagation of high-quality plant material using modern biotechnological techniques.

Increasing Livelihoods

TERI has initiated efforts by establishing TRISHA (TERI's Research Initiative at Supi for Himalayan Advancement) at Supi in Nainital district of Uttarakhand. Since agriculture is the main occupation,

research and extension has been largely undertaken to improve the livelihoods of local farmers. Using various sustainable agro-based technologies, marginal farmers have been benefitted and their incomes have increased. Till date, more than 5,000 farmers have been touched by TERI's initiatives.

Resource-Efficient Process Technologies

TERI has been at the forefront of developing technologies for value added use of waste / renewable materials, such as membrane filters from bagasse ash for applications in wastewater treatment, hot gas cleaning, sugarcane juice clarification, and biodegradable polymers from agro resources. TERI is also working with metal SMEs in India and other South Asian countries to improve their resource efficiency.

Raising Awareness Online

The TERI website became operational in December 1996. To increase awareness and interaction on a variety of issues related to sustainable development, TERI's website has become thematic. TERI's projects, events, publications, films, and case studies are divided under particular themes, such as biodiversity, nanotechnology, sustainable habitats, and so on. The website records more than 2 million hits and over five lakh page views a month from over 130 countries; close to 1,000 websites the world over carry a link to www.teriin.org.

Database of Scientific Equipment

As an innovative project, the Library and Information Centre (http://www.teriin.org/library/) has developed a nation-wide searchable Database of Scientific Equipment which is widely acclaimed by scientific communities in India. The project was sponsored by the Department of Science & Technology, Government of India. Recently, LIC undertook a study on mapping institutions, research and funders in India within the Water–Energy–Food Nexus research area, commissioned by Research Councils UK, India. The study mapped the research publication outputs of the increasingly critical interface of water, energy, and food, and their intertwined relationship in Indian research.

Development of Specialized Knowledge Centres

During past years, LIC was engaged into development of specialized knowledge centres. These centres are self-sufficient in resources and were working in bridging the knowledge gap across different civil society stakeholders. Some of our major initiatives are worthy to be mentioned here.

- Knowledge X-change for Sustainable Development (www.kxsd.org) to facilitate knowledge sharing across the facets of sustainable development.
- Specialized Library on Climate Change (http://www.teriin.org/slcc/), functions as information clearinghouse on climate change.
- ENVIS Centre on Renewable Energy and Environment (www.

terienvis.nic.in) provides knowledge support to research, innovation and policy making in India.

- Mycorrhiza Information Centre (http://mycorrhizae.org.in/index.php) sponsored by the Department of Biotechnology, Government of India, disseminates the knowledge and research in the field of Mycorrhiza globally.
- The Indian Transport Data and Statistics Section specialises on providing Indian transport related data for the International Transport Forum/OECD, Paris.

Urban Development and Mobility

Focussed on policy analysis, sustainable urban planning, capacity building, and knowledge creation, TERI has been recognized as a Centre of Excellence in this field by the Ministry of Urban Development, Government of India, and has been empanelled as a consultant for providing technical assistance to cities under the Smart Cities Mission of the Government of India. TERI also provides training support to the Institute of Urban Transport (India), under the Sustainable Urban Transport Project of Government of India. In this capacity, TERI has prepared tool kits to build the capacity of city officials on subjects related to sustainable urban transport.

Micropropagation Technology Park

TERI has extensive capabilities in the area of plant tissue culture backed by over

two decades of research, development, and commercial demonstrations. In 1989, TERI established a state-of-the-art Micropropagation Technology Park (MTP) at Gual Pahari, Gurugram, at the Delhi–Haryana border with Department of Biotechnology support, includes infrastructural facilities ranging from modern laboratories and greenhouses to nurseries. With an annual production capacity of 1.5 million tissue-cultured plants, the facility is managed by a dedicated team of research scientists and production staff.

Power Regulation Studies

TERI has also been actively engaged in studies in the field of energy regulation and governance and Demand Side Management (DSM). It has undertaken detailed studies of electrical load patterns of different categories of consumers in 14 utilities spread across 7 Indian states over the past around 5 years and identified DSM interventions that would help in demand management. TERI had also undertaken a few Learning and Development Programmes on 'Regulatory Framework in Power Sector' for senior officials of Powergrid and POSOCO in the past. The objective of these programmes was to provide in-depth insight into relevant acts, policies, and regulations of interest to practicing professionals.

South–South Knowledge Exchange

The 'South–South Knowledge Exchange' is a TERI platform to share experiences and knowledge of sustainable development related to climate change, energy, resources, trade, and so on, to aid people from various developing, least developed, and emerging countries. The South-South Knowledge Exchange aims to integrate diverse regions and its people through this forum. The platform offers a unique opportunity to people associated with activities in these diverse nations to voice their opinions and perspectives on sustainable development and is available at http://south-south.connect.teriin.org/.

Responsible Minerals Policy and Management for India

TERI has been focussing on a more responsible minerals policy and management for India. In this context, its research and advocacy has highlighted some of the areas in which minerals development can work more positively for local people, such as the importance of sharing benefits with local people, ensuring consent, and environmental stewardship. It is also engaged in identifying critical minerals and ensuring their security, working on materials efficiency, and on emerging issues around trade in minerals and metals. Its work on resource and environmental federalism seeks to highlight the point that federalism is not just about the distribution of powers across government levels, but has to also be understood with reference to people of the states.

Contributing to India's International Engagement

TERI has been working on several global issues, including climate change, environment, trade, resource security and sustainable development goals and also been providing inputs to the government ministries and agencies not only for policy making at national and state levels, but also to help evolve their international position and negotiating strategies and approaches in international platforms that deal with these issues. For example, such inputs were used in developing India's submissions and negotiating position in UNFCCC and its conferences, WTO discussions, and United Nations Conference on Sustainable Development.

OUR RESEARCH AND SUPPORT SERVICES DIVISIONS

Research in TERI is undertaken through Divisions. It caters to the needs of the national and international community within the broad mandate of energy, resources, environment, and sustainable development.

Biotechnology and Management of Bioresources

The Division comprises four areas, each one specializing in different but related fields of biotechnology with the mission to create innovative and green solutions for the challenges and pressing problems being faced in the field of agriculture, environment, and bioenergy. The Centre for Mycorrhizal Research (CMR) promotes cost-effective, environment-friendly alternatives to ensure higher plant productivity in agriculture, unproductive lands, and reclamation of wastelands, created due to industrial operations, by employing beneficial group of organisms known as mycorrhizal fungi. The Nanobiotechnology Centre (NBC) is using pioneering technologies and solutions to achieve sustainability in agriculture through nanotechnology. The next-generation genomics interventions create and innovate solutions for cleaner and greener energy, while waste management through nanotechnology is yet another area which is eventually targeting higher crop productivity. The Micropropagation Technology Park (MTP) focusses on large-scale production of tissue-cultured plants of various economically important species with an annual capacity of over two million. This facility is ISO 9001 certified and is also accredited under the National Certification System for Tissue Culture Raised Plants (NCS-TCP) by the Department of Biotechnology, Ministry of Science and Technology, Government of India, for the production of quality planting material through tissue culture. The Plant Tissue Culture and Molecular Biology (PTCMB) area has been working on the themes of genetic improvement of crops to achieve food and energy security under changing environments with a wide array of crops of high economic value; bioprospecting and production of valuable compounds

for agriculture and health; and livelihood augmentation through dissemination of agro-technologies amongst the farming community.

Environmental and Industrial Biotechnology

The detrimental impact of pollutants on the environment, including the global concern for energy security and food security, has resulted in a shifting of the global priority towards finding solutions for environmental protection, energy production, and food production in a sustainable manner.

To achieve the goal of sustainability, the Environmental and Industrial Biotechnology Division (EIBD) is actively engaged with research areas spanning the domain of microbial as well as plant-based interventions to explore sustainable approaches for protection of environment, protection of crops from pests, for enhanced production of oil from matured oil wells as well as for alternate renewable energy production. Innovative research explorations of EIBD finally paved the way for the development of a couple of microbial and plant-based technologies such as 'Oilzapper' (for bioremediation of oil spill and oily sludge), 'MEOR' (Microbially Enhanced Oil Recovery), and 'PDB' (Paraffin Degrading Bacteria), for prevention of paraffin deposition in oil well tubing. These technologies eventually commercialized and implemented in field scale with the creation of a joint venture 'ONGC TERI Biotech Ltd (OTBL)'.

Carrying forward the research activities in energy production, this Division developed a large-scale dark fermentative biohydrogen production process in 1,000 litre scale by using sugar industry waste as feed stock. Other energy research explorations include microbial production of ethanol, hydrogen gas generation from second generation feed stock, algal biofuel production, including enhanced coal bed methane production and carbon sequestration. Further, this Division is actively engaged with exploitation of metagenomics for production of biodegradable plastics, detection and control of microbial induced corrosion in oil and gas pipelines, probiotics

and clinical trials and development of biological production of 2, 3-butanediol from bacterial fermentation broth.

The other activities of this domain include bioprospecting of endophytes for production of bioactive metabolites and promotion of integrated pest management (IPM) modules across different states of the country. The Division has already isolated more than 1,500 endophytes from different medicinal plants growing in India and screened against a plethora of plant pathogenic fungi for antagonistic activity, hytotoxicity studies, nematicide activity, and anti-feedancy activity against plant pests of economically important crops. These endophytes are currently under various stages of evaluation and subsequent development and in the near future, may become a part of IPM programme. Presently, the Division is pursuing research in the field of micropropagation, algal biofuel, and field trial in various agro-climatic zones.

All the research explorations carried out on various domains as highlighted above are recognized in the form of 16 patents (9 sanctioned and 7 filed) and more than 100 high impact factor peer reviewed international publications.

Industrial Energy Efficiency

The industry sector is a crucial component of the Indian economy in terms of its contribution to economic growth, trade, and as an employment provider. The sector is also the largest consumer of commercial energy, accounting for nearly half of the total energy consumed in the country.

The industry sector is a mixture of large as well as Micro, Small and Medium Enterprises (MSMEs). India's growth story and the government's ambitious 'Make in India' campaign is contingent upon the prosperity of this sector. The challenge, however, is to grow in a manner that is resource-efficient and addresses sustainability considerations from all perspectives—social, economic, and environmental. In this context, TERI's Industrial Energy Efficiency (IEE) Division works closely with the corporate sector and provides

services to both large and small industries to improve their energy performance.

The pool of engineers in the Division, many of who are accredited and certified energy auditors with the Bureau of Energy Efficiency, Government of India, regularly conduct energy audits in industries to identify options for energy conservation at the plant level. With expertise and deep knowledge of applicable technologies, the Division is able to offer the corporate sector high quality technical advice on ways to reduce their carbon footprint. TERI is a leading name in promoting energy efficiency and facilitating deployment of energy-efficient technologies in the MSME sector, courtesy the IEE division's continuous engagement with the sector for the past two decades. Other than conducting energy audits and sectoral studies and facilitating implementation in industries, the Division researches and provides services in all vital sub-sectors of electricity regulation. The Division has significant experience in working on tariff rationalization, load forecasting, load flow analysis, loss assessment, strategic system planning, framing and evaluation of policies/regulations, etc.

Green Growth and Resource Efficiency

The mandate of the Green Growth and Resource Efficiency (GGRE) Division is to design and provide holistic solutions by undertaking integrated assessments across resources and sectors in keeping with the basic tenets of resource efficient green growth and sustainable development. The Division has been involved in greenhouse gas (GHG) emission inventorization & projections, helping in the formulation of India's Intended Nationally Determined Contributions (INDCs), informing policy formulation and planning across the energy sectors, and evaluating transition pathways for clean energy access. The research on energy security focusses on identifying risks due to geopolitics, markets volatility, governance bottlenecks, etc. The Division has also worked with State Electricity Regulatory Commissions (SERCs) on regulatory issues in India's clean energy transformation.

The Division is also engaged with several State Governments to examine multiple issues including green budgeting, natural resource accounting, carrying capacity assessments, delineating opportunities to align mitigation options with the developmental aspirations, and in identifying solutions for promoting natural resource management and environmental sustainability.

The research on sustainable development goals (SDGs) focusses on issues of sustainable consumption production and resource efficiency in different sectors. It also analysed the

linkages between trade liberalization, resource efficiency, and environmental protection in the broader context of globalization and sustainable development. The Division has also been engaged in examining the policy and institutional framework for supporting organic agriculture along with exploring benefits and challenges of organic farming at the national and state levels.

Sustainable Habitat

The Sustainable Habitat Division focusses on cities, transport, and buildings with its projects ranging from city- to building-level interventions. In the area of urban development, the Division has carried out research to help create sustainable, resilient, and 'smarter' cities. The Division works in collaboration with various stakeholders, including national and international governments, bilateral and multilateral agencies, foundations, research institutes, corporates, NGOs, civil society and sector experts. The Division provides technical and capacity building assistance to city governments to address issues pertaining to urban development, policies, and governance.

With the key objectives of promoting low carbon and sustainable transportation, the focus of the Division's work in the domain of transport research has been on policy analysis, energy and environment analysis, capacity building, and knowledge creation.

The Centre for Research on Sustainable Building Science (CRSBS) has been focussing on the development and mainstreaming of sustainable buildings and large developments, to improve performance levels of existing buildings, to facilitate the efficient design of new buildings, demonstration/ implementation of low cooling/heating technologies, and raise awareness on sustainable buildings. The group specialized in offering environmental design solutions for habitat and buildings of various complexities and functions. The CRSBS group is actively working in the space of affordable housing and has documented case studies and carried out lifecycle cost analysis of affordable housing. TERI has recently set up a Centre of Excellence (CoE) with the support of Mahindra Lifespaces to carry out research activity on building materials to promote sustainable and affordable housing in India.

The GRIHA Council under Sustainable Habitat Division has been established jointly by TERI and Ministry of New and Renewable Energy (MNRE), Government of India. GRIHA Council promotes and facilitates GRIHA (Green Building for Integrated Habitat Assessment) – National Rating System for green buildings in India. The rating system has been recognized

as a key guideline for construction of sustainable buildings across the country. In a recent report by the Government of India on 'India's Intended Nationally Determined Contributions', GRIHA has been acknowledged as India's own green building guideline. The strength of this unique rating system lies in the rigorous implementation through due diligence visits and proven performance of rated projects.

Energy Environment Technology Development

This Division endeavours to develop innovative technological products and services based on renewable energy technologies and resource efficiency through a multidisciplinary approach and close interaction with the user—the community and industry. The Division was among first few to start wind energy resource mapping and energy resource data analysis in 1980s. While technology development is its primary function, the Division works on multiple issues related policy, regulatory and implementation of renewable energy technologies across the sectors. Its activities range from providing biomass-gasifier-based energy to remote rural communities to facilitating renewables-based large-scale power generation; from efficient utilization of biomass in small- and micro-enterprises to enhancing resource efficiency in industrial processes; from developing renewables-based multi-utility platforms for productive loads in villages to smart mini-grids for large habitats; and from developing a two-stage gasifier capable of providing ultra-clean syngas to the next generation of liquid biofuels.

It has notched its niche in energy planning and renewable energy integration in national energy planning. The Division carried out an extensive 'Integrated Energy Management Master Plan for The Royal Government of Bhutan' which resulted in driving their energy sector with innovative concepts like electric mobility and so on. The team was also first to carry out studies on RECs (Renewable Energy Certificates) for India.

The Division also supported international organisations like REEEP

by managing their regional office, and providing knowledge and data inputs to international efforts like Global Status of Renewables report of REN21. It has been part of many major international multi country studies funded by European Union, the GEF (Global Environment Facility), IEA (International Energy Agency), and so on. The Division also lends assistance to renewable energy integration with grid, smart grid studies and renewable energy forecasting.

The Division also focusses on innovative utilization of waste materials for a variety of applications, such as biodegradable polymers for packaging and biomedical applications, fly ash filters for various applications, membrane bioreactors for wastewater treatment, advanced biomethanation systems for organic waste treatment, and waste-derived catalysts.

Technology Dissemination

TERI has been developing a range of sustainable technologies and solutions, ranging from biomass gasifiers to biofertilizers, biopesticides, and oil-eating microbial solutions. The Technology Dissemination (TD) Division in TERI ensures the smooth and systematic movement of TERI technologies from laboratories to industry. TERI's technologies have been developed by various research groups working in several areas from biotechnology to clean energy-based solutions with an understanding of current market and environmental concerns and the need for sustainable solutions to address the same. The primary objective of TD is to bring together a diverse group of people with multi-disciplinary skills for effective technology dissemination. In order to accomplish the same, we work in several areas such as:

- Actively facilitating the framing and signing of commercial agreements
- Identification of potential licensees and network agents
- Ensuring TERI's intellectual property is protected via patents (both national and international), trademarks, and copyrights. Recently, TERI has secured patent protection for its biopesticide technology 'Bollcure' in several international jurisdictions, such as Australia and South Africa
- Leveraging TERI's intellectual property for commercialization
- Promoting TERI's technologies through demonstration, exhibitions, and stakeholder workshops.

One of the key goals of the Division is to develop strategic alliances and partnerships for the marketing and dissemination of technologies, both in national and international markets that mutually benefit TERI and its partners. Under the TERI–SDC Biomass

Programme (TSBP), the Division headed the delivery and dissemination component with respect to accelerated dissemination of biomass gasifiers. Over the past few years, TERI has effectively disseminated its research with joint ventures and partnerships.

Social Transformation

The Social Transformation Division is the action-research arm of TERI in the rural development space that works primarily through a combination of grass root interventions and action-research based policy design. It brings together the latest in techno-socio-institutional knowledge, to deliver locally appropriate solutions that address the basic needs of underserved communities. Over the last few years, the Division has worked extensively in the field of 'energy access' to accomplish TERI's commitment towards enabling affordable and sustainable energy services through interventions that address consumptive and productive energy requirements at the household and micro-enterprise level, specifically in rural, remote, and peri-urban areas.

In this realm, with 'energy access' as a pivotal theme for the Division's activities, the effort has been to address two key aspects for effective and sustainable energy provisioning. The first is to ensure that affordable and reliable clean energy solutions (for lighting and cooking) reach rural households, particularly the poorer households. This has been driven through the development and implementation of innovative, affordable, responsive, and replicable technologies and delivery models, the creation of new partnerships and collaborations at the grassroots, and the adoption of a bottom–up approach, engaging members of the community to create inclusive energy provisioning supply chains.

Some key projects undertaken by the Division include, the installation of clean and reliable power infrastructure to improve the operational reliability and service quality of primary health centres in rural India; enabling the maintenance of vaccines in identified community health centres and clinics through the installation of smart monitoring solutions that help technicians to monitor optimal freshness and quality of vaccines more efficiently and effectively; enabling the creation of improved and prolonged study environments for children in rural India through the provision of standalone clean lighting solutions; fostering the creation of community centres and knowledge hubs through the development of green and sustainable community libraries in villages; assessing household and village energy needs to recommend and design integrated energy plans for the development of smart villages;

incentivizing the adoption of improved cooking solutions through a simulated carbon credit market; evaluating the impact of socio-economic components in the Integrated Watershed Management Programme and building capacities of community-based organizations and Watershed Committees for effective management of natural resources.

Water Resources and Forestry

Water is a pristine resource which supports life on this planet. The core objective of the Water Resources and Forestry Division is to develop and implement integrated solutions for sustainable water management. The Division has core competencies in quantitative and qualitative assessment of water resources, water audit and water foot-printing, watershed management, urban water demand management, glacier research, hydrological assessments, rural water supply and sanitation sector, water quality and pollution studies, and policy analysis.

Over the years, the Division has built expertise in carrying out water audits and water foot-printing studies and has helped various industries and clients in enhancing water use efficiency. The Division has also been instrumental in proposing strategic recommendations for the corporate sector for better management of water resources.

The Division also works on the important and emerging issues of water–energy–food–climate change nexus and has analysed the intricate nexus at various spatial scales with a focus on urban areas and power generating plants. The Division has been actively involved in carrying out various research activities in the high altitude regions, including studies on glaciers and glacier-fed catchments and their impact on downstream community.

The Division is also a Resource Centre on Water Use Efficiency, jointly hosted by TERI and Jain Irrigation Systems Ltd. It has been endorsed as the Regional Knowledge Hub for Water and Climate Change Adaptation by the Asia Pacific Water Forum. It has also been recognized as the National Key Resource Centre for rural drinking water and sanitation

by the Ministry of Rural Development, Government of India.

The forestry area developed ten A/R CDM projects, covering ten forest divisions of Uttar Pradesh, which have been successfully registered with the United Nations Framework Convention on Climate Change (UNFCCC). The area is carrying out a major long-term study on Monitoring, Evaluation, Learning and Documentation (MEL&D) of projects under Integrated Watershed Management Programme (IWMP) for batch II, III, and IV projects in Uttarakhand. The group works on several aspects of biodiversity, including assessment of flora and fauna, management of protected areas, community conserved areas and sacred natural sites, landscape level planning, sustainable use of non-timber forest products (NTFPs), and various policy issues, including Access and Benefit-Sharing (ABS) out of the commercial use of biodiversity resources. At present, the area is implementing a programme on Agriculture, Greening, Training, Capacity Building, and Income Generation activities supported by Coal India Ltd. The area is working with Ministry of Tribal Affairs, on fixing minimum support price of twelve major minor forest produce of the country. The area is working with INBAR on a project exploring market potential and livelihood linkages in bamboo sector in Mizoram. In addition, the area has been organizing the two months Mid-Career Training (MCT) Programme for senior IFS officials and one-week training programme for senior IFS officials on a regular basis since past few years. Besides, the group also conducts number of training programmes on forestry, biodiversity and climate change issues for various stakeholders, including the foresters.

Sustainable Development Outreach and Youth Education

The Sustainable Development Outreach & Youth Education (SDO&YE) Division of TERI ensures that TERI's research and knowledge is shared with varied audiences, including governments, policymakers, corporates, academic and research institutions, media, youth, and civil society. Through seminars,

workshops, conferences, and summits at national and international levels, the Division facilitates exchange of information and ideas amongst various stakeholders.

The Environmental Education and Awareness Area (EEA), has been working diligently to create awareness and enable youth to comprehend their relationship with the environment and make concerted efforts to conserve it for a 'quality' environment with improved standards of living. EEA engages students, teachers, and the youth in promoting environmental sustainability and support them in value-based learning for creating environmentally responsible citizenry and self-reliance in communities through effective resource management initiatives at the local, national, and global levels.

The Delhi Sustainable Development Summit (DSDS) was initiated in 2001, with the sole aim to make 'sustainable development' a globally shared goal. The Summit brought together the finest minds and leading thinkers of the world to focus attention on prevalent challenges related to sustainable development at the global, regional, and local levels. Following the landmark Paris Agreement and the adoption of the Sustainable Development Goals by the global community, the DSDS has evolved into the World Sustainable Development Summit (WSDS). This endeavour aspires to raise the platform, attract greater talent and expertise, and devise ways so that messages that are crafted at this platform are widely disseminated leading to constructive action. The 2016 edition of the WSDS was hosted from October 5–8, 2016, under the broad rubric of 'Beyond 2015: People, Planet & Progress' at the India Habitat Centre, Lodhi Road, New Delhi.

Earth Science and Climate Change

The warming of the Earth's surface has adverse consequences for all life forms on the planet and is a policy challenge at the global level. At the same time, local environmental degradation has more immediate impacts on social well-being and requires policy reforms.

The Earth Science and Climate Change Division has core competencies in environmental monitoring and modelling, impacts assessment, and policy analysis. State-of-the-art air quality models are used by the Division for suggesting measures to improve air quality at urban and regional scales. The group has also been active in advocating policies for clean and sustainable transport in the country. Energy–environment relationships in urban, industrial, and rural settings have received continued interest in a number of research studies that involve both quantitative modelling as well as the use of participatory field-based methods.

Over the years, the Division has built expertise in establishing and assessing the linkages between environment and health which have been instrumental in driving national-level policies. In the context of climate change research, the Division focusses on climate modelling; impacts, vulnerability, and adaptation assessment; policy analysis; climate change mitigation and GHG (greenhouse gas) inventorization as its key thrust areas. Capacity building and outreach forms the core of each of these thrust areas.

The Division has been regularly carrying out capacity building programmes for various stakeholders on different subjects, such as air quality modelling, indoor air quality measurements, etc. Recently, the Division has started extending its research and capacity-building activities to other developing countries and emerging economies, including a major e-learning programme on the science and policy of climate change. A strong research-based collaborative programme is already in place for Africa. A number of international collaborations with institutions of global repute have ensured that there is exchange of knowledge and expertise and strengthening of the core competencies within the Division.

Knowledge Management

As a research-based think tank organization, TERI emphasizes on knowledge ideation, creation, and global dissemination of its research on sustainable development. Its objectives are fulfilled through the provision of a library, documentation, managing knowledge, and publication services. The Division supports TERI's collaborative research activities through a well-designed, state-of-the-art knowledge management system. The Knowledge Management Division has two major areas—Library and Information Centre and TERI Press.

The Library and Information Centre (LIC) caters to the rising knowledge needs of both TERI researchers and external professionals by collecting, collating, and disseminating knowledge-based products and proactive online and digital value-added services. LIC subscribes to a wide array of resources, including books, reports, periodicals, and

e-resources. Besides providing research assistance to users, the core competency of LIC professionals includes providing innovative knowledge-based services; capacity building for research and knowledge and information professionals; web content development: contributions to publications: and setting up specialized information centres on contemporary themes such as transport, renewable energy and environment, mycorrhiza, and climate change.

TERI Press, the publishing arm of TERI, is one of the foremost publisher of environmental books in the country. Best known for its titles in the areas of environment, energy, and sustainable development, TERI Press is committed to publishing high quality works at all levels—from children's books to higher education titles and from magazines to journals. TERI Press publishes fiction, non-fiction, educational, children's books and reference titles on topics such as recycling, climate change, water conservation, clean energy, etc.

We publish in both print and digital media to serve the needs of learners at all levels and the research community as a whole. In keeping with the intellectual quality of the titles we publish, we ensure that every title benefits from our exacting professional standards. We also go on to ensure quality education with solutions on sustainable development, environment conservation, energy efficiency and green growth. We are a trusted partner of corporates, multilateral/bilateral institutions, and government agencies for developing knowledge resources and literacy skills addressing the SDGs goals towards education for sustainable development. Our endeavours have benefitted more than 1 million children and youth across the globe. The TERI Press team of dedicated editors, graphic designers, graphic artists, production supervisors, and dissemination experts places great emphasis on quality, adhering to a stringent set of standards.

Information Technology

The Information Technology Division is responsible for providing state-of-the-art IT infrastructure, platforms, and applications for bringing operational efficiency, enhancing productivity, and enabling collaboration. It also provides support to other divisions for knowledge sharing, capacity-building, and outreach activities.

The Division has strengthened its expertise in developing mobile applications. Internal applications, such as the TERI People Directory, Pool-a-Car, ClaimXpense, and external quiz app, GreenIQ to assess level of awareness on sustainability issues were developed. Expanding its video documentation work, the Division made short videos, video-infographics,

3D animations, and motion graphics for disseminating research project outcomes, promoting events, and creating awareness on different topics. In the area of customized applications, the HVAC Energy Analysis Tool was developed to help the researchers of Building Science to size and choose equipment and estimate annual energy consumption, specifically for centralized cooling system. For GRIHA Council, two new rating systems were developed in the online rating platform, namely, 'GRIHA 2015' and 'GRIHA for Larger Development 2015'. For TERI University, the Division developed an online annual appraisal system and automated the submission of Major/Minor projects to bring in operational efficiency and transparency. The Division has also set up the IT infrastructure and web presence for TERI Prakriti School.

Human Resources

The objective of the Human Resource Division is to provide the organization with a pool of satisfied employees who diligently work towards the realization of the vision and mission of TERI and, in turn, serve society. Its role is not only to identify and acquire the desired 'talent' for TERI, but it also takes initiatives for talent management and retention. Apart from facilitating the learning and development activities for the staff as per their roles and requirements, the Division endeavours to facilitate smooth induction of new employees, mentoring and enhancing the engagement levels of existing employees through various employee engagement activities. Colleagues at all levels, across the Institute are exposed to training programmes on a variety of behavioural and technical skills. These programmes aim at refining leadership skills, enhancing personal effectiveness, sharpening interpersonal skills, improving time management, and building people management skills. The outbound learning activities focus on promoting team dynamics at work and building a proactive approach for generating new research ideas.

TERI's cross-functional research activities provide opportunities to professionals to contribute to areas other than their primary research area, thereby enhancing interdisciplinary work. The Division organizes sports and cultural activities for TERI's employees and their families to strengthen employer-employee bonding. A system of rewards and recognitions, over and above the annual appraisal system, recognizes colleagues for their significant contributions at work. Town Hall Meetings and the Annual Vision Retreat provide a platform for employees to share ideas and participate in decision making. The Internal Complaints

Committee (ICC) for TERI had been constituted as per the New Act 2013 on Sexual Harassment of Women at Workplace: Prevention, Prohibition and Redressal. Its objective is to look after the welfare of the women employees, to facilitate redressal of their grievances, to help maintain a harmonious atmosphere at office, and to enable women to pursue their work with dignity and reassurance. The Division caters to the ever-changing needs of the organization to develop new strategies to keep employees happy and engaged.

Facilities and Support Services

The Facilities and Support Services Division provides the necessary administrative and maintenance support 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. The strength of the Division lies in its well-motivated, dedicated, and qualified staff that supports all operations of TERI round-the-clock. It maintains and runs all amenities and utilities meeting international standards. TERI's Quality Management System (QMS) is certified as per ISO 9001:2008 standards, its Health and Safety Management System as per BS OHSAS 18001:2007, and its Environment Management System as per ISO 14001:2004.

TERI's growing reach and visibility make it an integral part of the itineraries of many international dignitaries and delegates, including heads of governments. The professional coordination and conduct of all such visits continue to receive appreciation from the Heads of Missions in New Delhi. The Delhi Sustainable Development Summit (DSDS), TERI's annual flagship event, and other conferences, events, and workshops that attract worldwide participation are successfully organized by the Division.


TRAINING
COACHING
MENTOR
MOTIVATION
SKILL
KNOWLEDGE

TRAINING

Training

As with TERI's other activities, the training programmes, too, cover a gamut of topics for participants, ranging from gardeners who learn how to tend to tissue-cultured plants to regulators who weigh the pros and cons of setting telecommunication charges by the amount of data transferred rather than the duration of the call. Such programmes also serve to make TERI's research more down-to-earth and consistent with the real-world problems because participants often share their experience in the field with researchers. TERI also conducts regular training programmes for officers of the Indian Administrative Service on behalf of the Department of Personnel and Administrative Reforms and for officers of the Indian Forest Service on behalf of the Ministry of Environment, Forest and Climate Change.

The role of forestry in conservation, development, and management of water resources, and clean development mechanism projects related to forestry; climate change and the associated risks and opportunities for businesses; basic statistics; trade and sustainable development; creation of awareness and knowledge on e-waste management; energy and energy economics; renewable energy and energy efficiency; solar buildings: sustainable design and energy efficiency; and best practices in quality control and assurance in fabrication (biomass gasifiers) are some of the areas in which training has been conducted over the years.

➤ ***Training Programme for School Educators'***

A residential training programme for teachers is regularly conducted by TERI. The strength of the teaching community as a partner in bringing about change in attitude among the students is phenomenal. Thematic in approach, each training programme focusses on a new issue related to ESD (Education for Sustainable Development).

➤ ***Training programme for Youth, Annual Youth Meet, 'YUVA'***

The educational institutions have narrow

scope of open dialogues for youth and hence the ability of critical thinking, creativity and ideation is minimal, thereby leaving them inadequately equipped to navigate through the social, economic, environment realities of the 21st century. YUVA meet is a new form of meaningful engagement that not only channels youth energy, but also establishes the foundation for caring and productive communities.

Organised annually by TERI since 2009, this meet witnesses local participation from all across India and international participation from over twenty five nations.

➤ ***TERI-ITEC Programme***

TERI-ITEC programmes are being conducted by TERI with the support of the Indian Technical and Economic Cooperation (ITEC)/Special Commonwealth African Assistance Programme (SCAAP), of the Ministry of External Affairs, Government of India. TERI has been an empanelled Institute since 2007.

The TERI-ITEC courses address sustainable development, renewable energy and energy-efficient technologies, rural energy access, biotechnology, climate change, resource governance, trade, and sustainable development. They are designed to meet the needs of mid-level government and non-government professionals and practitioners in developing, and least developed and emerging countries of the global South.

➤ ***Programme on Solar Energy-based Technology Applications for Rural Communities of ECOWAS***

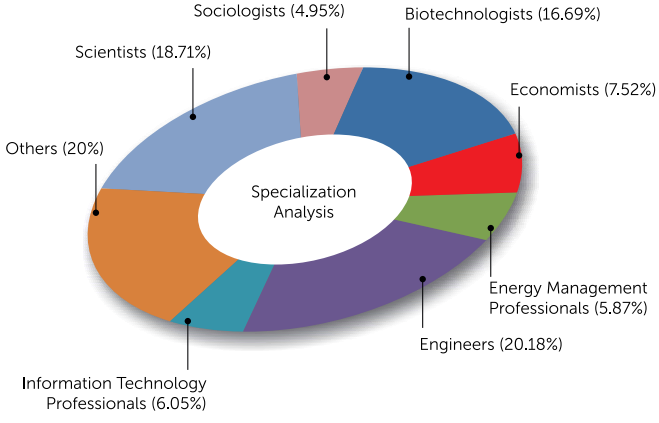
This is a knowledge exchange process through a five-day training programme on solar energy-based technology applications for providing livelihood solutions for rural communities of the Economic Commission of West African States (ECOWAS). The programme is supported by the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) and attended by experts, practitioners, and decision makers from various ECOWAS states. The programme deals with the basics of solar PV technology, its assessment, design, economics, operation, and maintenance. It also deals with project management and business models of solar livelihood projects. One of the essential aspects of the training programme is quality assurance and monitoring of solar PV projects.

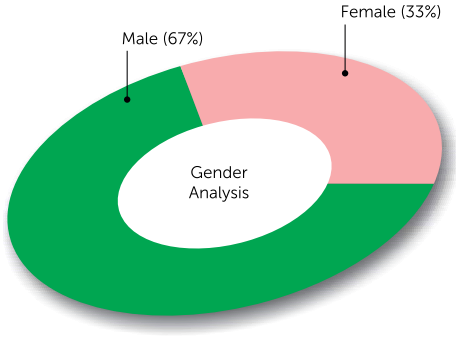
➤ ***Delhi Sustainable Development Summit***

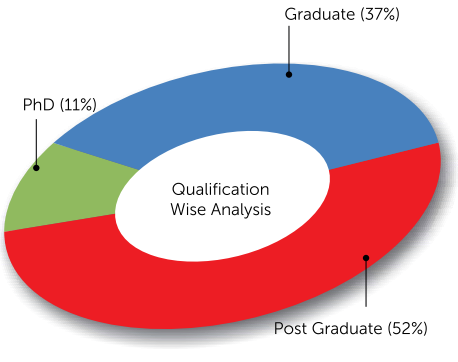
The flagship event organized by the Institute is the Delhi Sustainable Development Summit (DSDS).

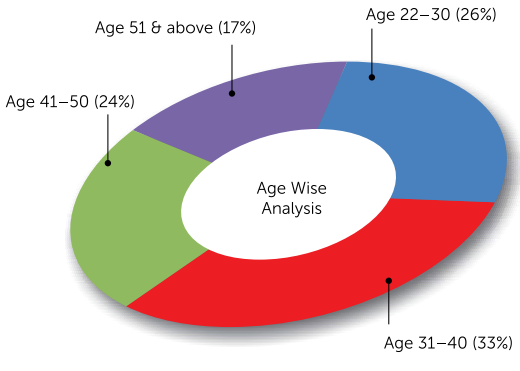
A global summit, the event draws distinguished participants—heads of state and senior ministers; heads of large

multinational corporations, UN agencies, and bilateral and multilateral agencies; scientists, including Nobel Laureates—from every continent to debate current issues of regional and international significance. The first such summit, organized in 1999, was inaugurated by the then President of India. Often spoken of as the alternative Davos, the Summit is the world's sole forum on sustainability issues, which transcends the global divide. The Summit has been harbinger of new ideas, addressing the most critical issues of prevailing times. TERI's annual flagship event has now transitioned into the World Sustainable Development Summit (WSDS). The 15-year-old journey of DSDS will find culmination in the future editions of WSDS. This endeavour aspires to raise the platform; attract greater talent, expertise, and leadership; and devise ways so that the messages that are crafted at this platform are widely disseminated leading to action: another step towards creating awareness and exchanging knowledge and experiences.


Sociologists (4.95%)
Biotechnologists (16.69%)
Scientists (18.71%)
Economists (7.52%)
Others (20%)
Specialization Analysis
Energy Management Professionals (5.87%)
Engineers (20.18%)
Information Technology Professionals (6.05%)


Female (33%)
Male (67%)
Gender Analysis


Graduate (37%)
PhD (11%)
Qualification Wise Analysis
Post Graduate (52%)


Age 51 & above (17%)
Age 22–30 (26%)
Age 41–50 (24%)
Age Wise Analysis
Age 31–40 (33%)

HUMAN CAPITAL

At TERI, we consider our people to be of utmost value and the key reason for the success of the institution. As befits knowledge organization, described by Peter F Drucker in *The New Realities*, TERI follows a flexible organizational structure. 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 on cross-functional and cross-divisional basis because it realizes that the interdisciplinary approach, the exchange of best work practices, and the concerted effort in thought and action leads to the desired outcome, which in turn enhances sponsor and client satisfaction. The Institute's largely project-based functioning also demands flexibility. Every project has a 'principal investigator', who leads the team. For organizational convenience, each professional is assigned to one 'area', depending on her or his primary expertise, managed by an 'Area Convenor'.

OUR NETWORK

The evidence of TERI's growing commitment to a sustainable future lies in the research and outreach activities that the Institute conducts across the globe. With over 1,200 people on its rolls; regional centres in northeastern, southern, and western India, and in the Himalayas; affiliate institutes in Washington and London, and a presence in Tokyo; TERI's global presence is significant for a developing country institution.

TRISHA

TERI's Research Initiative at Supi for Himalayan Advancement (TRISHA), situated at a height of 7,500 feet in the district of Nainital, Uttarakhand, is a distinct venture towards sustainable development. Since agriculture is the main occupation, research and extension has been largely undertaken to improve quality and quantity of agricultural produce. It involves:

- Diagnosing deficiencies and applying biotechnological tools for improvement of nutritional, physical, and biological health of agricultural lands
- Providing innovative solutions to increase yield by providing planting material of an array of high value temperate crop varieties, including medicinal and aromatic plants along with complete package of practices using diverse and dynamic cropping patterns
- Optimally enhancing resource-use efficiency
- Increasing marginal farmers' capacities through training and demonstration
- Development of market linkages guaranteeing economic returns to the farmer
- Enabling entrepreneurship by establishing value chains

There are various facilities at Supi, including a soil-testing lab for farmer fields, vermicomposting unit to produce biofertilizer, polyhouses and glasshouses, oil distillation unit, herbal garden, air quality monitoring unit, knowledge-cum-training centre, the Kumaon Vani facility (a community radio service for the local populace), and rainwater harvesting

systems. TERI is working with around 1,500 farmers in 16 villages in Ramgarh and Dhari blocks of the district to provide them end-to-end solutions for increasing their farm incomes. Hence, TERI has created a platform for enhancing livelihood security by eliminating intermediaries and thus, created a win-win situation for all stakeholders.

TERI Southern Regional Centre, Bengaluru and Goa

The Southern Regional Centre of TERI is located at Bengaluru and Goa. The Bengaluru Centre was set up in 1990 with the primary objective of promoting concepts and practices for improving energy efficiency through a concerted programme of research, consultancy, training, and information dissemination. Over the years, this activity has grown from strength to strength and this Centre is recognized by the Bureau of Energy Efficiency (BEE), Government of India, as one of the few organizations in the country possessing professional standards and skill sets in conducting energy audits. It has been conducting energy audits and energy efficiency consultancy activities on a continuing basis in several public and private sector organizations within the country and abroad.

The Industrial Energy Efficiency Group constitutes the backbone of the Centre at Bengaluru. Set up in 1990, the Group focusses on providing practical solutions to complex, mission-critical problems for public and private clients and provides better resource management options to capitalize on new resource-driven opportunities. The Centre has also set up its own capabilities in other allied activities, such as Sustainable Habitat, Environmental Services, Rural and Renewable Energy, Educating the Youth for Sustainable Development, and Resource Efficient Process Technology Application (REPTA). The last-mentioned group of professionals (REPTA) have done significant work in the areas of development of bio-degradable and green plastics for short and long-term uses.

TERI Coastal Ecology & Marine Resources Centre is a multidisciplinary research centre, and has been implementing research in the areas of marine and coastal resources, sustainable agriculture and forest resources, water resource management, and energy for rural development. Various environmental awareness, education and outreach projects, and activities are also implemented at the Centre.

The Centre regularly organizes various training programmes, seminars, and educational tours in for schools in order to connect students to science, inspire environmental action, and increase exposure to different coastal habitats and traditional practices as well as sustainable technologies.

TERI Northeastern Regional Centre, Guwahati

TERI's Northeastern Regional Centre continues its effort in the areas of watershed management, production of quality planting materials, agricultural extension activities, and biotechnological research and outreach in the region.

The Centre is consistently producing quality planting materials of horticultural crops of economic importance, such as black pepper, Assam lemon, and Khasi mandarin. In the area of sericulture, a Muga grainage facility was established in Kamrup district of Assam for the production of Muga disease free layings (DFLs) and capacity building of rearers in producing DFLs. The Centre also provides consultancy services for livelihood generation for the river erosion victims in Kamrup (Rural) districts in Assam through improved Eri-spinning and weaving and vegetable cultivation and undertakes capacity building of different stakeholders in the prioritized areas. The biotechnological research of the Centre includes utilization of wastewater for algal biomass production and biofuel conversion.

TERI Western Regional Centre, Mumbai

TERI's Western Regional Centre (WRC) in Mumbai was re-established in the year 2007 with an objective to focus on the priority areas of the Western Region of India which include food and nutrition security, environmental resource management, wetland restoration, green buildings, and so on. The Centre has been able to develop a strong network amongst the diverse stakeholders from the government, corporates, public sector units, academia, citizens, and the activities have grown state-wide.

The centre has developed environmental and resource status reports for various municipal corporations, Mumbai Metropolitan Regional Development Authority (MMRDA), and state Pollution Control Board (MPCB) which are regarded as regional benchmarks. The Eco City project implemented in collaboration with Navi Mumbai Municipal Corporation is a pioneering step taken towards developing a modern sustainable city of the century.

TERI Japan, Tokyo

TERI Japan continues to promote relationships with Japanese institutions, universities, governmental agencies, and NGOs interested in emerging global concerns in the areas of energy, environment, and sustainable development. In recent years, the bilateral relations between Japan and India have been growing rapidly and are opening up new opportunities for collaboration and technology transfer in areas of direct interest to TERI, such as energy efficiency and conservation and the renewable energy sector.

TERI has a close working relationship with the Institute of Global Environmental Strategies (IGES), where TERI Japan office is located. IGES also has its representative's office in TERI, New Delhi. This collaboration is strengthened further through visits to Japan by the Director General of TERI and through projects undertaken jointly with IGES and other Japanese institutions. TERI's collaboration with the Kansai Research Centre (KRC) of IGES continued to focus on low-carbon technology transfer aspects.

TERI Africa

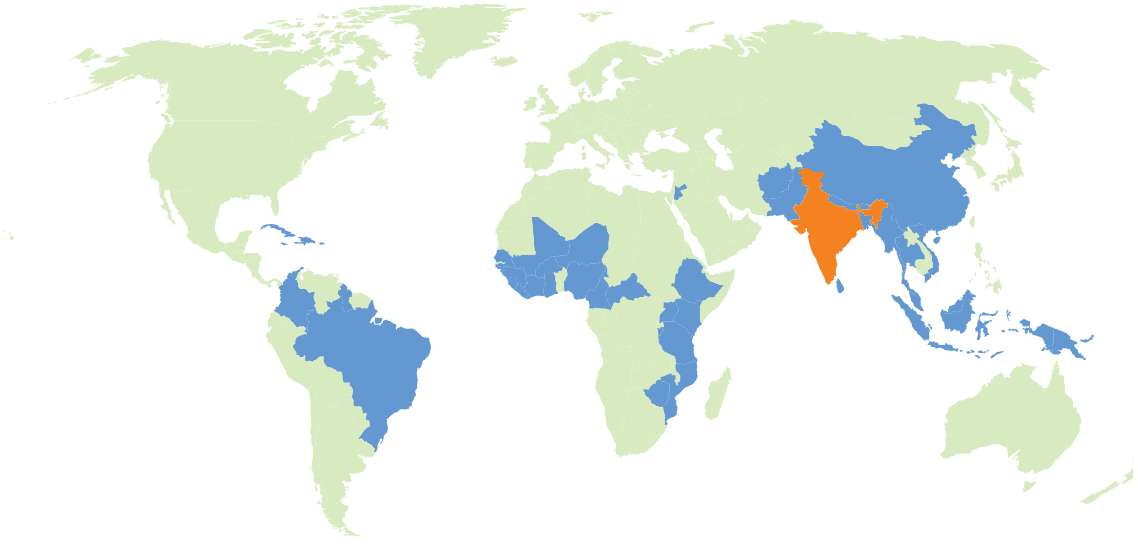
TERI has been working in several domains of sustainable development in Africa. Initiatives involve capacity enhancement, technology transfer, and knowledge and skills exchange.

It has been engaged in projects dealing with ways of infusing renewable energy technology applications and energy efficient practices in municipalities, colleges, buildings, schools, hospitals, and in micro, small, and medium enterprises of Africa. TERI works with regional institutions of Africa in designing adaptation and mitigation related climate policies. Additionally, benefits of application of TERI technologies using modes of biotechnology on degraded lands have been identified. In the policy domain, TERI has initiated work on resource governance issues in Africa. In parallel, TERI has been engaged in training programmes on: (i) Decentralized energy solutions; (ii) Renewable energy and energy efficiency; (iii) Biotechnology applications; (iv) Climate change and sustainability; (v) Trade and sustainable development; and (vi) Sustainable habitat. Along with this, it has been actively engaged in policy dialogues and discussion forums in regional networks.

TERI Europe, Utrecht

TERI Europe has been implementing projects in the following key areas: supporting climate change policies in developing countries, including carbon trading and sustainable building design; promoting trade in sustainably produced goods; analysing corporate responsibility trends and practices; analysing sustainable investing trends in emerging markets; and building capabilities for sustainability reporting amongst small and medium enterprises (SMEs).

TERI Europe also played a useful role in building relationships with Nordic institutions, particularly in the field of climate modelling and other aspects of climate science. It was decided that in the coming years, TERI Europe would carry out consolidation of its activities and coordinate amongst the various entities that constitute TERI Europe. It was also decided that TERI Europe would work much more closely with VITO,



Geographical Reach of South-South Cooperation Projects

a private sector research organization based in Belgium, which is working on development of a large number of green technologies and their dissemination.

TERI North America, Washington, DC

TERI North America (TERI NA) was established in the year 1990 to foster new partnerships between the United States and India, addressing bilateral concerns about energy, environment, and sustainable development. Through its initiatives, TERI NA strives to enhance the understanding and collaborative efforts between the developing and the developed world.

The year 2015 marked 25 years of TERI North America. To commemorate its Silver Jubilee anniversary, TERI NA instituted the Young Sustainability Leaders Fellowship (YSLF) in 2015. It provides American students an opportunity to study environmental issues in India, making them more aware of challenges faced in the developing world. The aim of the Fellowship is to shape the leaders of tomorrow and enable them to work towards a more sustainable future. Two fellowship categories have been created—academic fellowships for students pursuing graduate and higher level studies; and corporate fellowships for mid-level corporate executives, interested in expanding their knowledge on environmental issues in a developing country context.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TERI UNIVERSITY

The genesis of the TERI University is rooted in the comprehensive research, consultancy, and outreach activities of TERI. Academic programmes at the TERI University are focussed around the challenges of providing for a rising global population with a limited and degraded natural resource base. In moving towards sustainability, the implicit understanding is that there is no panacea or straight road, with recognized and established methodologies, tools or specializations leading to such development. The solutions therefore do not lie in a specific subject or discipline, but must be appropriate and relevant to the context or the practical problem being addressed. Developing such an understanding among its students is best achieved through exposure to a variety of subjects, tools, and methodologies offered in the interdisciplinary mode. This has been the guiding philosophy behind the programmes offered by the TERI University and is practised by building a theoretical understanding in courses covering a variety of traditional disciplines, such as ecology, natural and social sciences, governance, policy, law, and engineering.

At the TERI University, students are exposed to a new way of thinking that looks at problems not from the lens of a subject specialist, but from the perspective of one who recognizes the complex linkages between man and his environment. The TERI University's programmes are unique, not only in terms of the degrees, but in terms of the fact that they equip the graduates to lead in a resource-sensitive world. The programmes leverage TERI's knowledge capital in sustainable development to deepen the social and ethical consciousness of higher education in India. Being a research university, its doctoral programmes cut across disciplinary boundaries and integrate a holistic view with more traditional fields. Its research activities focus on natural resource management, policy and governance, environment and

development, business sustainability, biotechnology, and renewable energy.

A variety of MSc programmes are offered in the fields of Environmental Studies and Resource Management, Climate Science and Policy, Geoinformatics, Water Science and Governance, Plant Biotechnology, and Environmental and Resource Economics. The University also offers programmes leading to the award of MA (Public Policy and Sustainable Development), MA (Sustainable Development Practice), MTech (Renewable Energy Engineering and Management), MTech (Urban Development and Management), and MTech (Water Science and Governance). MBA programmes are offered in Infrastructure and in Business Sustainability. This academic year, the University has commenced LLM programmes in Environment and Natural Resources Law and in Infrastructure and Business Law.

Accredited with an 'A' grade by the National Assessment and Accreditation Council of India (NAAC), the University has received accolades for incorporating new and innovative elements in education. In keeping with its global outlook, the TERI University has academic collaborations with select foreign universities, which provide for joint research and curriculum development as well as faculty and student exchanges. The top performers in the masters programmes get an opportunity to carry out their major projects abroad. The University attracts students from all over the country and also a fair number of international students.

FROM THE VISITOR'S BOOK

"It has been a wonderful experience being here at TERI. There is lot of positivity of working together in the area of sustainable development through our Academic Staff Colleges, NMEICT Project and Distance and Open Learning systems. I wish TERI all the best."

Ashok Thakur, Secretary, Higher Education, MHRD.

"It was an excellent visit. Meeting with TERI community will be cherished by me for a long time. Hope the ideas of making RE a mass movement and the Global Industrial Meet in partnership with TERI becomes a great success. Special thanks to DG, TERI, who was so kind and nice through this visit."

Shri Upendra Tripathy, Secretary to Government of India

"For me this visit to TERI was like a long felt dream come true. It is an organization which has reached at an international level in the shortest possible time."

Gireesh B Pradhan, Chairman, CERC

"Delighted to be here discussing issues of social interest. Great team and expertise. Happy to extend our partnership towards higher cause."

Bimal Sayal, Indus Tower

"Thanks for inviting me to TERI. I see TERI as an embodiment of technological excellence, environmental concern research and inspirational dedication. Keep it up and very best wishes."

D K Sarraf, Chairman & Managing Director, ONGC

"Has been a real pleasure to exchange our views on climate change and energy policy and how to cooperate in future."

Franzjosef Schafhausen, Environment Germany

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