teri

The Energy and Resources Institute

ANNUAL REPORT

2015-16

Vision

Creating Innovative Solutions for a Sustainable Future

Mission

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

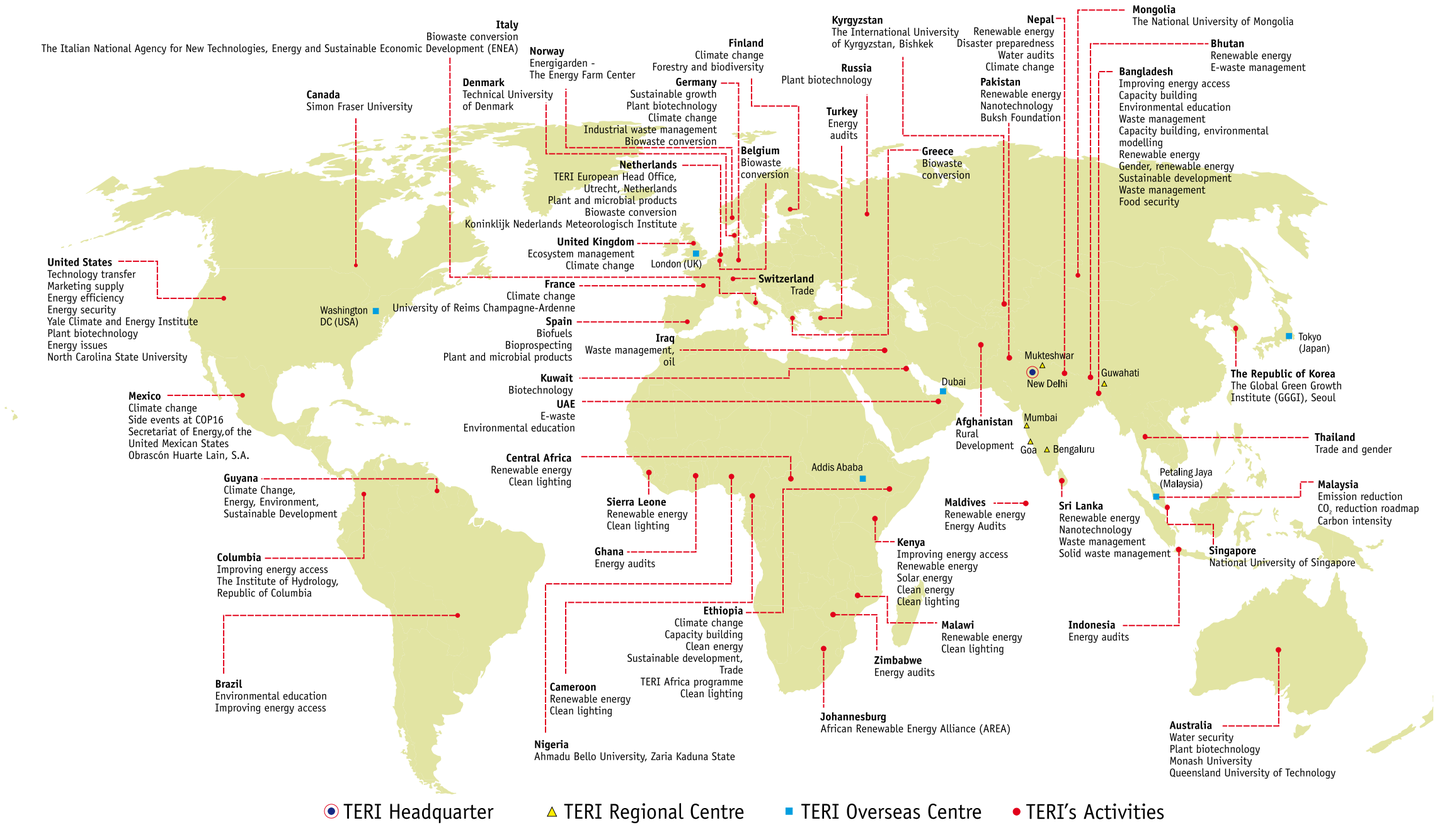
Enhance networking for sustainable interventions

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

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

Our growing commitment to a sustainable future

Research and outreach activities in over 50 countries



CONTENTS

Director-General's Message

I took over as the Director-General of TERI in February 2016 and am honoured to lead this great and dynamic institution and its 1,200+ employees spread all over India and abroad. The people of TERI—TERI-ers, as we call ourselves—are a committed and motivated group, and it is a privilege for me to work with this team and build further together on the huge successes that this organization has had since it initiated its own research activities in 1982.

The year 2015–16 has been a year of transitions for TERI. Apart from the change in the Director-General, we have also welcomed Mr Ashok Chawla as the new Chairman of the Governing Council. We owe a debt of gratitude to both Prof. B V Sreekantan (the former Chairman of the Governing Council) and Dr R K Pachauri (the former Director-General) for their role in building this Institute. Both of them had been associated with the Institute since 1982—Prof. Sreekantan as a Member of the Governing Council and Dr Pachauri as its founding Director. We remain committed to further strengthen TERI as an independent institution focussed on research that enables sustainable development.

During 2015–16, TERI continued to make its mark as a research institute that works on policies, technology development, and services that help bring sustainable development into our homes, offices, factories, and farms.

> TERI's work in the areas of sustainable buildings, urbanization, energy efficiency and renewable energy development, and sustainable agriculture also helped shape the discussions leading to the adoption of the sustainable development goals.

At the same time, TERI has vigorously engaged with stakeholders from all these sectors, through all forms of outreach, so as to take the products of its research closer to them and support them in using these products to address their own challenges and problems. TERI's research, outreach, and support activities were extensively used during 2015–16 as the world negotiated the Paris Agreement on Climate Change and adopted the Sustainable Development Goals. Both these significant events mark a turning point in the global movement towards sustainability. TERI has been closely associated with both these initiatives—both at the national and global levels—and its policy work, strongly informed by its work on technologies and services, contributed to successful global outcomes. TERI's energy-economy model—developed, modified, and validated over the past 25 years—provided inputs on growth options for India, and its research on the global political economy of climate change helped in the development of the pledge-achieve- pledge-more approach, which forms a pillar of the Paris Agreement. TERI's work in the areas of sustainable buildings, urbanization, energy efficiency and renewable energy development, and sustainable agriculture also helped shape the discussions leading to the adoption of the Sustainable Development Goals.

We also engaged extensively with the corporate sector, with our analyses and assessments helping in formulation of an industry viewpoint on desired outcome from the climate negotiations and their own climate actions. The corporate viewpoint was outlined in a document 'Corporate Vision on Climate Change: Reinforcing India's Commitments,' which was presented and discussed during the Paris negotiations. We will continue this engagement with the corporate sector, through the TERI Council for Business Sustainability, with a view to enhance and support corporate action to address climate change and sustainable development goals.

TERI's contributions this year—through research, outreach, and policy and corporate support—both towards the Paris Agreement and the Sustainable Development Goals reflects its long-term engagement in these areas, and the trust and confidence of various stakeholders in the analyses and assessments provided by TERI.

In the area of technology development, research towards development of new technologies and their markets continues to be the *raison d'etre* of the three decades and more of TERI's active research efforts. Several technologies that are more energy efficient or provide energy without resorting to imported and polluting fossil fuels or drastically reduce the pollution load on the environment have been developed. These include the double-blast cupola foundries, biomass gasifiers both for thermal and power applications, the Oilzapper bacterial consortium for remediation of oil-contaminated soils, and bio-pesticides and bio-fertilizers. TERI notched another feather in its cap by export and successful installation of its biomass gasifier technology in Cambodia as well as through installations in remote tribal areas of Odisha, where there is no electrical grid and they function in a stand-alone manner. We now have five licensees for our biomass gasifiers, and we see this technology as a plug-and-play substitute for current technologies that directly burn wood for generating heat or electricity.

We also saw the extremely successful application of the Oilzapper technology to about 217,000 m^3 of the oil-soaked soils of Kuwait, which have been contaminated by oil spills and are unfit for any use since the First Gulf War. The Oilzapper technology is breaking up the oil, and converting these oil-contaminated soils into ready-for-plantation soils in a short period of 4–5 months after the application of the Oilzapper bacterial consortium. This has convincingly demonstrated the viability and suitability of bio-remediation of oil-contaminated soils in Kuwait and of the effectiveness of the Oilzapper

> We have also taken a step forward in the production of bio-pesticides that have been ingeniously extracted from the mustard oilcake left after the extraction of the oil.

technology in particular. We now look forward to large-scale application of this technology in Kuwait to clear more than 100 sq. km that are currently unusable due to oil contamination.

We continue to improve on the effectiveness of the bio-fertilizers and look to enhancing and expanding the use and application. We have also taken a step forward in the production of bio-pesticides that have been ingeniously extracted from the mustard oilcake left after the extraction of the oil. Extraction of the bio-pesticides from oilcakes also makes the oil cake a high quality animal feed, and our research in that direction will hopefully yield successful results in the years ahead.

Our Industrial Energy Group continues to set new benchmarks for the industry. They play a key role in providing mandatory energy audits of industries specified as 'designated consumers' under the Energy Conservation Act, as well as the specific energy consumption verification audits that are part of the Perform, Achieve, and Trade (PAT) programme under which designated industrial units have been mandated to reduce their specific energy consumption. We have also successfully completed the energy audit of the Kochi Refinery, which marks the first time that an Indian organization has carried out a full refinery audit. This establishes the methodology, framework, and protocols for audits of refineries, which are now specified as designated consumers under the Energy Conservation Act.

Water audits of industries and municipalities is another area where TERI is playing a pioneering role, providing solutions on water use management and reduction, as well as creating awareness in these sectors about possibilities for water conservation. We have also initiated micro-watershed conservation activities as part of a sustainable livelihood programme around our campus in Mukteshwar, in the hills of Uttarakhand. We also provide high-quality planting material to the farmers there, along with a promise to buy the products of the plants grown. This enhances the quality and quantity of the yield as well as provides additional cash flow to the farmers. We are now engaging with these communities to help them on a broader scale through other livelihood programmes, water conservation initiatives, etc.

These policies, technologies, and services have supported individual, corporate, and community actions to help us move on the path to sustainable development. To accelerate this move, we have also reached out to school children and university students, and have engaged students, teachers, and the youth in environmental sustainability initiatives and support them through pedagogical modules for teachers, competitions for students, and conclaves for knowledge sharing. We also continue to produce books and journals, for all ages that provide up-to-date information and knowledge and enable knowledge sharing across peoples and languages.

TERI remains steadfast in its commitment to research on policies, technologies, and practices to promote sustainable development. In addition, we also remain committed to strengthening this research, as well as strengthening outreach efforts that help all to rapidly adopt these policies, technologies, and practices. We commit to continue to be an agent for change towards sustainable development.

We also continue to produce books and journals, for all ages that provide up-to-date information and knowledge and enable knowledge sharing across peoples and languages.

Ajay Mathur
Director-General, TERI

1 Who's Who at TERI

Governing Council

Chairman
Prof. B V Sreekantan
(up to 11.02.2016)

Chairman
Mr Ashok Chawla
(since 12.02.2016)

Executive Vice-Chairman
Dr R K Pachauri
(up to 31.03.2016)

Dr Wakako Hironaka

Mr Deepak S Parekh

Ms Naina Lal Kidwai

Dr Shailesh Nayak

Mr Hemendra Kothari

Dr Henrik O Madsen

Dr Leena Srivastava

Dr Ajay Mathur

Advisory Board

Mr Sanjeev S Ahluwalia, IAS (Retd)
New Delhi

Mr Prasad Chandran
Mumbai

Dr Bhaskar Chatterjee
Director General & CEO
Indian Institute of Corporate Affairs
New Delhi

Dr Arup Roy Chowdhury
Chief Commissioner
West Bengal Right to Public Service Commission
Kolkata

Mr J K Dadoo, IAS
Additional Secretary & Financial Adviser
Department of Commerce
Ministry of Commerce and Industry
New Delhi

Dr Vibha Dhawan
Distinguished Fellow & Senior Director
TERI, New Delhi

Mr Zubin Irani
Managing Director
TPG Capital
Singapore

Mr Kiran Karnik
Trustee - NASSCOM Foundation and
President, India Habitat Centre, New Delhi

Ms Preety Kumar
Managing Partner & Member of
the Executive Board
Amrop India Consultants Pvt. Ltd, Gurgaon

Mr K C Mehra
New Delhi

Mr Prasad R Menon
Chairman, Tata Projects Ltd
Mumbai

Mr Manjeev Singh Puri
Ambassador of India to the European Union,
Belgium and Luxembourg, Belgium

Dr Pronab Sen
Country Director
India - Central Team, Researcher
International Growth Centre
IGC India Central Programme
Indian Statistical Institute, Delhi Centre,
New Delhi

Mr Prabir Sengupta
Distinguished Fellow & Director
TERI, New Delhi

Dr Leena Srivastava
Vice Chancellor, TERI University
New Delhi

Dr R S Tolia
Former Chief Secretary and Chief Information
Commissioner - Uttarakhand
Dehradun

Mr B C Tripathi
Chairman & Managing Director
GAIL (India) Ltd
R K Puram

The Management Team

Dr Leena Srivastava
Acting Director-General
(02.03.2015–19.07.2015)

Dr R K Pachauri
Director-General
(up to 07.02.2016)

Dr Ajay Mathur
Director-General
(since 08.02.2016)

Mr Dinesh Varma
HR & MDPs

Mr Girish Sethi
Industrial Energy Efficiency

Ms Mili Majumdar
Sustainable Habitat
(up to 31.12.2015)

Ms Minni Sastry
Sustainable Habitat

Ms Akshima Tejas Ghate
Sustainable Habitat

Mr Pronab Dasgupta
TERI-SRC

Mr Amit Kumar
Energy Environment Technology Development

Ms Ranjana Saikia
Educating Youth for Sustainable Development
(up to 14.01.2016)

Dr Annapurna Vancheswaran
Sustainable Development Outreach & Youth Education

Dr Alok Adholeya
Biotechnology & Management of Bioresources

Mr I H Rehman
Social Transformation

Mr Prabir Sengupta
Knowledge Management

Dr Ritu Mathur
Green Growth & Resource Efficiency

Dr Prodipto Ghosh
Earth Science & Climate Change

Dr Leena Srivastava
Vice Chancellor, TERI University

Ms Rishu Nigam
Sustainable Development Outreach & Youth Education

Dr Banwari Lal
Environmental & Industrial Biotechnology

Ms Sangeeta Gupta
Information Technology & Services

Ms Suruchi Bhadwal
Earth Science & Climate Change

Ms Hina Zia
Sustainable Habitat
(up to 31.05.2016)

Dr Syamal Kumar Sarkar
Water Resources & Forestry
(since 29.07.2016)

Mr Shirish Garud
Energy Environment Technology Development

Dr Anjali Parasnis
TERI-WRC

Mr Anshuman
Water Resources & Forestry

Mr Pradeep Kumar
Sustainable Habitat
(since 01.01.2016)

Dr Suneel Pandey
Green Growth & Resource Efficiency

Ms Divya Datt
Green Growth & Resource Efficiency

Dr Rajiv Seth
TERI University

Mr S Vijay Kumar
Social Transformation

Ms Livleen K Kahlon
Sustainable Development Outreach & Youth Education

Dr Dipankar Saharia
Environmental & Industrial Biotechnology

Mr G R Narasimha Rao
Industrial Energy Efficiency

Mr Debajit Palit
Social Transformation

Col (Retd.) Sanjai Joshi
Facilities and Support Services

Distinguished Fellows

Mr S Sundar
Distinguished Fellow & Professor,
TERI University; Former Secretary,
Ministry of Surface Transport,
Government of India

Mr Nitin Desai
Distinguished Fellow, TERI;
Former Under-Secretary-General,
United Nations

Dr Prodipto Ghosh
Distinguished Fellow, TERI;
Former Secretary,
Ministry of Environment and Forests,
Government of India

Mr Prabir Sengupta
Distinguished Fellow, TERI;
Former Secretary, Ministries of Commerce,
Petroleum and Natural Gas,
Defence Production, Government of India

Air Commodore (Retd)
M M Joshi
Distinguished Fellow and
Former Director, TERI

Mr Shri Prakash
Distinguished Fellow, TERI;
Former Member (Traffic) Railway Board,
Ministry of Railways, Government of India

Mr K Ramanathan
Distinguished Fellow, TERI;
Former Member,
Central Electricity Authority

Dr P G Dhar Chakrabarti
Distinguished Fellow, TERI;
Former Director, SAARC,
Disaster Management Centre, India

Mr S Vijay Kumar
Distinguished Fellow, TERI;
Former Secretary,
Ministry of Mines, Government of India

Dr Syamal Kumar Sarkar
Distinguished Fellow, TERI;
Former Secretary, Ministry of
Water Resources and DoPT

Amb. Ajai Malhotra
Distinguished Fellow, TERI;
Former Ambassador of India
to the Russian Federation

Amb. C Dasgupta
Distinguished Fellow Emeritus,
Centre for Global Agreements, Leg. & Trade
Green Growth and Resource Efficiency Division,
TERI

Mr Pronab Dasgupta
Distinguished Fellow and Director,
Industrial Energy,
Southern Regional Centre, TERI; Former Member,
TDSAT

Prof. S L Rao
Distinguished Fellow Emeritus
Former Director General,
National Council of Applied Economic Research

Dr Vibha Dhawan
Distinguished Fellow & Senior Director,
TERI

- Biotechnology and Management of Bioresources
- Environmental and Industrial Biotechnology
- Industrial Energy Efficiency
- TERI University
- Green Growth and Resource Efficiency
- Knowledge Management
- Human Resources
- Facilities and Support Services
- Information Technology and Services
- Earth Science and Climate Change
- Energy Environment Technology Development
- Social Transformation
- Sustainable Development Outreach and Youth Education
- Water Resources and Forestry
- Technology Dissemination
- Sustainable Habitat

2 Research and Support Services Divisions

Research Divisions

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 by the various industries, 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 agritechnologies 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 limited (OTBL)'.

The broad-scale application of indigenously developed 'Oilzapper' in mitigating oil spills and oily sludge in diverse areas across the nation, poised this technology further to achieve global recognition in overseas countries. This eventually enabled TERI to acquire an industrial scale project from Kuwait Oil Company (KOC) through a global competitive bid, to restore effluent pits, repair environmental damage, and clean up more than 210,000 m^3 soil contaminated with petroleum hydrocarbon pollutants.

To achieve the milestones, TERI installed site office and satellite office in Kuwait Oil Company oilfields, conducted the radiological survey, EOD and UXO of the site, and characterized the site, prior to start of remediation of oil contamination in the soil. To remediate the oil contaminated soil, TERI employed three different approaches; Indirect TDU, Direct TDU, and Bioremediation approach through the use 'KT-Oilzapper' (developed from indigenous microbes of Kuwait). These approaches helped to remediate more than 210,000 m^3 soil through bioremediation approach alone, out of 210,000 m^3 soil approximately 123,000 m3 oil-contaminated soil was remediated. This is one of the biotechnology-based processes that not only helped to restore the oil contaminated environment globally across the nations but also restored the livelihood of several farmers and created ample job opportunities.

Keeping in view the detrimental impact of chemical pesticides, the Division has developed an eco-friendly eucalyptus extract-based broad spectrum biopesticide, 'Bollcure', which is effective in protecting more than 180 plant species, including rice, wheat, sugarcane, cabbage, potato, chillies, beans, cauliflower, tomato, okra, eggplant, and cucurbits from the infectious pests like *Spodoptera*, diamond black moth, cabbage looper, silver leaf whitefly, melon aphid, asian citrus psyllid, root knot nematode, thrips, and jassids, from infectious pests.

Carrying forward the research activities in energy production, the Division has developed a large-scale dark fermentative biohydrogen production process in 1,000 litre scale, by using sugar industry waste as feedstock. 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 Division did a major project on development of comprehensive district and state agriculture plans for Tripura, comprising agriculture and allied sectors, viz. irrigation, animal husbandry, fisheries, and sericulture. 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, phytotoxicity studies, nematicidal 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.

The IPM modules designed and developed for different crops offer a promising solution to the multiple problems that arise due to intensive agriculture in a sustainable manner. It has offered fruitful results to the farmers, some of which are increased marketable surplus, better marketable quality of produce, thus, offering higher value realization with enhanced bargaining power, reduction in usage of chemical pesticides by around 50–60 per cent, ecosystem approach, and better management/utilization of available resources, etc. The Division is also working on improvement of nutritional quality of Indian mustard seeds by joining hands with Nirmal Seeds under the aegis of BIPP scheme of Department of Biotechnology, Government of India. Homozygous BC4F2 lines have been developed as double low variety ready for cultivation in India. In another project on Agarwood (*Aquilaria malaccensis* Lam.), a highly valuable species used for production of agar oil from its infected wood. The Division's Biotechnology area has isolated fungal and bacterial community residing inside the *Aquilaria malaccensis* plant and surrounding soil of the plants and explored their prospective in induction of agarospirol production by artificial infection method. In another project on Berberis, the area has developed and validated a simple and sensitive analytical method for authentication and quality control of Berberis plant parts using HPLC fingerprinting with chemometric method.

The Division also organized the Second International Symposium on "New Processes & Applications for Plant & Microbial Products (ISNPMP 2016)" on 1 and 2 March, 2016, and organized a symposium on "Metabolites from endophytic microorganism to combat biotic stress in crop plants" in the 250th ACS National Meeting & Exposition August 16–20, 2015, Boston,

Massachusetts, USA. The Indo-Spanish Mini Symposium on Endophyte-based Bio pesticide Development: Progress and Perspectives was organized in April 2015 and the DBT Inter-Ministerial Workshop on Jatropha feedstock: Current status in collaboration with DBT in July 2015.

Presently, the Division is pursuing research in the field of micropropagation, algal biofuel, and field trial in various agro-climatic zones.

The north-eastern states of India are one of the richest in the country in terms of their diverse biological resources. The vast natural resources and rich biodiversity of the region include enormous scope for technological intervention towards improvement of livelihood, through adoption of sustainable land-based activities. The Agriculture and Rural Extension Area of TERI-NE under the EIBD division focusses on rural development, extension-oriented activities, and implementation of projects related to agriculture and horticulture development, natural resource management, sericulture, production of quality planting material, watershed development activities, and capacity building programmes. The Division carried out R&D and implementation works on sericulture, demonstration and validation of Jatropha, and preparation of detailed project reports (DPRs) and, is presently engaged in providing consultancy services on sustained livelihood generation, monitoring and evaluation of Integrated Watershed Management programmes, and production of quality planting material.

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 a 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 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.

During the year under review, the Division undertook energy audits in different kinds of industries in India like refineries, textiles, glass, sugar, chlor-alkali, jute, food processing, as well as in power plants and hotels and provided support under the Perform Achieve and Trade (PAT) scheme of Bureau of Energy Efficiency for large consumers of energy. In addition, TERI also undertook energy conservation studies in plants located in the Netherlands and Indonesia. The other highlights of work undertaken included providing knowledge and technical assistance to MSMEs located in different industrial clusters in India. The work in MSME sector was primarily supported by SIDBI/World Bank, UNIDO/BEE, SDC and the Ministry of MSME. The Division also undertook load research studies for electricity Distribution Companies (DISCOMs) of Punjab, Haryana, and Goa.

TERI University

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 will commence 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.

Green Growth and Resource Efficiency

The mandate of the Green Growth and Resource Efficiency (GGRE) Division is "to articulate 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 worked in the domain of greenhouse gas (GHG) emission projection for the national Intended Nationally Determined Contributions (INDCs) supported by the Ministry of Environment, Forest and Climate Change, Government of India, and also conducted a short-medium- and long-term sectoral analysis, modelling for determining a range of energy choices for India supported by Shell Group of Companies, and research projects, dealing with measurement of sea lane security risks for particular littoral states of Southeast Asia.

The Division is also engaged with states like Andhra Pradesh, providing technology foresight exercise involving threats and vulnerabilities to natural resources/environment in the thematic area of agriculture and food system, and assessment and modelling studies on greenhouse gas emissions in agriculture as part of the study on assessment of impacts, adaptation, vulnerability, and mitigation of climate change in the state. Furthermore, it has engaged in policy visions and narratives through interdisciplinary frameworks, for the states of Himachal Pradesh and Punjab. The GGRE Division has worked with rural communities in identifying solutions for promoting natural resource management and environmental sustainability. The research works on sustainable development goals (SDGs) focussed on issues of sustainable consumption production and resource efficiency in different sectors, including tourism and the automobile sector. It also analysed the linkages between trade liberalization, resource efficiency, and environmental protection in the broader context of globalization and sustainable development. The Division continues its research in energy security, research on the risks impacting the various energy sectors from geopolitics, markets volatility, governance bottlenecks, accidents and other sources, and assessment of energy risks for different energy value chains supported by Department of Atomic Energy, Government of India. The Division has undertaken a research and capacity building study on Regulatory Role and Engagement in India's Clean Energy Transformation which seeks to find ways to consolidate regulatory engagement in India's clean energy transformation and pursue them with selected State Electricity Regulatory Commissions (SERCs). 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. The report titled, "Green Growth and Sustainable Development in India" was released by Shri Prakash Javadekar, Hon'ble Minister of Environment, Forest and Climate Change, Government of India, and Shri Suresh Prabhu, Hon'ble Minister of Railways, Government of India, at a national workshop organized in November 2015. The Division organized many capacity building activities during the year—ITEC programmes on "Resource Security and Governance: Issues, Challenges and Opportunities" and "Trade and Sustainable Development: Issues for Developing Countries"; international seminar on "Accessing Resources from Global Market: Geo-political Challenges and Strategies", with support from Konrad-Adenauer-Stiftung in September 2015; an international workshop to bring together Indo-German perspectives on Inclusive Green Economies which was addressed by Dr Arvind Panagariya (Vice Chairman, NITI Aayog); and a dissemination workshop on "Potential Impacts of Export Restrictions on Natural Resources" on January 20, 2016. A five-day training programme on "Public Policy for the 21st Century: Demystifying Resource Regulation", from November 30, 2015 to December 4, 2015' with support from the Department of Personnel and Training, Government of India, was also conducted for officials of the All India Services (AIS) to provide a comprehensive overview of legal and regulatory arrangements for natural resource management in India. The Division which is the research fulcrum of the TERI Energy & Environment Data Diary & Yearbook released the thirtieth edition of the publication in March 2016. The Division came up with flagship publications, *"Energy Security Outlook"* and *"Energizing India— Towards a Resilient and Equitable Energy System"* and two issues of *The International Journal on Green Growth and Development.*

Knowledge Management

As a research organization, TERI emphasizes on knowledge 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 research activities through a well-designed, state-of-the-art knowledge management system.

The Library and Information Centre (LIC) caters to the knowledge needs of both TERI researchers and external professionals by collecting, collating, and disseminating knowledge-based products and services by subscribing and arranging 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 services, capacity building for research and knowledge 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. The LIC developed value-added knowledge products in the form of sectoral and industry trend reports on topics of national importance, such as smart cities and the Indian steel sector. As part of its capacity building initiative, the LIC organized competency development workshop in social media for knowledge professionals on "Creative Librarian 2.0: Connect, Collaborate and Share Knowledge using Social Media Platform" during August 6–7, 2015. Besides, LIC has also organized two interactive seminars on "Open Access in Research" during August and December 2015, for research and knowledge professionals to sensitize the challenges and opportunities related to open access movements. The LIC also organized two awareness building workshops on sustainable management and preservation of indigenous knowledge in the north-eastern states during November 19–21, 2015, in Assam and March 1–3, 2016, in Mizoram.

TERI Press, the publishing arm of TERI, is based in New Delhi. 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 has enhanced its capacity and gained prominence over the past few years. With its new and experimental forms of publications, such as non-fiction knowledge books, under the imprint of Terrapin for children on environment issues, TERI Press has made its presence felt. Eager to consider proposals for new books, their biggest endeavour is to promote indigenous scholarship, and bring Indian and South Asian scholars and their work to the international academic arena. TERI Press has built a strong marketing network with the objective of maximizing the sales potential of respective publications. Our effort is to combine knowledge about the content and understanding of the long-term publishing needs to produce a book that satisfies the market and reflects the author's enthusiasm and expertise. The production editors take every care to ensure error-free production of each title. Using the latest technology available, our books are produced efficiently and quickly. The area's dissemination services rely on a continuously updated database and contact management system to ensure that the publications reach the right audience. The TERI Press team of dedicated editors, designers, graphic artists, production supervisors, and dissemination experts, place great emphasis on quality, adhering to a stringent set of standards.

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.

Information Technology and Services

The Information Technology and Services 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.

This year, 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.

This year, 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 has developed an online annual appraisal system and automated the submission of Major/ Minor projects to bring in operational efficiency and transparency.

The Division has set up the IT infrastructure and web presence for TERI Prakriti School. This year saw increased use of video and web conferencing platforms for interactions with various stakeholders in the form of meetings, consultations, and webinars. This year's infrastructure refresh cycle saw revamping of the Data Centre for reducing energy consumption and performance optimization and centralized storage for better data management.

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 have been used in 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 climate modelling work focuses on understanding climate risks at different spatial and temporal scales, both in the context of current climate variability and change and future climate change. For this purpose, the Division uses state-of-the-art global and regional climate models such as CCSM 3.0, CESM 1.0, GFS and Met Office Unified Model (GCMs) and PRECIS, WRF and COAWST (regional coupled) (RCMs). These outputs are then linked to various Impact Assessment Models such as ADCIRC (for storm surge and coastal circulation), SWAT (for water resources), DSSAT (for agriculture), IBIS (for forestry), and DIVA (for coastal zones) for the Impacts Assessments. TERI has a 5.5 TFLOP high-performance computing infrastructure which helps in performing these model simulations. The work on impacts and vulnerability assessments focusses on key sectors, such as water, agriculture, and health through engagement with multi-stakeholders including policymakers as well as local communities. The research also focusses on various aspects of adaptation, such as identification, prioritization, monitoring and evaluation, and capacity building for policymakers and other stakeholders on different issues related to impacts, vulnerability assessment, and adaptation. The Division also focusses on policy analysis and recommendations on climate change and sustainable development at national and international level.

These include analysis and innovation for global climate policy negotiations, thus providing a developing country perspective on issues of mitigation, adaptation, technology, and finance; analysis, recommendation and consultancy on market mechanisms and emerging new market mechanisms; generation and analysis of data on GHG emissions, including carbon footprint and focussed analysis, innovation and consultancy on negotiating, designing and implementing Nationally Appropriate Mitigation Actions (NAMAs), and informing Intended Nationally Determined Contributions (INDCs).

The Division also gives importance to ecosystems and ecosystem services by focussing on emerging issues related to climate change and forests, as well as issues of long-standing interest such as participatory natural resource management, natural resource economics, productivity enhancement, and biodiversity conservation and management. The Division holds expertise in developing forestry clean development mechanism projects and has recently prepared ten small-scale projects. The Division 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), medicinal plants and various policy issues, including Forest Policy, Forests Right Act, Access and Benefit-Sharing (ABS), etc. The Division has also been facilitating the Mid-Career Training (MCT) programme for Indian Forest Service (IFS) officers with 16 to 18 years of service.

The Division has been regularly carrying out capacity building programmes for various stakeholders on different subjects like 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.

During the year, the Division developed 10 project design documents (PDDs) for A/R CDM projects, covering 10 separate forest divisions of Uttar Pradesh, which have been successfully registered with the United Nations Framework Convention on Climate Change (UNFCCC). The Division is carrying out a major long-term study on Monitoring, Evaluation, Learning and Documentation (MEL&D) of projects under the 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 NTFPs, and various policy issues, including access and benefit-sharing (ABS) out of the commercial use of biodiversity resources. At present, the Division is implementing a programme on Agriculture, Greening, Training, Capacity Building, and Income Generation activities, supported by Coal India Limited. The project, spread over three years from 2015 to 2017, aims at improving the socio-economic conditions of 1,250 farmers, covering 10 villages in the Neturia Block of Purulia District of West Bengal. In addition, the Division has been organizing the two-month Mid-Career Training (MCT) Programme for senior IFS officials; a one-week training programme for senior IFS officials; and a one-day workshop on Plantations including Transplantations along National Highways as a measure for carbon sequestration' at the national level in partnership with National Green Highways Mission, National Highways Authority of India (NHAI), and the Ministry of Environment, Forest and Climate Change, Government of India.

Energy Environment Technology Development

The year 2015–16 was an exciting year for the Energy Environment Technology Development (EETD) Division.

The Division added new feathers to its cap by exporting and commissioning its gasifier to Cambodia under the UNIDO-funded project; its solar lighting lab received accreditation from the Ministry of New and Renewable Energy (MNRE), Government of India, while its NBAL certification was renewed with additional certification allowing TERI lab to test solar PV panels. It also got approval for another path breaking research project on "Developing a Diagnostic Tool for alignment checking in solar concentrators." This 50 million project (TERI's budget) will be carried out jointly with EPTISA, a multinational engineering, architectural and information technology company based in Spain, under Indo-Spanish joint research programme.

Our interdisciplinary team, working on various kinds of challenges faced by solar rooftop programme of the Government of India (GoI), produced eight training programmes on the subject for a variety of stakeholders, besides developing a well-received study on the sector for KfW, Germany, as part of their strategy defining study. TERI also came out with guiding manuals for bankers and financial institutions on solar rooftop technology which is now available through Ministry of New and Renewable Energy (MNRE) website. Our work on policies and RPOs (Renewable Purchase Obligations) scheme of the GoI, has produced new insights on the subject and it has planned to take it further through studies on the impact of large-scale integration of renewables on grid. Our work on quality issues in solar rooftop PV systems has resulted in drafting quality standards and manuals for MNRE which are now being finalized through a larger stakeholder consultation process. We also carried out third party inspection for more than 1 MWp capacity solar roof top PV power plants during the year.

In the bio-energy area, TERI's TEAM (TERI's Enhanced Acidification Methanation) Technology was licensed to three new licensees during the year, apart from four installations. Our work on second generation bio-oils has reached a new milestone by producing more than 500 litres of oil on a continuous basis, thus, creating confidence about the production capabilities of TERI's technology. TERI's experts are also working on biomass palletization technologies and its appropriateness for cook stove and other applications.

During the year, the Division also worked with the Ministry of New and Renewable Energy, Government of India, to survey and map potential clients for medium temperature solar concentrator technologies. This survey carried out for UNDP-GEF funded projects covered more than 400 possible clients, including industries, institutions, hospitals, hotels, and so on, in ten southern states.

One of the unique projects carried out by the Division include advocating and preparing a report on expansion of research infrastructure at NISE (National Institute of Solar Energy), a premier laboratory established by MNRE. The report aims to provide investment plans for financing the expansion.

In line with our tradition of opening new research frontiers, the Division started work on electric mobility by organizing a meeting of experts to identify core issues. These efforts were well-received and the Division plans to establish long-term collaborations in this area with international laboratories.

Our work on the multi-year EU-funded project on improving resource efficiency in Indian industries was well-received and also rewarded with another contract from EU to expand the same to industries in southeast Asian countries, including Sri Lanka, Bangladesh, and Nepal.

Our work on biodegradable polymers for packaging, biomedical, EMI shielding, and fire-resistant applications continues.

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.

Lighting a Billion Lives (LaBL), TERI's flagship initiative for clean energy access, is a major programme being led by the Division in this space that implements localized village-level interventions to provide lighting and clean cooking solutions, fosters the creation of partners and networks at the village, block, and state levels, and enables the provision of a bouquet of customizable and reliable technology solutions for households and small enterprises. As of March 2016, Lighting a Billion Lives has completed eight years of operations, impacting 4.5 million lives across 23 states in India and 12 countries in Africa and South Asia. In the case of clean cooking solutions, the Division has worked towards customizing forced draft cooking technology to improve quality and to suit consumer preferences and contextual cooking conditions. More than 11 variants of forced draft cooking technologies, varying in complexity and, cost, have been developed and demonstrated by the Division over the past four years. In 2015–16, a forced-draft cookstove designed specifically for households in coal mining areas was developed and optimized for burning coal as a cooking fuel. As of March 2016, more than 60,000 improved cookstoves have been disseminated through various interventions by the Division. The second key aspect that has underlined the Division's work in 2015–16 takes interventions in energy access beyond the conventional scope of addressing only basic lighting and cooking requirements directly, and attempts to weave 'energy' as a contributor towards other associated aspects of development, such as, health, education, livelihoods, empowerment, and mitigating climate change.

In this context, the nature of 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 centers 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 centers 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.

Effort has also been made to bring focus to gender-related perspectives in energy access and energy service delivery. A key project in this context is working to build a better understanding of the implications of electrification on women's empowerment by building evidence on the empowerment opportunities that are created through electrification and how these opportunities are further affected by several variables like technological design, management of systems, prevalent socio-cultural factors and practices (e.g., gender ideologies, roles and relations, household finances, poverty, etc.), policy regulations, and financing schemes, among others. The value of engaging women on the supply side of energy provisioning as technicians, cookstove manufacturers, and entrepreneurs has been well-established through numerous energy access interventions undertaken by the Division and there is a consistent endeavour to engage women in delivery processes as much as possible.

Going forward, the Social Transformation Division will continue to expand its scope in developing and delivering innovative and integrated solutions, focussing on clean energy and resource-use efficiency with an emphasis on replicable interventions that support rural livelihoods and sustainable management of natural resources with better resilience to climate change. Building on its past experience in the areas of Integrated Rural Development, Natural Resource Management and Watershed Management, the Division also aims to work towards expanding its activities in these areas.

Sustainable Development Outreach and Youth Education

The Sustainable Development Outreach & Youth Education (SDO&YE) Division ensures that TERI's research and knowledge is shared with varied audiences, including Governments, policy makers, corporates, academic and research institutions, media, youth, and civil society Through seminars, workshops, conferences, and Summits at national and international levels, the Division facilitates exchanges 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 is evolving 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 will be 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.

TERI Council for Business Sustainability (CBS) serves as a knowledge hub on climate change imperatives such as greenhouse gas accounting and management; energy efficiency and water management measures; and financing energy transitions for the corporate sector. Presently, the network has more than 100 corporate members across India from various industries. The Council's 2015 special report on 'Corporate Vision on Climate Change'

document, released at the 21st Conference of the Parties in Paris (COP21), reinforces India Inc.'s commitments to deal with the impacts of climate change, while aligning their initiatives with the Government's commitments.

The Film and Television Unit produces a range of films and videos on issues related to sustainable development. The film 'Nagaland is Changing, but...', on conservation practices in Nagaland, won the Golden Beaver Award at the National Science Film Festival in Mumbai. 'Losing Ground', a film on the climate vulnerability of coastal cities, won a Special Jury Mention at Vatavaran Film Festival in Delhi.

Kumaon Vani, TERI's community radio in Nainital district, broadcast a 365-episode daily series on women's health and nutrition. The radio station reaches out to nearly 500 villages in the Kumaon region of the Himalayas.

The Communications Group is TERI's link with the media, through which it facilitates a seamless flow of information to various stakeholder groups. TERI's work on air pollution during the two phases of odd-even rule in Delhi and NCR received outstanding coverage in the media in 2016.

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 & 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 and climate change nexus and have 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.

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 like 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.

Sustainable Habitat

The Sustainable Habitat Division continues to focus on cities, transport, and buildings with its projects ranging from city- to building-level interventions. In the area of urban development, TERI carries out research to help create sustainable, resilient, and 'smarter' cities. Focussed on policy analysis, sustainable urban planning, capacity building, and knowledge creation, TERI has been recognized as a Center of Excellence in this field by the Ministry of Urban Development, Government of India, and has been empanelled as a consultant for the Smart Cities Mission of the Government of India.

TERI is assisting the city of Dharamshala, Himachal Pradesh, in developing its Smart City proposal under the Smart Cities Challenge of the Government of India. As a National Partner and Policy Advisor to the Asian Cities Climate Change Resilience Network (ACCCRN), TERI is supporting the State Urban Development Departments of Goa and Uttarakhand in developing a state-level policy roadmap on Urban Climate Resilience. TERI also conducted training programmes on 'Building Urban Climate Resilience' for elected representatives of state and city municipal officials across four states in India. This was undertaken under the CAPaBLE programme of Asia Pacific Network for Global Change.

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

TERI is currently undertaking a study for the Asian Development Bank (ADB) to identify India's efforts for moving the country's transport system to a low carbon trajectory. In another study, with support from Shakti Foundation, TERI is working towards identifying strategies for increasing the share of the Indian Railways, total national freight mobility. In another collaborative research with the Delhi Metro Rail Corporation (DMRC), TERI is estimating the demand elasticity for different commuter categories of Delhi Metro. TERI has also been commissioned by the Ministry of Road Transport and Highways (MoRTH), Government of India, to identify carbon reduction potential of the highways sector and identify interventions to enhance climate resilience of the highways sector in India. As knowledge partner for the Ministry of Railways, Government of India, TERI helped coordinate the national activities related to transportation at the 21st Conference of the Parties (COP21), Paris. TERI is a member of the international Sustainable, Low Carbon Transport (SLoCaT) Partnership, a global partnership hosted by the United Nations Department of Economic and Social Affairs (UN-DESA).

The GRIHA Group under the Sustainable Habitat Division is actively working in the space of affordable housing and has documented case studies and carried out lifecycle cost analysis of affordable housing. The GRIHA rating system, conceived by TERI and supported by the Ministry of New and Renewable Energy, Government of India, has been recognized by Government of India as a key guideline for construction of sustainable buildings across the country. In the recent report by Government of India on "India's Intended Nationally Determined Contribution", GRIHA has been acknowledged as India's own green building guideline. The key strength of this unique rating system lies in the rigorous implementation through due diligence visits and proven performance of rated projects. The updated guideline, GRIHA Version 2015 which incorporates the recent market developments, was launched.

Some of the key projects that received a 5 Star rating in 2014–15 include the Manipal University, Jaipur; Infosys SDB 4 & 5, Hyderabad and Institute of Public Enterprise, Shamirpet. In addition, IIT Gandhinagar & IIT Ropar achieved 5 Star GRIHA LD Masterplan Rating. In addition to Delhi, Goa, Maharashtra, Punjab, Government of Sikkim and Pune Municipal Corporation; Government of West Bengal & Rajasthan also adopted GRIHA. The third GRIHA Trophy was conducted at the Annual Convention of National Association of Students of Architecture (NASA) held at Surat. University School of Architecture & Planning won the first prize. The Centre for Research on Sustainable Building Science (CRSBS) Group under the Sustainable Habitat Division has been set up to facilitate development and mainstreaming of sustainable buildings and large developments in order to improve performance levels of existing buildings, facilitate the efficient design of new buildings, and raise awareness on sustainable buildings. The CRSBS Group, comprising architects, planners, engineers, and environmental specialists, has been offering environmental design solutions for habitat and buildings of various complexities and functions, for nearly two decades. Further, the Centre specialized in urban and rural planning, low energy architecture and electro-mechanical and systems, water and waste management and renewable energy systems and has been offering environmental design solutions for habitat and buildings of various complexities and functions for nearly two decades.

The Centre has undertaken several research and development activities and has successfully installed geothermal heat pumps integrated with renewable energy system at Tawang, Arunachal Pradesh. Other low energy cooling strategies like geo-exchange cooling system feasibility study was conducted at multiple locations (Ujjain and Madhai in Madhya Pradesh and at Tawang in Arunachal Pradesh). As part of the research activity, test-bed facility has been developed at Gual Pahari to perform the visual and thermal comfort monitoring of Somfy Roller Blinds in the Indian context. As an ongoing activity, TERI- UTC CoE Setup and PMU (Project Management Unit) set up with Odisha State Designated Agency (SDA) was renewed for next financial year. As part of TERI-UTC CoE project, energy audit of 23 existing buildings, across India, was conducted. Also, in-house research activities were taken up for the development of a web-based tool for selection and optimization of HVAC systems for new and existing buildings, monitoring of indoor air quality in TERI, Defence Colony office, and Harmonics Study and power quality study for the TERI corporate office.

The Centre has also provided environmental design services and conducted building performance analysis for new as well existing buildings. Under these design services, consultancy services were also provided to more than 15 projects. Resource efficiency services were provided to the French Embassy, New Delhi, and Wangari Muta Matai Foundation, Nairobi, Kenya. Under the Policy and Guidelines Formulation, a study was conducted for the development of Nationally Appropriate Mitigation Actions (NAMAs) for the buildings sector with United Nations Environment Programme (UNEP). The guidelines for integration of energy and resource efficiency measures and renewable energy technologies were incorporated into existing building codes and/or regulations, in Nigeria, as part of a programme known as 'Energy and Resources Efficiency in Building Codes in West Africa'. The CRSBS Group has also provided India-specific inputs to support the diffusion of both energy-efficient technologies and policy packages that overcome barriers for implementing these technologies as part of BigEE project.

Awareness generation and capacity building programmes were organized for architects, building developers, and service engineers, on issues such as energy efficiency / green buildings/ resource efficiency in building envelopes and systems.

- TERI Northeastern Regional Centre, Guwahati
- TERI Western Regional Centre, Mumbai
- TRISHA Mukteshwar
- TERI Southern Regional Centre, Bengaluru & Goa
- TERI Africa
- TERI Japan, Tokyo
- TERI North America, Washington, DC
- TERI Europe, Utrecht

3 Domestic and Global Operations

Domestic Operations

Creating a broad framework for continued and sustained research and analysis of the various facets of environmental conservation requires dedicated work across several sectors and with partners. TERI has been engaged in forging long-term linkages and partnerships with agencies and organizations, including the government, so that the effort towards a green tomorrow never stops. In keeping with this agenda, TERI has established regional presence in various nerve centres of the country, supported by the headquarters in New Delhi.

TERI Northeastern Regional Centre, Guwahati

TERI's Northeastern Regional Centre continued its effort in the areas of watershed management, production of quality planting materials, agricultural extension activities, and biotechnological research and outreach in the region. Under Jatropha Micromission, the Centre has created a Jatropha Conservation centre in Kamrup (M) district, Assam, where 513 accessions are being maintained. With the experience gained during evaluation of preparatory phases of Integrated Watershed Management Programmes (IWMPs) in Assam, the Centre has initiated Monitoring, Evaluation, Learning and Documentation (MEL&D) of IWMPs in Assam. 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 has undertaken activities for the man–elephant conflict resolution using various methods, such as awareness generation, planting of elephant food plants in natural habitat, and natural barrier plants in village fringe areas. 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. Phototrophic biofilm research was initiated to facilitate adaptation conditioning and easier harvest of biomass. The mycological research included Mustard aphid population control and Muga silk degumming. In the molecular biology facility, research on cDNA AFLP (Complementary Deoxyribo Nucleic Acid Amplified Fragment Length Polymorphism) is being carried out for identifying the genes involved in agarwood oil formation in Aquaria malacansis. Further, the ripening process of Seabuckthorn *(Hippophae salicifoilia)* fruit using Nextgen Sequencing platform is also in progress.

> The Centre is consistently producing quality planting materials of horticultural crops of economic importance, such as black pepper, Assam lemon, and Khasi mandarin.

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 such as projects focussing on sustainable cities, 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.

An ambitious Eco City project has been launched by WRC in 2012 in collaboration with NMMC (Navi Mumbai Municipal Corporation) and several technology demonstration projects have been undertaken. The project is being implemented through a unique target oriented programme-based approach focussing on low carbon growth through impact oriented and quantifiable initiatives across the societal sectors—residential, industrial, and government. This project is being implemented under the guidance of the Urban Development Department, Government of Maharashtra (GoM). A dedicated space termed 'Eco-City Cell' has been established at the NMMC's headquarters to increase interface between citizens and the project partners.

Malnourishment is one of the critical issues in tribal, rural and urban areas; for which WRC has been working on the programme—PROTEIN (Programme to Revitalize the Overall health of Tribals by Ensuring the Intake of Nutritious food products) since 2014. In the current year, the programme centred its activities in the tribal areas of Palghar District of Maharashtra, which is seriously grappling with the issue of malnutrition, resulting in higher mortality rates amongst women and children. The programme revolves around the following interdependent approaches.

- *Documenting the rich ethnic local knowledge related to wild edibles, tubers, mushrooms and so on in the form of a digital library and also as germplasm collection*: As a first of its kind effort, more than 160 species of dietary and medicinal significant wild edibles have been documented and germplasm for around 70 species has been maintained for further analysis and propagation. The project is sponsored by by JSW Steel Ltd.
- *Encouraging the tribal communities to undertake year long cultivation of nutritious fruits, vegetables, and tubers for self-consumption in their own backyards*: The project sponsored by GKN Sinter metals has successfully witnessed change in the mindset of tribal communities with increase in the ingredients in their existing food pattern making it more holistic. The health status of the target population is regularly monitored to assess the progress. Since availability of water was a critical constraint in cultivation of local vegetables, the villagers were specially trained to use treated grey water for gardening. TERI provided the technology as well as training to the youth and women.
- *Processing and fortifying the food using local ingredients*: The local food is processed in specialized well-equipped unit set up with support from IOCL. The women are trained to prepare Khakara, a nutritious snack. Given the ease of its preparation, possibilities of fortification, novelty, market demand and longer shelf life, khakara is becoming popular. There is great acceptance amongst the children. The processing centre has set an example in the region and has great potential for replication.

> The Green Building Cell (GBC) was actively involved in promoting GRIHA in the western region from the past three years through various promotional as well as consultancy based activities.

The Centre worked on advocating recommendations based on analysis of secondary data for environmental and resource related parameters to various state agencies, such as Urban Local Bodies, Maharashtra Pollution Control Board, Planning Authorities, and so on. The Green Building Cell (GBC) was actively involved in promoting GRIHA in the western region from the past three years through various promotional as well as consultancy-based activities. In the year 2015–16, the group conducted an innovative 'Design to Sustain Program' with Pillai College of Architecture, which helped the students understand the green design principles in a more realistic and integrated format. In addition to the training programmes, the group, in consultation with Mangrove Cell, Government of Maharashtra, undertook the assessment of MTDC's existing Bed and Breakfast (B&B) units in Sindhudurg, Maharashtra. The assessment included the detailed documentation of the various green practices native to the region which need to be conserved. The assessment also gauged the potential of developing a green rating system for the units, which can synergize the tourism requirements as well as environmental conservation.

- *The activities of the cell are proposed to address issues related to environment, energy, and resource management*: On account of World Wetlands Day on February 2, 2016, the WRC celebrated its annual event 'Jaltarang', 2015, for the ninth consecutive year under this flagship programme. A capacity building and training programme was organized at Parthardi village, Mokhada Block, Palghar, to brief the villagers on how wetland conservation practices can improve the quality and quantity of water available to them. Also, to enhance access and availability of water, desilting and conservation of a village pond was undertaken through community participation. Primary water filtration system for treatment of household grey water was installed as a demonstration, which enabled collection and treatment of around 40 litres of water for one household. In a village, seven such systems have been further installed.

TRISHA, Mukteshwar

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

> TERI is working with around 1,500 farmers in Ramgarh and Dhari blocks of the district to provide them end-to-end solutions for increasing their farm incomes.

- 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 & Goa

The TERI Southern Regional Centre, Bengaluru, provides comprehensive service packages to its clients in areas as varied as energy efficiency and other environmental services, rural extension, consultancy for green buildings and sustainable habitat activities, research on resource efficient process technologies, and educating the youth on sustainable development.

The Industrial Energy (IE) group, with years of experience and expertise of providing high quality service is now an undisputed and acknowledged

market leader in the fields of comprehensive energy efficiency and audits, harmonic audits, regular monitoring of energy efficiency in large power-consuming plants and buildings, implementation assistance, training and capacity building, scrutinizing project reports to incorporate energy-efficient parameters, introducing 'energy management' processes in organization, and 'ordering' advice on energy-efficient equipment purchase. It helps its clients to remain competitive in a fast-changing world by providing them with expert advice through accurate and unbiased information that can be used to reduce life-cycle energy costs, increase workplace comfort levels, and conduct greenhouse gas (GHG) emission studies. The IE group is also facilitating renewable energy and energy efficiency drive across the public institutions through CSR funds.

The Centre for Research on Sustainable Building Science group (CRSBS) is working with various PSUs and corporates like BEL, EMPRI, PGCIL, HAL, ISRO, HUDCO, ITC Ltd, Zuari Infraworld India Ltd, assisting them with green building design consultancy. The Centre is carrying out policy research and supporting State governments in framing and implementing policy incentives for mainstreaming green buildings and recently developed policy incentives for Chennai Metropolitan Development Authority for facilitating green buildings in Tamil Nadu. The group is actively engaged in collaboration with many industry partners in defining parameters that should be considered for thermal performance evaluation of building materials. The Centre is also working at the grass-roots level to implement sustainable building concepts in rural India. The Centre has developed a tool to establish relationships between various urban parameters and the heat island effect. The project was carried out with support from the Green Rating for Integrated Habitat Assessment (GRIHA). The Centre has developed business models for the affordable housing segment and is carrying out many affordable housing projects in India and the world. It has developed a relationship with educational institutes like Manipal University, Andhra University, SPA Vijayawada, and College of Engineering Trivandrum for research and academic collaborations. The Centre has started working on the concept of sustainable consumption and production of building materials, in partnership with TERI University under the support of UNEP. It is also engaged in working out the green building concepts in the context of development of 'Smart Cities' in our country.

The Resource Efficient Process Technologies Application (REPTA) group focusses on the development of biodegradable and 'green' plastics using renewable natural resources, which will ultimately lead to the production of a sustainable product to replace the conventional plastics used in packaging, short-use moulded products, such as disposable cutlery, agricultural mulch films, etc. This is especially beneficial in the current scenario when the global petroleum resources are continuously diminishing.

The Water Resources and Forestry Division is currently implementing and contributing to several studies in the areas of water supply and sanitation, climate change and water, industrial water use, and forestry and biodiversity.

The Water Resources and Policy Management area within the Division has successfully implemented projects on integrated water resource management, water quality assessment and remediation, implementation of water and sanitation programmes, climate change impact on water

> Projects supported by NABARD actively engage and encourage the local fishing communities to undertake mariculture.

resources, monitoring and evaluation of projects related to drinking water, and sanitation and capacity building activities related to water and sanitation.

The Forestry and Biodiversity area, an integral part of the division, works with various departments in the field of sustainable forest management, biodiversity conservation and studies investigating the linkages between forest and water.

The Rural and Renewable Energy (RRE) group is working on the monitoring, evaluation, learning, and documentation of the Integrated Watershed Management Programme of the Watershed Development Department in Karnataka. The group is actively engaged in the dissemination of solar lanterns, improved biomass cook stoves, and creating awareness on sanitation and hygiene in Koppal district with the CSR support of Sales Force Foundation.

The Environmental Education and Awareness group of SDO&YE Division aims to instill a sense of responsibility among youth towards the environment, and encourages them to formulate out-of-the-box solutions for environmental problems by working with schools, colleges, youth groups, vulnerable communities, citizen groups, ministries, government agencies, corporate houses, and other national and international organizations.

TERI Coastal Ecology & Marine Resources Centre, Goa, 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.

In the field of marine and coastal areas, the project, supported by Toyota Foundation, aims in empowerment and capacity building of artisanal fishery to sustain fishery resources in the coastal areas through community-based management. Another project supported by Goa State Pollution Control Board (GSPCB) Goa, is being undertaken to determine the persistence of pesticides in different coastal ecosystems of Goa. Projects supported by NABARD on the demonstration of mussel and crab farming actively engage and encourage the local fishing communities to undertake mariculture In water resources management, the project supported by the National Health Medical Research Council (NHMRC) of the Government of Australia, will provide a better understanding of the health, changes in water use, and economic impacts of providing access to treated river water, using Riverbank Filtration Technology (RBF) in Krishna River, Karnataka. Further, a similar project on RBF supported by Rambol-Environ Foundation, USA, demonstrates how heavily polluted river water can be converted into clean irrigation water. A DSTE, Government of Goa, supported project is being undertaken which involves assessment of climate change impacts on Zuari river sub-basin, using high resolution climate and hydrological modelling.

In addition to the above research projects, 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.

Global Operations

TERI, with a vision to address the universal nature of the problems that human society faces today, continues to make efforts, on a global scale, to create a sustainable future for the human society. Over the years, TERI's global affiliates and centres have developed strong linkages with like-minded institutions and important organizations to further the cause of sustainable development.

TERI Africa

During 2015–16, TERI strengthened its collaboration in Africa. This happened through the DFID–TERI partnership for clean energy access which was implemented with the support of Horn of Africa Regional Environment Centre and Network (HOAREC&N) in Ethiopia and African Centre for Technology Studies (ACTS) in Kenya. TERI provided clean cooking and lighting solutions to poor households of Kenya and Ethiopia. There are more than 10 countries in Africa where the Lighting a Billion Lives (LaBL) campaign has reached out. TERI worked with communities in these countries and enabled an increased partnership with government, private sector, NGOs, and research institutions.

Business models for clean energy access were also developed. Additionally, clean cookstove solutions and biomass gasifier applications were also transferred to communities of East Africa and West Africa. In 2015–16, TERI has reached 300,000 people by providing them with clean cooking and lighting solutions through constant innovation in technologies and business models of delivery. Ten new technological solutions were tested leading to dissemination of 33,124 improved cook stoves and installation of 23,411 solar lighting solutions with the support of private and developmental organizations.

TERI has also been working with the Ethiopian Electricity Authority on energy audit and has been engaged in training programmes with regional partners like WWF-Africa related to energy policy, petroleum sector, and sustainable energy leadership with UNIDO for the global south.

> There are more than 10 countries in Africa where the Lighting a Billion Lives (LaBL) campaign has reached out.

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).

TERI has a close working relationship with the Institute of Global Environmental Strategies (IGES), where the office of TERI Japan is located. IGES also has the office of its representative located in TERI, New Delhi. This collaboration is strengthened further through occasional 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 and the

two institutes successfully organized two workshops in India during the year (at Ahmedabad and Pune). In addition, TERI also organized a successful workshop on heat pumps in Chandigarh, jointly with Energy Conservation Centre Japan (ECCJ) and Punjab Energy Development Agency (PEDA). TERI also extends support to IGES in the organization of its annual International Forum for Sustainable Asia and the Pacific (ISAP).

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.

TERI NA has been organizing the annual US–India Energy Partnership Summit since 2009. The sixth edition of the Summit titled, 'US-India: Past Cooperation, Future Strategies & New Opportunities' was held in Washington, DC, on September 21, 2015, on the heels of the US–India Strategic & Commercial Dialogue and the Energy Dialogue. The Summit brought together 200 participants, including senior political representatives, leading policy makers, researchers, and corporates from both countries, to address various issues related to energy efficiency, access, and technology. These stakeholders discussed avenues for new and strengthened collaboration in various aspects of clean technologies, renewable energy and green buildings, and sustainable cities. Eminent speakers included Ernest Moniz, United States Secretary of Energy; Amos J Hochstein, Special Envoy and Coordinator for International Energy Affairs, Bureau of Energy Resources, US Department of State; Reid Detchon, Vice-President for Energy and Climate Strategy, United Nations Foundation; and Robert F Ichord, Deputy Assistant Secretary, Bureau of Energy Resources, US Department of State.

> To commemorate its 25th anniversary, TERI NA instituted the Young Sustainability Leaders Fellowship (YSLF) in 2015.

To commemorate its 25th anniversary, TERI NA instituted the Young Sustainability Leaders Fellowship (YSLF) in 2015. The YSLF 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. The first Fellowship was instituted as the 'David Jhirad Young Sustainability Leaders Fellowship', in memory of Dr David Jhirad, a global leader in the field of energy, technology, science, and policy. The first fellow was a PhD student from Arizona State University. The primary areas of the Fellowship included aspects of finance related to affordability and reducing financial risk of energy access, particularly valuation and monetization of selected co-benefits. Fellowship opportunities are available in the areas of biofuels, green buildings, rural energy, sustainable transport, and water management.

TERI Europe, Utrecht

Since its establishment, 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). During 2015–16, TERI Europe continued to build on the expertise and insights gained on sustainable investing and sustainability reporting.

- Agriculture
- Climate Change
- Energy
- Environment
- Forestry and Biodiversity
- Urbanization and Transport
- Water

4 Thematic Overviews

Agriculture

Agriculture holds the key to the holistic development of a country's economy. Keeping in mind that improving soil health, food, water safety, and crop productivity are the biggest challenges in sustainable agriculture, TERI is uniquely poised to develop pioneering technologies and solutions using microbial systems, genetic improvement, crop diversification, bioinformatics, nanotechnologies, and biocompatible materials. It offers cross-sectoral, technology-based solutions that are to be implemented in an integrated manner for achieving equitable and sustainable results.

To preserve the natural environment and prevent environmental degradation in the agriculture sector, TERI's technologies are quite relevant for the production of higher crop yields.

Mycorrhizal Biofertilizers and other Agriculturally Important Microorganisms for Improved Plant Yield

TERI's mycorrhizal technology is an innovative invention offering a partial substitute to chemical fertilizers, thus, providing an edge to plants to thrive better and offer enhanced yield and establishment in nutrient poor conditions. TERI's mycorrhizal biofertilizer is a multipurpose and multi-faceted product. It is a soil conditioner, bio-remediator, and bio-control agent and has wide applications in agriculture, plantations, horticulture, forestry, and biofuels. The product is most suitable for harsh environment because it has higher shelf life, does not require cold storage, and includes a possible broader host range, unlike all other biofertilizers. In 2015–16, demonstration trials were laid in vulnerable areas of Uttarakhand using TERI's mycorrhiza fortified with nitrogen-fixing bacteria for pea, kidney bean, and millet crops. Six farmers were selected and two kharif crops were tested in their fields. The yield of all three inoculated crops showed significant differences to the tune of a 30 per cent increase in yield for kidney bean, 25 per cent increase for millet, and 25 per cent increase for pea.

TERI has also undertaken basic research on deciphering the regulatory molecules produced by agriculturally important bacteria that may have the capability to influence and improve plant growth. The Division also developed Computational Genomics pipeline for understanding proteome and regulatory networks of agriculturally important microbes, including plant growth promoting agents and biocontrol agents. In 2015–16, the role of genes/molecules, important in bio-control of an important plant parasitic nematode, was characterized.

Nanobiotechnological Interventions for Agriculture

TERI has developed a gold nanoparticle-based simple, quick, and onsite early diagnostic kit for apple scab disease, which causes significant damage to the apple crop annually. The kit is under large-scale validation at present. In the search for an effective nanopesticide for controlling soil-borne bacterial and fungal pathogens, bulk nanoemulsions of nalidixic acid sulphonyl acyl hydrazine were

synthesized and evaluated for their toxicity against a variety of microbes.

High Quality Superior Tissue Culture Plants

Micropropagation Technology Park (MTP) of TERI has infrastructural facilities ranging from modern laboratories and greenhouses to nurseries that are required for mass production of tissue-cultured plants. The facility has production capacity of over 2.0 million plants. MTP has to enter in large-scale production of potato seed tubers, which have marginal contribution to current production numbers. With increase in an array of products, MTP can serve a larger mass of farmers for better crop production and thereby improve socio-economic status of farmers of different states like Uttar Pradesh, Bihar, Punjab, and Gujarat.

Enhancing Livelihoods of Marginal Farmers using Bio-innovations

With an aim to expand livelihood of farmers via resolving core agricultural issues of the selected area, such as high input cost, inaccessibility to quality planting material, poor soil health, frequent crop failure, erratic rainfall, and meager market linkages, TERI is working in Uttarakhand to strengthen farmers by providing them with need-based technologies, agri-knowledge, and motivating them to become entrepreneurs from producers. TERI has initiated a project supported by the Louis Dreyfus Foundation with the objective to revitalize the traditional crops and knowledge to improve local food security in a more sustainable and uncomplicated way in vulnerable areas of Uttarakhand. TERI is also working in Kamrup, Morigaon, and Dhubri districts of Assam to create awareness in the farming community about the farm-related technologies, provide need-based recommendations, provide quality planting material, educate beneficiaries about scientific method of cultivation, demonstrate benefits of integrated nutrient management (INM) and finally encourage micro-entrepreneurship among the farming community.

The Khasi mandarin of the northeastern region is very famous for its superior quality and unique taste. However, there has been a sharp progressive decline in production and area under Khasi mandarin during the last few years in the region.

Production of Khasi mandarin has reduced due to non-adoption of improved production technology, including crop protection measures. Lack of quality certified budded plant is also an important factor for decline in productivity. In this regard, TERI North Eastern Regional Centre has undertaken a major initiative for production of budded Khasi mandarin plant for reviving the declining citrus sector.

Biopesticide Product for Various Crops

TERI has developed a bio pesticide in funding support with the Department of Biotechnology, Government of India. The product named as "Bollcure" has been tested effectively for its usefulness against Helicoverpa armigera in Cotton and Chickpea in India and abroad. The field trials of Bollcure on crops other than cotton and chickpea for the control of pests, other than *Helicoverpa* spp, are at different stages of completion. So far, it has been tested at field trials on crops, such as rice, wheat, sugarcane, cabbage, potato, chillies, beans, cauliflower, tomato, okra, eggplant, and cucurbits for its effectiveness against spodoptera, diamond black moth, cabbage

looper, silver leaf whitefly, melon aphid, asian citrus psyllid, root knot nematode, thrips, and jassids. The product is CIBRC registered and has also been registered for use as an input in organic agriculture. This makes Bollcure suitable for use in conventional/ IPM/ organic farming systems. The IPM modules, designed and developed by TERI for different crops, offer a promising solution to the multiple problems arising due to intensive agriculture in a sustainable manner for the generations to come. It has offered fruitful results to the farmers, such as increased marketable surplus, better marketable quality of produce, thus offering higher value realization with enhanced bargaining power, reduction in usage of chemical pesticides by around 50–60 per cent, ecosystem approach, and better management/ utilization of available resources, etc.

Consultancy Services for Natural Resource Management and Livelihood Security

An effective operational monitoring, evaluation, learning and documentation (MEL&D), system is required for tracking the progress and performance of the project, streamlining the initiation process interventions, possible mid-course corrections, and assessing the impacts of intervention. In this direction, TERI is undertaking MEL&D of 47 Integrated Watershed Management Programmes (IWMPs) in five districts in Assam. TERI also undertook the preparation of natural resource-based community development plans (CDPs) in west and north districts of districts of Tripura and prepared 20 CDPs, based on the community feedback and feasibility study. Consultancy services are also being provided to Flood and River Erosion Management Agency of Assam to improve the livelihood of 700 river erosion victims of Palasbari area in Assam who had lost their land and property and are residing on the embankment of river Brahmaputra.

Policy and Institutional Support for Organic Agriculture: Enabling Pathways for Inclusive Sustainable Development

Supported by the Ministry of Agriculture and Farmers Welfare, Government of India, and undertaken in collaboration with NISTADS, this study analyses the context and implementation mechanisms for organic agriculture, examining its sustainability and viability in Punjab, Uttarakhand, and Karnataka. Policy and institutional assessment, value chain analysis, and impact assessment, are core themes alongside assessment of national level programmes and international experience. The study recommends strengthening participatory research-extension systems, building comprehensive market linkages and community awareness, and creating ecosystems for developing organic production systems in villages.

Climate Change

Under the climate change theme, TERI has been focussing its research on climate science under which it has been undertaking work on climate modelling; impacts, vulnerability, and adaptation; GHG inventorization and mitigation; and national and international policy review and analysis. TERI has been actively engaged in implementing projects related to mitigation and adaptation, with a focus on renewables and energy efficiency, promoting sustainable livelihoods in rural and urban areas, and building capacity through various stakeholder-oriented training programmes, consultations, and workshops.

> TERI has been actively engaged in implementing projects related to mitigation and adaptation, with a focus on renewables and energy efficiency and promoting sustainable livelihoods, along with outreach and capacity building initiatives.

Climate Modelling

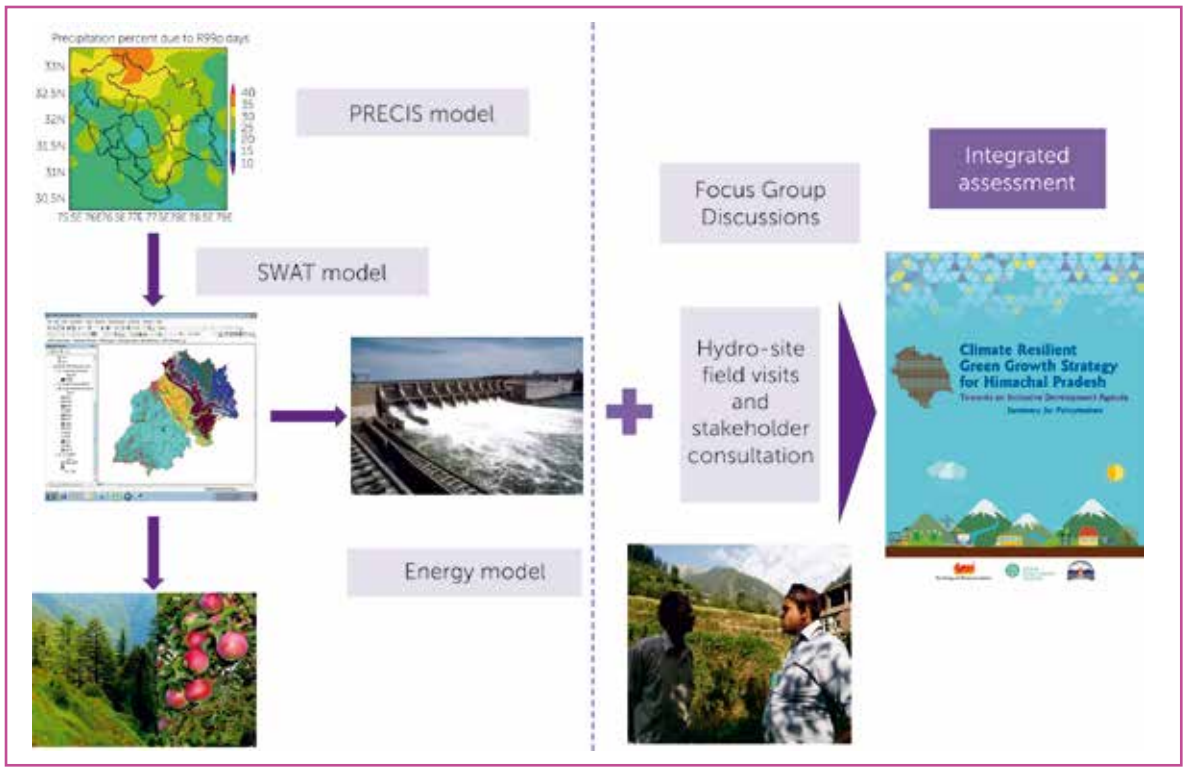
TERI possesses in-house capacity for running global earth system models, high resolution regional climate models with the objective to assess and address existing uncertainties and gaps in climate science and modelling. The high performance computing facility at TERI helps in generating climate projections both at global and regional levels. TERI, along with Bjerknes Centre for Climate Research (BCCR), undertook joint research on global and regional climate modelling and the installation of an earth system model to understand the various interactions in the earth's system and the processes involved. Under this collaboration, scientists have conducted downscaling, considering 'Tropical Channel Setup' over the Indian domain to address rainfall and temperature for contrasting monsoon years. To simulate the climate at local scales, TERI, in collaboration with UK Met Office, has developed in-house capacity to project climate change scenarios over the Indian region at high spatial resolution. These high resolution climate modelling inputs are validated over the region with the observations, and the results are then tailored to feed into Impact Assessment Models. Recently, the National Designated Entity (NDE) of Thailand for CTCN (Climate Technology Center and Network) requested for technical assistance to establish a high resolution regional climate data centre and to help Thailand formulate a decision support system for the planners and policy-makers. CTCN selected TERI (lead) and ICRAF, Kenya (co-lead) for the responsibility to draft a response plan that is tailored to the needs of the request. The response plan is currently in the stages of being drafted with inputs from Chiang Mai University (CMU), Thailand and ICRAF, Kenya. The group's activity spectrum ranges from the use of state-of-art global and regional climate model such as Community Climate System Model (CCSM 3.0), Community Earth System Model (CESM 1.0), Providing Regional Climates for Impacts Studies (PRECIS), Weather Research and Forecasting (WRF), and ADvanced CIRCulation model (ADCIRC), which has been used to assess and map potential storm surge impacts over coastal areas. The Institute has a well-equipped climate modelling infrastructure consisting of a 5.5 TFLOP supercomputer to carry

out the climate simulations at various spatial and temporal scales along with high end servers for running impact models.

Impacts, Vulnerability, and Adaptation

TERI is linking the regional climate projections to various Impact Assessment Models such as ADCIRC (Advance CIRCulation model for storm surge and coastal circulation), Soil and Water Assessment Tool (SWAT), MIKE 11 (for water resources), Decision Support System for Agro-technology Transfer (DSSAT for agriculture), Dynamic Interactive

Vulnerability Assessment (DIVA for coastal zones), etc. TERI is one of the partners of the Himalayan Adaptation, Water and Resilience (HI-AWARE) consortium. The consortium is led by International Centre for Integrated Mountain Development (ICIMOD) in Nepal and comprises of Pakistan Agricultural Research Council (PARC), Bangladesh Centre for Applied Sciences (BCAS) and ALTERRA-Wageningen University and Research Centre in Netherlands. It is one of the four consortia funded by the Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA) and particularly looks into issues of climate change impacts, vulnerabilities, and resilience in glacier-fed river basins of South Asia. The project has three Work-packages (WP)—Knowledge generation (WP1), Research into Use (WP2), and Capacity Building (WP3) and WP1 has five Research Components (RCs)—Biophysical drivers of change (RC1), Socio-economic, governance and gender drivers of vulnerability (RC2), Adaptation options (RC3), Critical moments and Turning points (RC4), and Adaptation Pathways (RC5). TERI is involved in all the WPs and is responsible for HI-AWARE related research and policy engagements in Ganga (Uttarakhand), and Teesta (Sikkim) river basins. The project is in its second year and has achieved a plan for dynamic down-scaling of climate information for selected river basins, a situation analysis of climate-related vulnerabilities of selected areas in different reaches of the river basins and a methodology for analysing critical moments, i.e., a time period of the year where climate vulnerability is most critical for a particular social group. Currently, the research team is engaged in fieldwork and information collection for RC2 and RC4 and also glacial research under RC1. TERI had organized workshops on water availability and access in Gangtok, Sikkim, on November 26, 2015, and Tehri, Uttarakhand, on December 4, 2015. The outputs from these workshops have helped in stakeholder mapping and also provided a rich picture of the governance context related to spring rejuvenation programmes in hill areas of the basins. TERI, jointly with ICIMOD, also organized a policy level conference—Climate Change Adaptation Policy and Science (CCAPS) on 25th and 26th February, 2016, Steering Committee Meeting of the project on February 27, 2016, and HI-AWARE Academy for PhD students, young researchers, and masters students funded under the project from February 28, to March 4, 2016.



Although numerous bilateral (India–EU) sustainable development research projects have been conducted, the long-term and sustained collaboration between Indian and European researchers, continuation of research, building up of expertise and knowledge of the Indian economy remains a gap. Short-term projects or partnerships have been limited to two organizations. One such partnership is the Climate Adaptation & Services COmmunity (CASCO) partnership that seeks to support the implementation of the Indo-European Partnership for Research and Innovation by bringing together expert clusters from the EU and India in the field of climate adaptation, within the focus area of 'sustainable environment and water'. CASCO will especially focus on long-lasting cooperation in the field of climate change adaptation by creating a community of European and Indian researchers and innovators. CASCO consists of a total of five European and four Indian core partners, with a wide range of network partners. It aims to produce a series of strategic research and innovation briefs, further climate adaptation services through innovation workshops and mobility and strengthen networking and partnerships through a PhD, post-doc, and mid-career professionals autumn school in India

on adaptive resources management and through participation in science-policy conference. The core target group in CASCO in India are a mixture of state-aided universities (Jadavpur University), private research institutes (TERI, Indian Institute of Human Settlements), and NGOs (Watershed Organization Trust). TERI would be utilizing the grant strategically as a top up for activities designed to impact policy and practice from its on-going Himalayan Adaptation, Water and Resilience (HI-AWARE) project and also building capacity of its own and partners' early and mid-career researchers. The first activity will be co-funding the Economics training programme conducted under the Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA)—Opportunities and Synergies (OSF) fund in March 2016. In late 2016, the Autumn School on Climate Science and Adaptation will be organized with CASCO partners and finally conference side events will be organized synergistically with HI-AWARE conferences in 2017 and 2018.

TERI, in collaboration with the Norwegian Institute of Urban and Regional Research (NIBR), Norwegian Institute for Water Research (NIVA), University of Oslo (UiO), is conducting a three year study (2015–17) on Governance of Climate Services (GovClimServices) that aims to study the conditions for effective multi-level governance of climate services in India, with a focus on the state of Maharashtra. The study is supported by the Research Council of Norway. The project will study Indian climate service systems, both public and private systems, and compare diverse systems and outcomes for different types of farmers and user groups (provider-user Interface). The project adopts a case study approach and has selected four Climate Service Providers—Reuters Market Light (RML), IFFCO Kisan Sanchar Limited (IKSL), Watershed Organization Trust (WOTR), and Agro-meteorological Advisory Service (AAS) introduced by IMD. The project inception workshop was held in Pune in June 2015 to understand the evolving governance structure of climate services in Maharashtra and to learn how service providers translate climate knowledge to farmers. The workshop was attended by over 50 relevant stakeholders comprising a good mix of representatives from government (IMD, IITM, KVKs, NABARD, ICAR) and private sector service providers (RML, CABI, TCS, IFFCO IKSL), research organizations (MPKV, IWMI, and NGOs WOTR, and farmers. The team also visited the villages of Pune and Ahmednagar district to interact with farmers and Climate Service Providers to understand how climate services in Maharashtra are evolving. In November 2015, the research team from TERI and NIVA visited villages in Pune and Ahmednagar districts to interact with farmers. The objective was to assess whether the climate services are participatory, equitable (open access), legitimate, accessible, timely, and tailored to various groups of end-users. Focus Group Discussions (FGDs) and individual interviews were conducted with climate services subscribers (large- and small-scale farmers and women farmers) and non-subscribers. The initial findings have revealed the existence of local information systems for transfer of agricultural knowledge through use of WhatsApp groups. This has complemented the climate services which are being delivered by the service providers. The team also found that farmers employ a multi criteria for decision making, of which climate services is just one criteria. Further, studies and in-depth field research is being planned to understand the micro dynamics within the farming community which influences their decision making and describes how climate services can be improved to augment this process.

TERI carried out a major initiative involving integrated assessments using climate models, soil and water assessment tool, energy model, and socio-economic case studies to help facilitate visions and policy narratives for informing climate resilient green growth strategies to realize sustainable development in Himachal Pradesh and Punjab. Integrated assessments can be used as policy tools for generating policy relevant knowledge and facilitating democratic and deliberative participation given the complexities of issues and implications as a result of climate change.

TERI, supported by the International Finance Corporation (IFC), undertook scoping studies on

climate-resilient low-cost housing in Nepal and Bangladesh. These studies are part of the Pilot Programme for Climate Resilience (PPCR). The focus is on low- and middle-income households who are vulnerable to climate risks and natural disasters. Often robust housing designs and technologies exist but households are unaware of or unable to afford these. These scoping studies aimed to assess the market potential for climate resilient housing and to design feasible business models that would encourage private sector financial institutions and property developers to venture into this market. Detailed household-level surveys were carried out in six districts in Nepal, and in eight districts of Bangladesh. Extensive stakeholder interviews were conducted with government organizations, banks, insurance companies, developers, non-governmental organizations, and donor agencies, active in the housing sector in these countries, to identify constraints to private sector participation in climate-resilient-low cost housing market, evaluate developers' plans, and perceived barriers. The studies also involved development of business models to attract private sector developers and financiers into the climate resilient, low cost, housing market.

TERI also has an ongoing project focussing on the impact of floods on urban transport in the cities of Bengaluru, Mumbai, and Delhi. The objective of this study is to assess the impacts of urban floods on the transport sector by using geospatial and flood impact models to identify the flood hotspots on road network and assess the potential need for interventions. The study is focussing on the potential impact of flooding on the performance of urban transport.

In addition to the above, we have also initiated a study on understanding the determinants of segregation of household waste in Delhi. The research aims to understand the effect of information on alternate waste handling practices in modifying household behaviour to comply with segregation norms laid down. In addition to the detailed household level surveys, it will involve stakeholder interviews with urban local body officials, non-governmental organizations, government organizations, and resident welfare associations to understand the perceived barriers to the compliance of the rules laid down in Municipal Solid Waste Rules, 2000. The study is being financially supported by International Growth Center.

TERI also has an ongoing study on heat island in Jharsuguda, Odisha, which is funded by Oxford Policy Management with support from Odisha State Pollution Control Board (OSPCB). The Jharsuguda Ib-valley region is a coal mining and industrial cluster and frequently records temperatures in excess of 45°C during the summer months. The study seeks to identify temperature hotspots in the region through GIS-based spatial analysis, and field monitoring using temperature data loggers, infrared camera, and heat stress meters. The study shall also provide an action plan outlining mitigation strategies for various heat sources such as coal mining, heavy industries such as iron and steel, aluminium refining, refractories, thermal power plants, brick kilns and rice mills, and adaptation strategies through heat sinks, such as vegetation, forests, and water bodies. The winter phase of monitoring was conducted in the first week of February 2016, where 12 data loggers were installed, in the different regions of the district, to record the ambient air temperature. A stakeholder consultation workshop was conducted to seek inputs from municipal officials and ward members, OSPCB officials and industry representatives, health specialists, researchers, and civil society organizations, on the heat stress situation and ways to mitigate and adapt to it. The summer phase of monitoring shall be conducted in the first week of May, using infrared camera, to help correlate with land surface temperature readings obtained from satellite images. The final action plan shall be

formulated with the help of TERI's internal analysis as well as stakeholder inputs from coal mines, industries, municipalities, and other experts.

The Plant Biotechnology area is working on the role of endophytic fungi in conforring resistance to biotic and abiotic stress in crop plants to combat the challenge of climate change. Also, demonstration and technology for adaptation to climate change at farmers' level.

Inventorization and Mitigation

The India GHG Program, jointly run by TERI, Confederation of Indian Industry (CII), and World Resources Institute (WRI) India, is an industry-led voluntary framework to measure and manage greenhouse gas (GHG) emissions. The programme builds comprehensive measurement and management strategies to reduce emissions and drive more profitable, competitive, and sustainable businesses and organizations in India. The India GHG Program also acts as an exchange platform for sharing best practices, creating a pool of trained practitioners, and encouraging businesses to have a high level focus on managing GHG risks and opportunities. Experts from WRI, TERI, and CII conduct various capacity-building programmes and till date, have trained close to 100 practitioners, helping businesses develop and customize tools and guidance policies. The Program currently has a registered membership of over 40 leading corporates and recognition from all relevant Ministries of the Government of India. In fact, the Program has been listed in India's Intended Nationally Determined Contributions (INDCs) as one of the key initiatives by the corporate sector for GHG mitigation. Recently, TERI also conducted an assessment of carbon footprint and GHG mitigation potential in the supply chain of a leading FMCG multinational (only select product) and its operations in India. During the year 2015–16, TERI conducted several engagements, with the industrial groups, on GHG accounting and measurement in the sectors. An in-house training was conducted at CESC, West Bengal, on August 21, 2015, on 'Deployment of Power sector Tool at CESC Ltd'. Another capacity building programme was conducted for combined industrial sectors representing iron and steel companies, aluminium firms, transportation, and others at Bhubaneshwar, Odisha, on December 15, 2015. Last year, TERI also conducted a two-day workshop on 'GHG Accounting and Management' on March 21–22, 2016, at IRICEN, Pune, supporting the vision of Indian Railways for transition towards a low carbon and sustainable pathway. The workshop aimed to help Indian Railways officials to learn about the emerging climate policies (domestic and international), role of transport sector, and Indian Railways in overall GHG landscape. The training was attended by 30 senior officials from Railway Board, zonal headquarters, training institutes, production units, etc. Speaking at the workshop, Mr K Swaminathan (Advisor, Environment, Railway Board) shared some of the strategic environmental initiatives that the Railway Board has undertaken for sustainable development. He urged the railway officials to meticulously measure current resource consumption at their respective locations including GHG emissions, energy/water consumption, and waste discharge. During the year, TERI has provided support to set up working groups on air, road, and rail transport emissions through its technical inputs and by facilitating participation of relevant companies in the program. On the policy front, till date, several formal/informal interactions with government stakeholders have been undertaken. Besides engaging with the policy-makers for their presence in the policy workshop, such interactions proved beneficial in terms of introducing them to the objectives of the Program and disseminating the work being done under the Program. The engagement with policy makers involved specific discussions looking at opportunities for private sector in the National Clean Energy Fund, Green Climate Fund, and the overall impacts of the much anticipated Paris Deal on corporate actions. TERI organized a roundtable to enable dialogue between policy makers, businesses, and financial institutions/agencies on the 'Emerging opportunities for Indian business in the evolving climate finance scenario' on January 29, 2016, at the India International Centre, New Delhi. Nearly 35 participants joined in the Program. Presentations from Ministries as well as the private sector together led the discussions around the key issues related to climate finance, reflecting on the post-Paris outcomes, consequences, and the business expectations. As an outreach, TERI has provided blurbs and newsfeed for content for wider dissemination through the Program website as well. In the coming year, TERI aims to deepen its engagements with the companies through the Program and expand the activities under the Program activities to areas aligning with the national priorities on climate finance, GHG accounting for companies, and transparency framework.

Beyond India, TERI organized a short-term training and experience sharing programme on carbon markets and Environmental Impact Assessment (EIA) practices for the Ministry of Water, Irrigation and Energy (MoWIE), Ethiopia, during May 6–20, 2015. The training was primarily a Training of Trainers (TOT) programme, aimed at delivering practical training on EIA processes and practice and Clean Development Mechanism (CDM) and other carbon market instruments. A team of 16 officials from various departments of MOWIE participated in the training. Besides use of presentations and other visual aids, the pedagogy included site/exposure visits. Field trips were organized to Sur Sarovar wildlife sanctuary; Bear Rescue Center, Taj Trapezium, and Bird sanctuary at Chambal safari for two days. In addition, a guided tour of the various facilities at Gual Pahari was also organized. The team was also taken to a Construction and Demolition (C&D) treatment facility in Delhi. The response from the participants on the programme content and the mode of delivery was overwhelming.

International Negotiations and Domestic Policy

On the domestic policy front, TERI, a stakeholder workshop was organized under the project, Strategizing nationally appropriate mitigation actions (NAMAs) in India, in August 2015, focussing on the type of mitigation actions and the institutional arrangements India may consider for planning mitigation projects in line with developmental priorities. Another stakeholder workshop was organized in March 2016 focussing on the strategies to implement INDCs with particular reference to the selection of mitigation actions and MRV challenges. The project aims to propose an institutional strategy to facilitate mitigation actions in India, along with mitigation ideas that could be considered for further development into projects. TERI has also contributed to research that informed the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, towards development of India's INDCs through modelling-based work. This was also supplemented with participation at various levels of national and sectoral debates and discussion towards enriching the deliberations on climate change through enabling and incorporating views of different ministries into the modelling studies.

TERI has also been actively involved in activities directly feeding into international climate negotiations, under the project Good Practice Analysis 2.0 on INDCs, LEDS, NAMAs, and MRV, contributed six case studies on climate policy initiatives focussing on limiting coal consumption in China, MRV system in Ghana, INDC preparation in Jordan, 100 per cent renewable energy targets in the Pacific Islands, integrated MRV system in South Africa, and web-based GHG management system of South Korea. This study (total 18 case studies) was supported by the International Partnership on Mitigation and MRV and the Low Emission Capacity Building Programme of the UNDP and the research was carried out by New Climate Institute (Germany), ECN (Netherlands), TERI (India), and Libélula (Peru) During UNFCCC SB-42 session at Bonn, a side-event was organized in collaboration with IGES, Japan, on June 4, 2015, focussing on assessment of submitted INDCs and prospects for Paris Agreement. Parallel to SB session, in collaboration with DIE and the Galvanizing Groundswell of Climate Action Network, a day long workshop was organized on June 5, 2015, to take stock of and explore the role of non-state actors in implementing climate actions. A similar session was organized with DIE and GGCA in November 2015 during the Switch Asia India Networking Programme. A two-day climate policy research workshop was organized in collaboration with the Ministry of Environment, Japan, on September 29–30, 2015, focussing on the preparation towards COP21. The workshop highlighted on how countries are focussing on reducing energy intensity of GDP and emission intensity of electricity supply as the major thrust for meeting the 2° goal. There are multiple successful experiences on North–South and South–South technology transfer, but how those experiences and experiments could be scaled up remains an open discourse, critical for climate policy. The role of international cooperation and various mechanisms in creating market dynamism, that will make the private sector to transfer and aggressively diffuse climate technologies, will be crucial. In the run-up to the Paris Summit and India's INDC preparation, the CGER also provided inputs to MoEFCC on the overall framing of INDCs. Post the INDC submission, colleagues were part of the delegation on behalf of the Government of India to give presentations on India's INDCs at various UK organizations, including the government.

At COP21, in Paris, the CGER co-organized and participated in many official and parallel side events during December 3–11, 2015. The events organized by CGER, included Ambition and impact of INDCs and the global deal (with Climate Analytics and PBL); Looking beyond the mitigation targets of INDCs: Finance, fairness and adaptation (with DIE and ACTS); Will Paris pave way for Africa's prosperity and transformation? (With Horn of Africa); and Galvanizing the Post-2015 Groundswell of Climate Actions Workshop (with DIE and Galvanizing Groundswell of Climate Action Network).

TERI with support from Department of Personnel and Training, Government of India, has been organizing an annual five-day training programme for All India Service officials, since 2011, on varied topics encompassing science and policy of climate change. The programme is structured in a manner that it is inclusive of the ongoing international, national, and local debates on climate change. Speakers and faculty for the programme are renowned experts in the field of climate policy, climate adaptation, and climate mitigation. The programme is infused with a number of examples, good practices, case studies, and also includes a visit to the sustainable living demonstration at Gual Pahari campus of TERI. The training programme is aimed at building the capacity of government officials, from different states of India, for facilitating integration of climate concerns into development planning.

TERI with the support of DELL Global Giving has initiated the Climate EduXchange, a school education programme, that harnesses the power of information and communication technology (ICT), providing a dynamic web platform for students from schools across India to share information and ideas across disciplines about the impacts of climate change and the best way forward for India to secure a path towards sustainable development. For more information, please visit www.climateeduxchange.org TERI has also initiated 'STARS': Sustainability Tracking, Action and Reporting in Schools programme with the help of Dempo Group of Companies, Goa, India, in collaboration with school and neighbourhood community, and parents. The aim is to promote resource efficiency in schools by putting identified interventions in place involve their immediate communities to address environmental issues of concern in Goa.

Energy

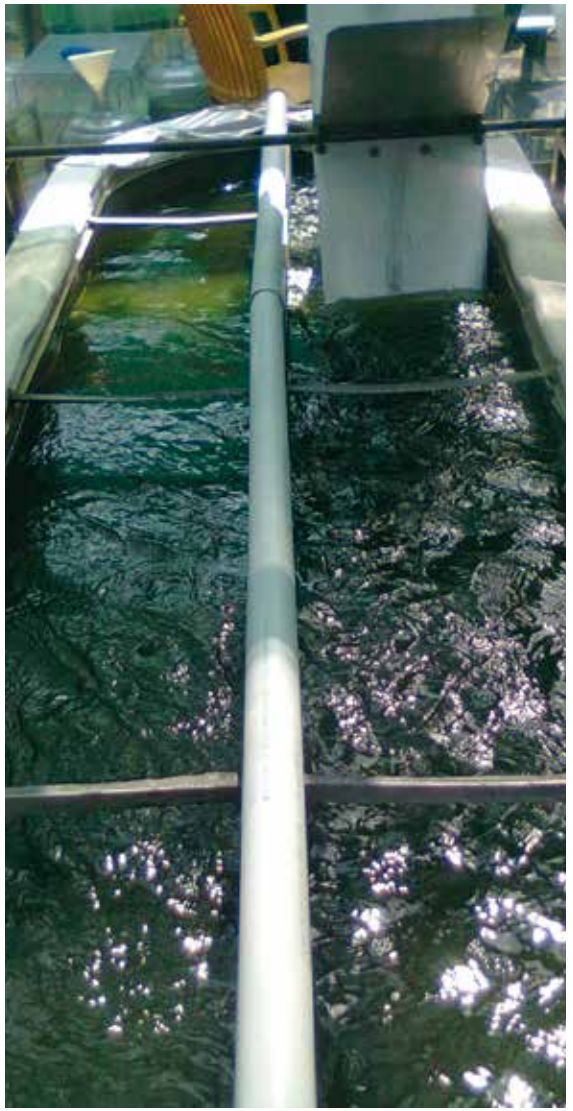
TERI is committed to contributing towards global energy access targets through clean energy interventions. In this endeavour, divisions working on energy have undertaken diverse activities in different scales of outreach.

> Energy consumption, in all its forms, has been steadily increasing over time since it is the basic requirement for most processes, whether domestic or industrial.

TERI has been working in the arena of improved cookstoves for the past two decades and has been engaged extensively in customizing forced draft cooking technology to improve quality and to suit consumer preferences and contextual cooking conditions. More than 11 variants of forced draft cooking technologies, varying in complexity and cost, have been developed over the last four years. The most recent addition in 2016 is a forced-draft cookstove optimized for burning coal as a cooking fuel, specifically meant for households in coal mining areas. Providing 'last-mile' delivery of services through a mix of market-based and non-market approaches is the cornerstone of TERI's rural development projects. In the case of improved cookstoves, a vast network of energy entrepreneurs, numbering over 300 (as in April 2016), has been created to provide household-level services to users of clean energy technology. Through this network of entrepreneurs, NGOs, and financial institutions, TERI has disseminated more than 60,000 improved biomass (forced draft) cookstoves till April 2016. In the coming years, TERI envisages a wider network for service delivery, involving myriad entities, including individual entrepreneurs, micro-finance institutions, NGOs, village cooperatives, and most importantly, self-help groups.

In a pilot project in Odisha and Uttar Pradesh (Climate Credit Pilot Project), TERI monitored black carbon emissions and usage of forced-draft cookstoves in rural kitchens, using mobile-based wireless sensors developed by Nexleaf Analytics and Qualcomm Technologies Ltd. Based on this data, the team working on Project Surya created a dummy carbon fund to provide monthly usage-based incentives to nearly 4,000 rural women directly to their bank accounts. As a follow-up of this project, TERI is comparing exposure to particulate matter in households using improved and traditional cookstoves, further linking it to health outcomes.

The flagship initiative of TERI, Lighting a Billion Lives (LaBL) has expanded its footprint in 24 plus states and 12 plus countries. In 2015, LaBL was included as partner for the UN Sustainable Energy for All's – 'Clean Energy is Life' campaign. The initiative was also acknowledged by the Energy Access Practitioner Network for its emergency response during the Nepal earthquake. Efforts of LaBL's village level entrepreneur, Shrimati Noorjahan (Uttar Pradesh) were recognized by Hon'ble Prime Minister of India, Shri Narendra Modi, during one of his 'Mann Ki Baat' radio sessions. Another female entrepreneur from Kanpur—Shrimati Priti Kushwaha, received several awards for her tireless



efforts in the area of rural energy access. During the financial year 2015–16, LaBL worked with a range of stakeholders such as Power Grid Corporation of India Limited, Power Finance Corporation, Rural Electrification Corporation, IDBI bank, Bihar Rural Livelihood Promotion Society (BRLPS), and Indus Towers. Projects executed by LaBL in 2015 have facilitated integration of energy access in the areas of education, health, entrepreneurship, and integrated rural development. With support and confidence entrusted by patrons, partners, volunteers, and supporters on the overall commitments of the campaign, the initiative has so far impacted over 4.3 million lives globally.

TERI recently completed a two-year project funded by a major public sector unit for provision of energy access through solar power plants to primary health centres in three Indian states. The solar power plants were designed to meet energy requirements of the health equipment in these centres, based on present availability and future patient needs.

Solar power plants have also been designed for several primary schools in eastern India to operate lights, fans, and computers in villages not connected by the grid and having erratic power supply. More recently, TERI has also been making interventions, focussing on like productive uses of energy. In the past, solar-powered small business units were set up in Uttar Pradesh, Madhya Pradesh, and Odisha to provide livelihood opportunities to self-help groups. With support from HCL Technologies, TERI is carrying out an assessment of the energy needs in a cluster of villages for both productive and consumptive uses. Consequently, an intervention plan will be developed to fill energy gaps with clean energy technology.

Alternative Energy

TERI has been working on development of alternate energy solutions and their applications for over three decades. These solutions when implemented have resulted in large-scale energy savings, reduction of carbon footprint, and high economic benefits to the beneficiaries.

One of the fields where TERI stands as leader is the biomass-based decentralized solutions, having worked extensively towards developing biomass- and waste-based technological solutions to cater to the clean energy needs of the society. TERI has developed technologies for conversion of wet as well as dry biomass into useful end products, such as gaseous energy, electrical energy, crude bio-oil, soil conditioner, etc.

TERI has done extensive work in the development of biomass gasifiers for thermal applications for small- and medium-scale industries. Close to 600 thermal gasifier systems were installed in 15 different small and medium enterprises and around 20 power gasifiers were installed for rural and other standalone applications across the country. TERI has developed advanced two-stage biomass gasifier system for power generation and is in the process of installing and commissioning one each in Rayagada and Koraput districts of Odisha.

Under the TERI–SDC Biomass Project, TERI along with Denmark Technical University and Effin Art developed a two-stage biomass gasifier that provides clean gas for power generation. This technology has been implemented in two villages in India and two more are lined up for implementation in Odisha and Madhya Pradesh to electrify village households and supplement the livelihood activities of the village populace.

In the recent past, TERI has been engaged in development of non-woody biomass gasifier systems for power generation using advanced gasification technology. Presently, the team is involved in a project for development and piloting of biomass gasifier for power generation in East Asia and Africa with the support of UNIDO Vienna. Under this project, a biomass gasifier-based power generation system using rice husk is installed in Cambodia for remote village electrification. This power plant will provide electricity to the nearby 5–6 villages and rural industries. TERI has also won a few bilateral international projects—one from REEEP and the second from WISION. The REEEP project is of high impact nature as it targets creation and upliftment of livelihood of marginalized rural population.

TERI's Acidification and Methanation (TEAM) process in the last six to seven years has been disseminated in various capacities (50–2,000 kg/day) with different materials of fabrication such as mild steel, stainless steel, and Fibre Reinforced Plastic. TEAM technology is successfully functioning at more than 24 locations across India. On an annual basis, TEAM is treating a total of 2,500 tonnes, which generates 1,500 m^3 of biogas, which in turn has 75,007.5 kg and 202.52 tonnes of LPG and CO_2 savings, respectively.

TERI is actively engaged in development of alternate transport fuel from biomass and waste sources through pyrolysis route. The bio-oil, which is a second-generation liquid bio-fuel, is being tested for utilization as a renewable substitute for conventional fuel in vehicular engines and various other industrial applications.

In the area of solar energy, TERI is involved in a wide range of activities targeted at market development and promotion. TERI undertook third-party inspection and testing of grid-connected solar photovoltaic (SPV) power plants for the Chandigarh Renewal Energy and Science & Technology Promotion Society (CREST), India. The assignment comprised inspection and validation of SPV power plants in Chandigarh (including rooftop SPV power plants of 1 MWp at PEC University, 475 kWp at government schools, and 200 kWp at India Reserve Battalion Complex), as per international standards.

TERI is also involved in a project for the upgradation of SPV quality infrastructure at the National Institute of Solar Energy (NISE). The project comprises solar resource estimation, preparation of a solar atlas, setting up of state-of-the-art calibration

laboratories for testing of sensors installed in solar resource assessment stations, and development of solar resource forecasting.

TERI is also engaged with the Ministry of New and Renewable Energy (MNRE), Government of India, in providing advisory and consultancy services for promotion and development of the grid-connected rooftop solar sector in the country. This is in support of the government's target of achieving 40 GW of grid-connected rooftop solar power capacity by 2022. In the course of this project, TERI has provided a wide variety of services such as potential assessment, market growth strategies, stakeholder engagement, business model analysis, awareness initiatives, development of quality standards, etc. TERI is also providing advisory services to MNRE on revamping and implementation of the Solar Renewable Purchase Obligation (RPO) and Renewable Energy Certificate (REC) policy measures. In the rooftop solar power space, TERI also partnered with the KfW Development Bank of Germany to conduct a comprehensive market assessment covering consumer segmentation, viability analysis, impact analysis on distribution utilities, assessing lender preparedness, etc.

The Solar Lighting Laboratory at TERI is working towards quality assurance and quality checks of off-grid solar lighting products. The laboratory received accreditation by National Accreditation Board for Testing and Calibration Laboratories (NABL), under Department of Science and Technology and by International Finance Corporation (IFC), under the World Bank. This year, the laboratory also got certification from MNRE and has become an authorized testing centre for solar lighting products. The laboratory is also actively involved with formulation and harmonization of standards for solar lighting products.

Biotechnology

TERI is also active in the area of biotechnology. Algae have been utilized for bioremediation of rubber

A process for microbial production and downstream purification of 2,3 butane diol from the fermentation broth (fermented by Enterobacter cloacae) was developed by TERI.

latex coagulation discharge through phototrophic biofilm. This biomass is utilized for oil extraction, and thereafter, de-oiled residues are utilized for bioethanol production.

Backcross breeding and marker-assisted selection has been carried out in Jatropha, a biofuel feedstock species, to develop donor lines for high yield and oil content. An advance backcross population is being developed. A linkage map based on next generation sequencing is currently being developed. A micropropagation protocol is being developed for bulking up of elite lines of *Pongamia pinnata*, another potential biofuel feedstock tree species. For the development of algal biofuels, a photobioreactor design based on distribution of sunlight (outdoor sunlight is 4–5 times in excess of algal requirement) has been developed. About 1.5–3 times higher areal productivity has been observed, and a patent has been filed. A simultaneous growth–harvest mechanism has been developed to address the major challenge of microalgal harvest.

Large scale consumption of fossil fuels resulted in rapid depletion of fossil oil reserves along with accelerated release of CO2. Hence in recent years, much attention has been paid by scientists worldwide to search for alternative sustainable energy sources. In this context, microbial hydrogen production from renewable sources offers a promising way to produce H2 through biological route. EIB division (EIBD) is in the forefront of fermentative biohydrogen production research and has been extensively working on hydrogen production majorly via dark fermentation, photo fermentation process including integration of dark and photo fermentative hydrogen production process (with the financial assistance provided by Department of Biotechnology, Hindustan Petroleum Corporation Limited (HPCL), Center for High Technology (CHT), Ministry of Petroleum and Natural Gas (MoP&NG), and Ministry of New and Renewable Energy (MNRE). With the lead on development of 1000 liter scale dark fermentative hydrogen production process from molasses, EIBD's research exploration now intensively focuses on hydrogen production through dark fermentation route from lignocellulosic biomass sugars, second generation non food competitive feedstock with a goal to generate energy in sustainable manner.

Fermentative biohydrogen production by C5 sugar utilizing Enterobacter cloacae DT-1 strain (isolated by TERI) from lignocellulosic biomass sugar (second generation feedstock) in 30 litre pilot scale bioreactor (20 litre working volume), through dark fermentation route.

Collection of sample from the CBM well, Jharia for isolation of indigenous methane producing microflora

Major concern is decline of new oil reservoirs. This has raised a global concern for petroleum industries to explore for processes for enhanced oil recovery from existing oil wells. Production of waxy crude oil pose a serious constraint in oil production as it leads to blocking of oil well tubing/oil pipelines. Oil industries spend enormously in implementing the conventional techniques for removal of paraffin/ wax deposition from the oil well tubing/oil pipelines. With in-depth research explorations, TERI and IRS (Institute of Reservoir Studies) ONGC have developed a cost effective microbial process for prevention of paraffin/ wax deposition in oil well tubing/ oil pipelines. This microbial process helped in increasing the oil production and thus eventually got commercialized. Since last seven years, this technology playing pivotal role in enhancing the oil production and has been successfully implemented in 244 oil wells of oil India and ONGC.

Currently, the Environmental and Industrial Biotechnology division in actively exploring for developing a process based on methane producing microbial consortium for in situ stimulation of coal -bed methane production from CBM wells in Jharia. 2,3-Butane Diol (23BD) is a specialty chemical which has profound application as a precursor molecule for synthesis of 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 tons per annum accounting to >$40 billion in sales revenues. Environmental and Industrial Division has achieved the lead on development of a microbial process for 23BD 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 23BD.

R&D in Chemical Processes with Energy Applications

TERI received a research grant from Ministry of Science and Technology, Government of India, for the development of a pilot-scale process for dark fermentative hydrogen production by *Enterobacter cloacae* DT-1 from lignocellulosic biomass, a second generation feedstock. The research focusses on hydrogen production through dark fermentation route from lignocellulosic biomass sugars, second generation non-food competitive feedstock with a goal to generate energy in sustainable manner.

TERI also received funding from the Oil and Natural Gas Corporation (ONGC) for researching into prevention of paraffin deposition in oil well tubing/oil pipeline by the application of paraffin/wax degrading microbes. With in-depth research explorations, TERI and the Institute of Reservoir Studies, ONGC, have developed a cost-effective microbial process for prevention of paraffin/wax deposition in oil well tubing/oil pipelines. This microbial process helped in increasing the oil production and thus eventually got commercialized. Since last seven years, this technology is playing a pivotal role in enhancing the oil production and has been successfully implemented in 244 oil wells of Oil India and ONGC.

With a goal to enhance energy recovery from coal bed, TERI received financial assistance from ONGC to explore development of microbial process for in-situ generation/enhancement of methane recovery from underground coal seams.

Lastly, TERI has achieved the lead on development of a microbial process for 2,3 Butane Diol 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 Butane Diol.

Energy Efficiency and Conservation

TERI works closely with the corporate sector and provides services to the industrial and commercial clients in the field of energy conservation. During the year, TERI provided energy audit services to many large industries in India in various end-use sectors. Under the Bureau of Energy Efficiency (BEE) promoted Perform Achieve and Trade (PAT) Scheme, TERI was involved in monitoring and verification audits for 22 designated consumers (such as Grasim Industries, ACC, Prism Cements, Aditya Birla Chemicals, GMR, DCW, Gokak Mills, etc.) and mandatory energy audits for 16 Designated Consumers (such as Taqa Neyveli, Century Pulp and Paper, Bombay Rayons, ACC, Lanco Power, Rayelsema Chemicals, ITC Paper, etc.). All these studies under PAT scheme were undertaken as per requirements stipulated by BEE. A major assignment that was initiated in 2015–16 by TERI is the detailed energy audit of BPCL Kochi refinery. Internationally, TERI also worked closely with the Government of Guyana, UNIDO, UNEP, and Ethiopian Electricity Agency providing services in Kenya, Ethiopia, China, and Indonesia.

Apart from serving clients in India, TERI undertook detailed energy audits of one of the world's leading petrochemical producers and a leading global manufacturer of wool yarns— Indorama Ventures Public Company Ltd., Netherlands, and for Indo P T Liberty Textiles, Indonesia, an arm of Aditya Birla Group. These audits revealed significant electricity and natural gas saving potential.

With support from SDC, TERI extended energy audit and implementation services in Rajkot foundry cluster and helped a host of other foundry industries in Howrah cluster to improve their energy performance by adoption of best operating practices. In the foundry sector, TERI successfully conducted activities in Belgaum and Coimbatore clusters under the BEE–UNIDO–GEF programme. TERI also expanded its knowledge collation and dissemination activities under its prestigious SAMEEEKSHA (Small and Medium Enterprises Energy Efficiency Knowledge Sharing) platform. During the year, TERI conducted field level surveys and developed cluster-level profiles for several energy intensive MSME clusters across sub-sectors such as rice mills, plastics, foundry, pump sets, textiles, ceramics, and so on. In this regard, TERI developed an interactive graphical interface—'MSME Map of India', to present information on energy, intensive MSME clusters in India. The map has been demonstrated on the SAMEEEKSHA website. TERI also continued its activities under the extended World Bank–SIDBI–GEF project and conducted detailed energy audits followed by preparation of investment-grade detailed project reports for 50 units in Varanasi and Mumbai-Thane mixed industries clusters. Additionally, in order to overcome knowledge and skill development gaps, TERI with support from SIDBI implemented a cluster level implementation project in Rajkot engineering/foundry cluster.

Field-scale implementation of PDB technology for enhanced oil recovery from oil reserves

TERI is supporting NEDO and a consortium of Japanese companies in developing a model smart grid pilot project in Haryana that will showcase the smart grid technologies such as advanced metering infrastructure, outage management system, and demand side management. This will be implemented in four feeders in Panipat city covering nearly 11,000 consumers. TERI, along with some Japanese partners, carried out capacity building for the electricity distribution company of Haryana on various aspects of distribution systems, such as transformer mending, transformer testing, etc. Apart from the above initiatives, TERI, in association with Hindustan Aeronautics Limited (HAL) and Bangalore Electricity Supply Company (BESCOM), is working with government schools in the Bangaluru Area in promoting energy efficiency measures and installing solar roof top PV system. Electricity generated through the solar system is purchased by BESCOM after meeting the requirements of schools through net metering system. So far, TERI has commissioned around 300 kWp solar systems in 25 schools and colleges. TERI has also been working on estimation of energy efficient options, allocation of energy resources, and measurement of sectoral demand for energy services.

Energy Governance

TERI has been engaged in the estimation of the projection of primary energy supply and demand situations through energy systems modelling at state and national level by integrating it to other models such as spatial and biophysical models within TERI. Moreover, TERI has also been working on the interphases of energy—air pollution, health impacts, co-benefits of climate mitigation and adaptation policies, inclusive and sustainable growth, and development issues. TERI has developed a systems framework model to understand the implications of urbanization in a city context along with a risk and uncertainty model to evaluate risks of rare events in an energy value chain.

Awareness and Capacity Building

TERI is recognized as a capacity building hub of the United Nations Sustainable Energy for All initiative. Since TERI adopts a rural enterprise-building approach for implementing its energy access initiatives, building technical and business capacities of entrepreneurs is an integral part of TERI's energy access programmes. In the past year, TERI developed video-based training modules for users and entrepreneurs in English, Hindi, and some regional languages to introduce them to improved cooking and clean lighting technology. Various state-level civil society organizations have also partnered with TERI for providing training programmes in states. To enhance financial capacities of entrepreneurs, TERI has partnered with micro-finance institutions and regional rural banks that provide capital support to entrepreneurs and consumer finance to rural buyers of clean energy technology.

TERI launched a three-month training programme on 'Suryamitra Skill Development', also known as 'Installation, Commissioning, and Maintenance of Solar Energy Systems' in February 2016. The main objective of the programme is to train undergraduates and ITI or diploma holders to execute and successfully implement the National Solar Mission across the country. The training programme also aims to develop high-quality options for long-term skilling, benchmarked to internationally acceptable qualification standards, for creating a highly skilled workforce. A total of 15 students from various ITI/Diploma institutions are participating in this training programme, which includes theoretical and practical classes along with industrial visits for educating the students about various aspects of solar technology.

In collaboration with the Ministry of New and Renewable Energy (MNRE), Government of India, TERI organized a total of nine training programmes on 'Grid-connected rooftop SPV systems for SNA, DISCOM, financial institutions, state regulatory commissions, banks, and channel partners' at TERI University, Vasant Kunj, New Delhi, and other states in India. The training programme was designed to enable the target groups to understand technical, financial, and regulatory aspects, including grid-interconnection, metering arrangements, and remote monitoring mechanism of rooftop SPV systems. Practitioners and renowned industry experts from TERI, MNRE, Solar Energy Corporation of India, Central Electricity Authority, India Smart Grid Forum, Indian Institute of Technology Delhi, Tata Power-DDL, Delhi Metro Rail Corporation, National Productivity Council, SunAlpha, Jakson, CMCC, and SMA, presented their views and shared experiences on implementing rooftop PV systems. Approximately over 70 distribution utilities/state nodal agencies/ electricity regulatory commissions and over 75 financial institutions and more than 175 channel partners were trained under this programme.

TERI also hosted a contingent of 15 officials from Afghanistan for a training programme under an MoU signed between GIZ and IT Power. The programme covered detailed operations of test equipment, implementation of test methods, and delivery of quality report to improve the compliance of local manufacturers and importers of SPV systems. A site visit was also organized to TERI's Solar Lighting Laboratory, and a 48 kWp solar rooftop plant was used for demonstration and hands-on practical training.

TERI organizes eight ITEC training programmes every year under the ITEC/SCAAP programme of Ministry of External Affairs, Government of India. Of the eight programmes, the three key programmes that focus on energy are: (a) Energy Access and Human Development, (b) Energy and Water-Use Efficiency, and (c) Renewable Energy and Energy Efficiency. Participants from more than 20 countries attended the programme, in five year under review, with maximum participation limit of 30 being attended in each course offered.

TERI and BESCOM initiated an energy conservation program 'ViJaYo' (Vidyuth Jagruthi Yojana)—a programme designed and implemented for conducting energy efficiency measures and demand-side management awareness activities in selected schools of urban Bengaluru and rural districts of Karnataka.

Initiated in 1999, TERI conducts the GREEN Olympiad, an annual written examination on environment that attracts participation from lakhs of school students from standard IV - X from India and abroad. It covers a broad range of topics such as water, energy, air, forest, biodiversity, climate, global warming, sustainable development, culture and current affairs pertaining to environment. This programme is partnered and supported by the Ministry of Environment, Forest and Climate Change, Government of India, CBSE, KVS, NVS, and other educational institutions and state educational boards.

Environment

TERI, over the past, has worked on assessing and improving the environmental quality. While efforts have been made to assess and report the status of environmental quality, several initiatives were undertaken in 2015–16 to mitigate pollution and sensitize the stakeholders. All this has yielded considerable benefits and in certain cases, has significantly helped policy formation and implementation.

> As in the past, TERI, in the year under review, continued to assess and improve the environmental quality, mitigate pollution, and sensitize the stakeholders.

In 2015–16, TERI has successfully completed the project aimed at development of a sustainable green cover, over 18 acres of land, filled with acidic phosphogypsum (PG) waste of Coromandel International Limited (CIL), a phosphate fertilizer company, located at Vishakhapatnam, Andhra Pradesh. TERI and CIL received a lot of appreciation when the success story of the project was presented to International Fertilizer Association PG/NORM Working Group during Pre-Conference Side events of Global IFA Technical Symposium held on March 14, 2016, New Delhi. During 2015–16, TERI also carried out maintenance work (application of compost and mycorrhiza to plants, mortality replacement and day to day activities, i.e., watering, drip cleaning) of a green belt covering an area of 20 acres at Tata Chemicals Ltd, Gujarat (developed earlier by TERI) on chlor-alkali waste.

Bihar Strategic Environmental Analysis (BSEA), supported by the World Bank, aimed at identifying the key environmental considerations that need to be factored into development decisions—both as risks and opportunities—across (development) programmes that are being (or are proposed to be) undertaken in the state. This is to help develop a shared vision across agencies responsible for delivering development outcomes. The BSEA will serve as a guiding tool, providing strategic direction with respect to the agencies, encompassing environmental issues, a unique means for engagement between implementing agencies, and an instrument that helps in the integration of environment management aspects in the development process of the state.

TERI, with financial assistance from Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India, developed the Oilzapper technology; Oilzapper, a consortium of crude oil and oily sludge degrading bacteria, isolated from samples collected from diverse natural environment. Owing to the wide spectrum, application of 'Oilzapper' in sustainable bioremediation of oily sludge and oil spills in a cost effective manner. This eventually enabled TERI to acquire an industrial scale project from Kuwait Oil Company (KOC) through a global competitive bid, to restore effluent pits, to repair environmental damage, and clean up more than

210,000 m^3 soil contaminated with petroleum hydrocarbon compounds.

TERI is also engaged in a study using Computable General Equilibrium (CGE) modelling. A holistic approach considering all sectoral inter-linkages, this study will analyse the impact of export restriction through the CGE model. After completion of construction of social accounting matrix (SAM) with sectoral flow for selected natural resources (Coal, Copper ore & concentrate and Iron ore), TERI is currently engaged in CGE analysis. Stakeholder consultation is also under progress to enrich and validate the empirical findings.

To understand grassroots perspectives, the TERI team facilitated focus group discussions using nominal group techniques, participatory GIS, and multi-criteria framework to understand priorities of men and women on natural resource management issues in Punjab. The exercise helped bring out gendered perspectives that can be factored in policymaking. The findings were communicated to policymakers and civil society through policy reports, summaries, and presentations. Studies involving monitoring of air pollutants, inventorization of source emissions, computer simulation and modelling of air quality, and development of air quality management plans were also undertaken by TERI during the year under review. TERI was involved in the pioneering source apportionment study for the city of Bengaluru and has also been working for many years on the use of state-of-the-art three dimensional multi-grid air quality models to predict urban/regional scale pollution of criteria as well as emerging pollutants, such as ozone. TERI has also been monitoring aerosols and their properties, particularly in the Himalayas, to assess regional-scale pollution. TERI seeks to outline avenues for community interventions in natural resource management. Researchers carried out field work in Rajasthan, Jharkhand, and Karnataka, to identify major challenges pertaining to natural resource use and understand the linkages between natural resources and livelihoods in rural communities.

Forestry and Biodiversity

The Forestry and Biodiversity group of TERI has major research interest in technical forestry, participatory forestry approaches, governance, rehabilitation of degraded areas, clean development mechanism, and emission reductions. In addition, this group is engaged in monitoring and evaluation of forestry and watershed development related activities. Besides, studies on biodiversity and payment for ecosystem services are undertaken. Capacity building activities, particularly for state forest departments is an important activity for this group.

> TERI relies on a multidisciplinary approach to focus on the development of technical capacity at various levels and the use of community centric approaches to the management of forests.

In the year 2015–16, the major focal area for TERI was 'Carbon Forestry and Biomass Estimation' where TERI undertook a detailed study of Clean Development Mechanism project assisting the state forest department of Uttar Pradesh to successfully register 10 small Afforestation/Reforestation CDM projects with the United Nations Framework Convention on Climate Change (UNFCCC).

Another thrust area for TERI is 'Biodiversity and Conservation', where a variety of national and international projects, such as 'Assessment of Community Conserved Areas in Nagaland, Feasibility Study for Biodiversity Centre at the University of

Guyana, and Preparation of Management Plan for Pant Wildlife Sanctuary in Rajgir, were planned and executed. The group also initiated a project with Tribal Cooperative Marketing Development Federation of India Ltd (TRIFED) on Enhancing Income of Forest Dependent Communities through Establishing Minimum Support Prices (MSPs) to assess 12 Minor Forest Produce (MFPs) in nine PESA states, during 2015–16. In addition, the Forestry and Biodiversity group of TERI is also involved in the monitoring and evaluation of projects and is doing consultancy for impact assessment of Pradhan Mantri Krishi Sinchai Yojana (PMKSY) Watershed Development Project in Uttarakhand.

Besides, TERI has also been actively involved in training and capacity building of state forest departments and regularly conducts training programmes, including the mid-career training programme for IFS officers. Presently, TERI is also engaged in Capacity Development for Forest Management and Training of Personnel in Arunachal Pradesh and Assam. The group works actively in the field of natural resource management and has currently finished developing and facilitating community development plans in Mizoram and Tripura under the North East Rural Livelihoods Project. TERI also works on various institutional issues relating to participatory forest management, and has major interests in the study of forest-based livelihoods and benefit-sharing at the community level. At present, the group is implementing a programme on Agriculture, Greening, Training, Capacity Building, and Income Generation activities supported by Coal India Limited.

TERI, thus, endeavours to facilitate the creation and development of models, systems, and concepts for conservation and sustainable utilization of natural resources. The organization has not only put considerable effort into documenting the research findings but has also stressed on outreach and training component by sensitizing the policymakers, government officials, educational institutes, and common people through various outreach activities.

Urbanization and Transport

The present century poses many challenges and pressures over urban areas. While population influx in cities is a continued phenomenon posing demand pressures on the city, the changing lifestyle and characteristics of urban centers have led to unfavourable environmental impacts. Climate change is one of many such environmental threats that urban centers are increasingly facing. There is a huge need to bring in energy-efficient and climate-resilient systems in urban areas to address climate change impacts and induced extreme events for a safe and sustainable future.

> TERI conducts extensive research in the areas of sustainable development with a view to inform policymakers and build capacity to implement sustainable practices.

With the key objective of promoting low carbon and sustainable modes of transport, TERI's recent work over the last year includes studies on increasing rail freight shares in Indian Railways, demand and fare elasticity estimation for Delhi Metro, assessment of low carbon transport strategies for India, and modelling the effects of such strategies on India's long-term transport energy and emissions.

TERI has in the past year provided assistance to the Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India, to help determine India's Intended Nationally Determined Contributions (INDCs). Through an integrated transport modelling exercise, TERI has helped in drawing up medium-term emissions reduction potentials from the transport sector in India.

As a knowledge partner for the Ministry of Railways, Government of India, TERI also helped in setting up and coordinating activities for an integrated transport event at the 21st Conference of the Parties (COP21) at Paris. TERI is also a member of Member of the SLoCaT Partnership, a global partnership hosted by the United Nations Department of Economic and Social Affairs (UN-DESA), on Sustainable, Low Carbon Transport (SLoCaT). TERI is currently undertaking a study funded by the Asian Development Bank (ADB) as part of a larger Indo-China low carbon study for assessing the current scenario of Low Carbon Transport Plans for India and drawing up optimal strategies to reduce the sector's emissions footprint. One of the key strategies for India for reducing the energy intensity of its transport sector is by increasing the shares of rail in the movement of both passenger and freight. Sponsored by the Shakti Sustainable Energy Foundation, TERI is currently undertaking a study to identify reasons for the Railways for losing its share in overall freight mobility in the country across commodities, such as cement, containers, and automobiles.

For passenger transport, TERI has been commissioned by the Delhi Metro Rail Corporation (DMRC), to estimate the fare elasticity of demand of DMRC users and draw up recommendations for increasing/changing fares and fare structures to increase DMRC revenues with minimal impact on ridership.

However, emissions from the transport sector are not limited to that from the operations of transport alone. TERI has, over the years, also undertaken studies to determine the life cycle emission estimates for transport infrastructure. In one such study for the Ministry of Road Transport and Highways (MoRTH), Government of India, TERI is studying the carbon reduction potential from highways of different typologies in India. The study also aims to identify interventions to enhance climate resilience of highways in India.

TERI has conducted studies to develop Heavy Duty Vehicle (HDV) efficiency standards in India with support from the Shakti Sustainable Energy Foundation. The project collected several details of the HDV sector in India and recommended tire technologies and testing protocols for HDV fuel efficiency standards for India. In a different project for the Shakti Sustainable Energy Foundation, TERI is working on strengthening the institutional framework for Inspection and Maintenance (I/M) programme for in-use vehicles in India. This involves understanding of the current PUC system and improving its effectiveness in India.

Apart from providing technical assistance and conducting policy studies, TERI has been actively involved in the assessment of Car-Free Days being conducted in Delhi to study its impacts on Delhi's Air Quality. Similar assessments were carried out to assess the congestion and air quality impacts of odd–even scheme implemented by the Delhi Government.

TERI, in collaboration with Tetra Pak India Pvt Ltd, initiated Project SEARCH (Sensitization, Education and Awareness on Recycling for a Cleaner Habitat)—a school environment education programme on waste management. The project is successfully running continously for the last seven years. Project SEARCH aims to encourage the young students, teachers, parents, and the community to practice the 4Rs—refuse, reuse, reduce, and recycle, and to make consumption choices that would ensure the sustainability of the planet in the years to come. For more information, please visit <www.projectsearch.in>.

Water

Water is a finite resource and with the burgeoning demand from various sectors, the resource is under constant stress. As reported, most of the river basins are water stressed and could face severe deficit by 2030, if not managed on time. With the growing concern in the water sector, TERI is actively engaged in the sector and is working on the various aspects of integrated water resources management.

In the light of water stress, TERI is one of the leading institutes to take forward integrated water resource management strategies through its various projects and activities.

Enhancing Water Use Efficiency

To support the National Water Mission's goal of enhancing water use efficiency, TERI is actively involved in studies that help to improve water use efficiency through water audits and assessment of water footprint along the entire value chain, and by providing inputs for benchmarking water use in specific sectors. Through water audits, TERI has helped sectors such as thermal power plants, heavy engineering, pulp and paper, food and beverage, IT companies, railways, etc., in reducing losses and specific water consumption, implementing recycle/reuse of water/wastewater, and improving their overall water use efficiency. TERI in association with Jain Irrigation has also established Resource Center for Water Use Efficiency.

Water-Energy Nexus

TERI is progressively working in the field of water energy nexus and has established the linkages at various spatial scales. TERI is trying to firm up these linkages in the power sector and developing a decision support tool for relevant stakeholders in the sector. TERI also did a study to establish linkages between water–energy–food nexus in urban areas.

Glacial Research

TERI is conducting research to quantify the impacts of climate change on the Himalayan cryosphere and estimate the differentiated contributions to snow and ice melt, attributable to changes in temperature, precipitation, and black carbon. The team monitors glacier dynamics which regulates the flow pattern of the river regimes with the help of the 'Glacier Monitoring Observatories'/field laboratories established at Kolahoi Glacier, Jammu and Kashmir and East Rathong Glacier, Sikkim, at altitudes of > 4000 masl.

Drinking Water and Sanitation

In the process of improving access to safe drinking water, TERI has implemented the River Bed Filtration Technology in Belgaum district, Karnataka, to treat the drinking water and assess the implications on public health. TERI also has an accredited water testing laboratory with state-of-the-art field sampling and analytical instruments.

In the sanitation sector, as part of 'Strengthening Water and Sanitation in Urban Settings', TERI conducted regional stakeholder consultation workshops for the northern, north-eastern, eastern, western, and southern regions of the country, in order to facilitate experience-sharing and cross-fertilization of ideas. Additionally, TERI undertook an impact assessment analysis of rural water supply and sanitation project implemented by the government in Uttarakhand.

Hydrological Studies

TERI is also involved in developing modelling protocol that couples future climate data with hydrological model to simulate discharge. This has been applied to assess the impacts of climate change on water availability in the Zuari river sub-basin.

For strengthening water and sanitation in urban settings, TERI launched the National Competition and Training of Trainers—a programme to conduct

comprehensive cross-sectional WASH-related risk analysis including living, social, gender-related variables and occupational conditions and human health impacts in a cluster of slums in Kolkata and Chennai. The optimum benefit from water and sanitation interventions can only be achieved when attempt for positive behaviour change amongst the communities are practised. At TERI, it has been realized that training of trainers, combined with a multi-school programme, greatly impact the student-teacher collaborative learning experience and develops essential skills through multiplier effect. These skills can be further developed to come up with community-based solutions, combining local actions with global perspective. As part of "Strengthening Water and Sanitation in Urban Settings", TERI aims to conduct Training of Trainers (ToT) and reach out to school teachers in select locations of Kolkata and Chennai to sensitize them on issues related to WASH, thus, making them peer educators and creating multiplier effect to come up with school and community-based solutions on the said issue. This will enhance the capacities in faculty, students, and decision makers to help address the challenges related to sanitation and health and their engagement in action research with the intent of finding replicable solutions to the sanitation problem.

TERI, with support from Bamcroft Arnesen Explore (BAE), and in partnership with the Access Water Ganga Expedition, under the programme 'From Hope to Action' also proposed to generate awareness amongst the youth from schools and colleges and the school community in six identified cities/peri urban areas along the river Ganga through mass awareness and action programmes.

5 Partnerships and Networks

Partnerships and Networks

When trying to link policy, research, and practice, TERI recognizes the need to build collaborative partnerships and networks with the objective of sharing knowledge, enhancing technological capabilities, fostering innovation, building local capacities, and strengthening competitiveness. It continues to team up with local, international, and bilateral institutions to promote sustainable interventions. Our research collaborations, MoUs, and partnerships, along with their areas of interest, through the year 2015–16, are listed in the following table.

Governments/PSUs

Partner	Profile	Focus Area	Type of Association
Andhra Pradesh State Development Planning Society	State Government - India	Climate change and SDGs	Funding support
Agriculture Insurance Company of India	Public Sector Undertaking - India	Community development	Partnership agreement for implementing CSR projects
Arunachal Forest Department	State Government - India	Capacity building for assisting the state project management unit in the implementation of JICA project	Funding support and capacity building
Assam Forest Department	Central Government - India	Capacity building for assisting the state project management unit in the implementation of JICA project	Funding support
Axom Sarba Siksha Abhijan Mission	State Government - India	Develop regional language content on environment and sustainability for the school children in Assam	Funding support
Bharat Petroleum Corporation Limited	Public Sector Company - India	Marketing infrastructure for petroleum products	Collaborative research
Bihar Rural Livelihoods Promotion Society	State Government - India	Rural livelihood promotion	Project partnership
Bureau of Energy Efficiency	Central Government - India	Energy efficiency	Funding
California Air Resources Board	State Government - International	Vehicular emission control	Technical support for research
Center for High Technology, Ministry of Petroleum and Natural Gas	Government of India	Microbial biotechnology	Funding support

Partner	Profile	Focus Area	Type of Association
Center for Tropical Crops and Bio-commodities, Queensland University of Technology, Brisbane, Australia	Australia Government	Microbial Biotechnology	Collaborative project partners
Coal India Ltd	Public Sector Undertaking - India	Livelihood, renewable energy, community development, agriculture and greening, sanitation, knowledge cum recreation centre	Partnership agreement for implementing CSR projects
Coal India Ltd	Central Government - India - PSU	Forest-and agriculture-based livelihood activities	Funding support
Credit Valley Conservation, Canada	Central Government - International	Water resource management	Knowledge partner and collaborators
CSIRO Energy Transformed Flagship, North Ryde, New South Wales	Australian Research Institute	Microbial Biotechnology	Collaborative project partners
CSIR-National Institute of Science, Technology and Development Studies	Central Government - Research Institute - India	Research on organic agriculture	Project partner
Cultural Affairs Department, Assam	State Government - India	Knowledge preservation	Knowledge partner
Delhi Metro Rail Corporation Ltd	Central and State Governments - India	Determination of demand elasticity	Funding support
Department of Atomic Energy	Central Government - India	Risk analysis and energy security	Knowledge partner
Department of Biotechnology	Central Government - India	Micromission project in Jatropha	National network partners
Department of Biotechnology	Central Government - India	Scientific research and development	Funding support
DBT-ICGEB Center for Advanced Bio-energy Research, Center for Genetic Engineering and Biotechnology, New Delhi	Central Government - India	Microbial biotechnology	Funding support
DBT-ICT Centre for Energy Biosciences, Institute of Chemical Technology, Mumbai	Central Government - India	Microbial biotechnology	Funding support
DBT-IOC Centre for Advanced Research on Bioenergy, R&D Centre, Indian Oil Corporation, Faridabad	Central Government - India	Microbial biotechnology	Funding support

Partner	Profile	Focus Area	Type of Association
Department of Biotechnology, Ministry of Science and Technology, India	Central Government - India	Microbial biotechnology	Funding support
Department of Chemical Engineering, for Process System Computations, Curtin University,Perth, Australia	Australia Government	Microbial biotechnology	Collaborative project partners
Department of Science and Technology, Ministry of Science and Technology, India	Government of India	Microbial biotechnology	Funding support
Department of Electronics and Information Technology	Central Government - India	Social media	Funding support
Department of Energy and Environment, Government of Maldives	Central Government - International	Biofuel feasibility study	Collaborative research
Department of Environment, Science and Technology, Himachal Pradesh	State Government - India	Green growth and development	Nodal support and policy incubation
Department of Horticulture, Bihar	State Government - India	Micropropagation of Banana	Supply of plants
Department of Horticulture, Punjab	State Government - India	Micropropagation of Citrus	Supply of plants
Department of Horticulture, Uttar Pradesh	State Government - India	Micropropagation of Banana	Supply of plants
Department of Renewable Energy, Kenya	Central Government Department - International	Renewable energy	Implementation partner in Kenya
Department of Science and Technology	Central Government - India	Digitization, digital library	Funding support
Department of Science and Technology, Arunachal Pradesh	State Government - India	Feasibility study of geothermal heat pump integrated with renewable energy system at Tawang	Funding support
Department of Science, Technology and Environment - Punjab	State Government - India	Green budgeting, green growth and development	Research collaboration, nodal support, and policy incubation
Energy Efficiency Services Ltd	Public Sector Undertaking - India	Energy efficiency, load research	Funding support
Environmental Agency, Abu Dhabi	Central Government - International	Research and development of knowledge books on renewable energy and marine ecosystem for children of Abu Dhabi	Knowledge support

Partner	Profile	Focus Area	Type of Association
Finnish Meteorological Institute	Central Government - International	Aerosols research	Project partners
GAIL (India) Ltd	Public Sector Undertaking - India	Community development	Partnership agreement for implementing CSR projects
Goa Electricity Department	State Government - India	Load research studies	Partnership
Goa State Pollution Control Board	State Government - India	Pollution	Funding agency/collaborative research
Government of Maharashtra	State Government - India	Climate change impacts and adaptation	Preparation of state adaptation action plan on climate change
Green Chemistry Center of Excellence, Department of Chemistry, University of York, Heslington, York, UK	UK Government	Microbial biotechnology	Collaborative project partners
Gujarat Industries Power Company Ltd	State Government - India - PSU	Developing action and monitoring plan for reclamation of mine-degraded lands and addressing socio-economic and livelihood issues of fringe populations	Funding support
Helmholtz Center for Environmental Research, Leipzig, Germany	German Government	Microbial biotechnology	Collaborative project partners
Hindustan Petroleum Corporation Limited	Public Sector Company - India	Marketing infrastructure for petroleum products	Collaborative research
Horn of Africa Regional Environment Centre and Network	Central Government - International	Policy research	Research and capacity building
Horn of Africa Regional Environment Centre and Network	Government - Foreign	Environmental concerns and sustainable development	Partnership and networking
India Energy Security Scenarios 2047	Central Government - India	Research and capacity building	Research network
India Energy Security Scenarios 2047	Central Government - India	Energy modelling	Partnership and networking
Indian High Commission in Africa	Central Government - India	South–South collaboration	Capacity building and knowledge partner
Indian Oil Corporation Ltd	Public Sector Company - India	Marketing infrastructure for petroleum products	Collaborative research
Indian Oil Corporation Ltd	Corporate PSU - India	Malnourishment, livelihood, education, environment conservation	Funding support

Partner	Profile	Focus Area	Type of Association
Indian Institute of Chemical Technology (IICT), Hyderabad	Government of India	Microbial biotechnology	Collaborative project partners
Indian Institute of Technology (IIT), Delhi	Government of India	Microbial biotechnology	Collaborative project partners
Indian Institute of Technology (IIT), Guwahati	Government of India	Microbial biotechnology	Collaborative project partners
Indira Gandhi National Centre for the Arts	Central Government - India	Knowledge preservation, indigenous knowledge	Funding support
Institute of Advanced Studies for Science and Technology (IASST), Guwahati	Government of India (a Unit of DST)	Microbial biotechnology	Collaborative project partners
Institute of Reservoir Studies, ONGC, Ahmedabad	Corporate Sector	Microbial biotechnology	Collaborative project partners
Integrated Watershed Management Programme, Uttarakhand	State Government - India	Watershed management programme	Funding support
Jeonju University, Jeonju, Korea	Korean Government	Microbial biotechnology	Collaborative project partners
Karnataka Electricity Regulatory Commission (KERC)	State Government - India	Research studies	Funding support
Karnataka Evaluation Authority	State Government - India	Evaluation and policy recommendations	Project partnership
Karnataka Forest Department	State Government - India	Evaluation and policy recommendations	Project partnership
Karnataka State Council for Science and Technology	State Government - India	Science and technology	Project partnership
Korea Maritime and Ocean University, Busan, Korea	Korean Government	Microbial biotechnology	Collaborative project partners
Maharashtra Forest Department	State Government - India	Preliminary study on implementation of FRA and vulnerability of forests and forest dwelling communities in Maharashtra	Funding support
Maharashtra Pollution Control Board	State Government - India	Pollution monitoring and regulation	Client

Partner	Profile	Focus Area	Type of Association
Mangrove cell (Mangrove and Marine Biodiversity Conservation Foundation)	State Government - India	Green buildings	Client
Marine Products Export Development Authority	Central Government - India	Aquaculture: Capacity building of fishing community	Support for projects
Ministry of Agriculture and Farmers Welfare	Central Government - India	Research on policy and institutional support for organic agriculture	Funding support
Ministry of Earth Sciences	Central Government - India	Monsoon research	Research collaboration
Ministry of Environment, Forest and Climate Change	Central Government - India	GHG mitigation options for the energy and non-energy sectors in India	Knowledge partner
Ministry of Environment, Forest and Climate Change	Central Government - India	Renewable energy and environment	Funding support
Ministry of Environment, Forest and Climate Change	Central Government - India	Funding	Funding
Ministry of Environment, Japan	Central Government - International	Climate change	Funding
Ministry of External Affairs	Central Government - India	Development of the BCIM economic corridor	Funding support
Ministry of External Affairs	Central Government - India	Energy efficiency	Funding support and partnership
Ministry of Health and Family Welfare	Central Government - India	Rural and urban health	Funding research
Ministry of Micro, Small and Medium Enterprises	Central Government - India	Energy efficiency in MSME sector	Knowledge support
Ministry of New and Renewable Energy	Central Government - India	Collection and dissemination of information and developments in the renewable energy sector	Funding support
Ministry of New and Renewable Energy	Central Government - India	Microbial biotechnology	Funding support
Ministry of Railways	Central Government - India	Knowledge partner-INDC, COP21	Funding support
Ministry of Road Transport and Highways	Central Government - India	Carbon footprint reduction and climate resilience	Funding support
Ministry of Water, Irrigation & Energy, Ethiopia	Central Government - International	Environment (general), climate change	Funding

Partner	Profile	Focus Area	Type of Association
Ministry of Water, Irrigation and Energy, Ethiopia	Central Government - International	Capacity building of the petroleum downstream operations regulatory directorate	Training workshop for Ethiopian regulators
Ministry of Water, Irrigation and Energy, Ethiopia	Central Government Ministry - International	National improved cookstoves program	Implementation partner in Ethiopia
Motilal Nehru national Institute of Technology (MNNIT), Allahabad	Public Sector	Microbial biotechnology	Collaborative project partners
Mumbai Metropolitan Region Develoment Authority	State Government - India	Special planning authority	Client
Nagaland Forest Department	State Government - India	Assess the biodiversity status of reserves of Nagaland	Funding support
Nanded Waghala City Municipal Corporation	State Government - India	Urban local body	Client
National and State Biodiversity Board	Central Government - India	Consultancy services for monitoring and evaluation of NMPB schemes	Funding support
National Development and Reform Commission	Government - Foreign	Low-carbon development and South–South Cooperation	Research and international cooperation
National Highways Authority of India	Central Government - India — Autonomous Organization	Conducted joint workshop on role of plantations along national highways in sequestering carbon	Funding support
National Institute of Interdisciplinary Science and Technology, Thiruvananthapuram	Central Government - India	Microbial Biotechnology	Collaborative project partners
Navi Mumbai Municipal Corporation	State Government - India	Urban local body	Client
New and Renewable Energy Development Corporation of Andhra Pradesh Limited	State Government - India	Promotion of new and renewable energy	Project partnership
NHPC Ltd	Central Government - India - PSU	Valuation of the socio-economic and environmental / costs and benefits of hydro power projects in India	Funding support

Partner	Profile	Focus Area	Type of Association
NITI Aayog	Central Government - India	Policy analysis and development of the energy system tools	Capacity building and knowledge partner
NITI Aayog	Central Government - India	Consultancy for Impact Assessment - II of HP Mid Himalayan Watershed Development Project	Funding support
Norwegian Ministry of Foreign Affairs	Government - Foreign	Designing a REDD+ pilot project in India	Funding support
Numaligarh Refinery Ltd	Public Sector Undertaking - India	Community development	Partnership agreement for implementing CSR projects
Odisha Space Applications Centre	State Government - India	Knowledge sharing	Exchanges and discussions
Oil India Ltd R & D Center, Duliajan, Assam	Corporate Sector	Microbial biotechnology	Collaborative project partners
Power Finance Corporation Ltd	Public Sector Undertaking - India	Community development	Partnership agreement for implementing CSR projects
Power Grid Corporation of India Ltd (PGCIL)	Public Sector Undertaking - India	Education	Partnership agreement for implementing CSR projects
Punjab Forest Department	State Government - India	Status of biodiversity and conservation in Punjab and preparation of Biodiversity Management Plan	Funding support
Punjab State Power Corporation Ltd (PSPCL)	State Government Corporate - India	Load research studies	Partnership
Rural Electrification Corporation (REC)	Public Sector Undertaking - India	Community development	Partnership agreement for implementing CSR projects
State Designated Agency for Implementation of Energy Efficiency Programs, Odisha	State Government - India	Consulting services for the Project Management Unit for energy conservation activities and energy efficiency in state	Knowledge partner & funding support
State Forest Departments (Ministries - Ministry of Environment, Forest and Climate Change, and Ministry of New and Renewable Energy)	Central and State Governments - India	Conducted 8-week training programme for Indian Forest Service officers (with 16–18 yrs of service) in association with Indira Gandhi National Forest Academy, Dehradun	Funding support

Partner	Profile	Focus Area	Type of Association
State Forest Departments (Ministries - Ministry of Environment, Forest and Climate Change, and Ministry of New and Renewable Energy)	Central and State Governments - India	Project titled REDD+ at Madhya Pradesh, Uttarakhand, Odisha, and Uttar Pradesh	Funding support
Tribal Co-operative Marketing Development Federation of India Ltd	Central Government - India - PSU	Minimum support price for 12 minor forest produce in 9 states	Funding support
Urban Development Department, Goa	State Government - India	Urban Climate Resilience Policy	Project support
Urban Development Department, Himachal Pradesh	State Government - India	Smart city proposal	Consultant
Urban Development Directorate, Uttarakhand	State Government - India	Urban Climate Resilience Policy	Project support
Uttar Haryana Bijli Vitran Nigam Limited (UHBVNL)	State Government Corporate - India	Load research studies	Partnership
Uttar Pradesh Forest Department	State Government - India	Biodiversity and socio-economic assessment of protected areas in Uttar Pradesh	Funding support
Uttar Pradesh Forest Department	State Government - India	Preparation of Afforestation and Reforestation. CDM PDD, facilitation of validation, registration, and verification. Monitoring and capacity building of UPFD staff on monitoring	Funding support and capacity building
Water Resources Department, Goa	State Government - India	Water resource management	Funding agency

Research and Academic Institutions

Partner	Profile	Focus Area	Type of Association
Adelphi Research, Germany	Research Institute - International	Policy analysis and strategy consulting	Collaborative research
Andhra University	Academic Institute - India	New opportunities	Workshops
Asia Society for Social Improvement and Sustainable Transformation	Research Institute - International	Capacity building in the area of energy, environment, health	Collaborative research

Partner	Profile	Focus Area	Type of Association
Asia-Pacific Network for Global Change Research	Research Institute - International	Capacity building on urban climate resilience	Funding support
Automotive Research Association of India	Research Institute - India	Vehicle and air pollution research	Collaborative research
Bangladesh Agricultural Research Institute	Research Institute - International	Climate change	Research partner
Bangladesh Centre for Advanced Studies	International Research Organization	Climate resilient housing in coastal Bangladesh, resource management, environment and development issues by use of existing intellectual, technology and manpower	Implementing partner in Bangladesh
Bihar Rural Livelihoods Promotion Society	State Government - India	Rural livelihood promotion	Project Partnership
Birla Institute of Technology and Science	Corporate Research Institute - India	Water remediation	Collaborative research
Bjerknes Centre for Climate Research, University of Bergen	Academic Institute - International	Climate modelling	Collaborative research
Ca' Foscari University of Venice	University - International	Green growth knowledge platform annual conference	Knowledge sharing and outreach
Calcutta University (Kolkata)	Academic Institute Government - India	Genetic modifications to improve biological nitrogen fixation for augmenting nitrogen needs of cereals	Collaborative research
Central Board of Secondary Education	Central Government - India	Enhancing environmental knowledge of students	Endorsement
Central Institute of Medicinal and Aromatic Plants (Lucknow)	Research Institute Government - India	Genetic modifications to improve biological nitrogen fixation for augmenting nitrogen needs of cereals	Collaborative research
Central Power Research Institute	Central Government - India	Research and developmental studies EMI shielding nanocomposites for power sector	Collaborative research
Central University of Finance and Economics, Beijing	University - International	Low-carbon development and finance	Research partner

Partner	Profile	Focus Area	Type of Association
Centre for Ecology Development and Research	Research Institute Government - India	Biodiversity conservation, Western Himalayas	Partner
Centre for Fly Ash Research and Management	Research Institute - India	Commercialization of fly ash based flame retardant nanocomposites	Partners
Centre for Green Economy Development, Nepal	Research Institute - International	South-South cooperation and green economy	Research collaboration
Chhatrapati Shahu Ji Maharaj University	University - National	Medicinal plants	Project partner
Climate Technology Centre and Network (CTCN)	Research Institute - International	Climate change	Collaborative partner
CSIR-Institute of Himalayan Bioresources Technology	Central Government Research Institute - India	Biodiversity	Project partner
CSK Himachal Pradesh Agricultural University	University - State Government	Biodiversity	Project partner
Deakin University	Academic Institute - International	Nanobiotechnology research and higher degrees by research	Collaborative research, support for higher degrees by research
Department of Genetics, University of Delhi, South Campus	Academic Institute Government - India	Developing Anthracnose resistance in chilli and tomato	Collaborative research
Dr HS Gour University, Sagar	Academic Institute - India	Biotransformation of nanomaterials	Collaborative research
Dr HS Gour University, Sagar	Academic Institute - India	Diversity studies in Indian earthworms using DNA barcodes	Collaborative research
ECN, Netherlands	International Research Organization	Climate change	Collaborative research
Ecofys	International Research Organization	Climate policy	Collaborative research
Economic Research Institute for ASEAN and East Asia	Research Institute - International	Research on energy cooperation, market development and risk assessment in the Asian region	Funding for a project on sea lane security and study group meetings on LNG market development
Economic Research Institute for ASEAN and East Asia	Research Institute - International	Research and capacity building	South–South cooperation
Economic Research Institute for ASEAN and East Asia	International Research Organization	Modelling analysis	Partnership and networking

Partner	Profile	Focus Area	Type of Association
EIRC Consultancy Pvt Ltd	Research Institute - India	Consultancy	Collaborative research
Energy Research Institute Network	Research Institute - International	Research and capacity building	South-South Cooperation
Energy Research Institute Network	Research Institute - International	Energy systems	Partnership and networking
Energy Research Institute of NDRC (ERI), China	International Research Organization	Regional low-emission pathways from global models	Partnership and networking
Federal University of Rio de Janeiro (COPPE/UFRJ, Brazil)	International Research Organization	Regional low-emission pathways from global models	Partnership and networking
Fondazione Eni Enrico Mattei	International Research Organization	Regional low-emission pathways from global models	Partnership and networking
Galvanizing Groundswell of Climate Action	International Research Organization	Climate change	Collaborative research and dialogue platform
Gauhati University	University - State Government	Biodiversity	Project partner
German Development Institute (DIE)	International Research Organization	Climate change	Collaborative research and dialogue platform
Global Network on Energy for Sustainable Development	Research Institute - International	Energy and sustainable development	Funding partner
Green Growth Best Practice Initiative	Global Network of Researchers and Practitioners in Growth	International best practices and peer learning	Research partner
Green Growth Knowledge Platform	Global Community of Organisations and Experts in Green Growth	Knowledge management and outreach	Knowledge sharing and outreach
ICAR-Indian Institute of Rice Research	Research Institute Government - India	Genetic modifications to improve biological nitrogen fixation for augmenting nitrogen needs of cereals	Collaborative research
ICAR-Indian Institute of Wheat Research	Research Institute Government - India	Genetic modifications to improve biological nitrogen fixation for augmenting nitrogen needs of cereals	Collaborative research
ICAR-National Rice Research Institute	Research Institute Government - India	Genetic modifications to improve biological nitrogen fixation for augmenting nitrogen needs of cereals	Collaborative research

Partner	Profile	Focus Area	Type of Association
India Meteorological Department	Research Institute Government - India	Atmospheric modelling	Collaborative research
India Meteorological Department, Pune	Central Government Research Institute - India	Climate change	Knowledge partner
Indian Agricultural Research Institute	Research Institute Government - India	Genetic modifications to improve biological nitrogen fixation for augmenting nitrogen needs of cereals	Collaborative research
Indian Council of Forestry Research and Education	Central Government	Mid-career training programme for senior IFS officers	Funding support and training
Indian Council of Social Science Research	Research Institute Government - India	Resource security and sustainable development	Funding support
Indian Institute of Technology, Guwahati	University - National	Algal research	Project partner
Indira Gandhi National Forest Academy	Central Government - India	Mid-career training programme for senior IFS officers	Funding support and training
Institut für Getreideverarbeitung GmbH, Germany	Research Institute - International	Research on utilization of oil seed waste	Research partner
Institute for Energy Economics Japan	Research Institute - International	Energy efficiency, renewable energy	Collaborative research
Institute for Global Environmental Strategies	Research Institute - International	Low-carbon development	Knowledge sharing and outreach
Institute for Global Environmental Strategies	International Research Organization	Climate change	Collaborative research
Institute for Global Environmental Strategies	Research Institute - International	Capacity building on climate change, energy efficiency	Collaborative research
Institute of Chemical Technology, Mumbai	Research Institute Government - India	Lignocellulosic residue hydrolysate assimilation using microalgae	Collaborative research
Institute of Energy Economics, Japan (IEEJ)	International Research Organization	Energy systems	Partnership and networking
Institute of Environmental Studies, University of Zimbabwe	University - International	South–South cooperation	Research and international cooperation

Partner	Profile	Focus Area	Type of Association
Institute of Transport Economics	International Research Organization	Climate change and transport research	Collaborative research
International Center for Integrated Mountain Development	Intergovernmental Research Organization	Mountain development	Lead of HI-AWARE consortium
International Centre for Integrated Mountain Development	Research Institute - International	One day events on REDD+ and carbon financing in partnership with ICIMOD	Funding support
International Crops Research Institute for the Semi-Arid Tropics	Research Institute - International	Agricultural research for development in Asia and Sub-saharan Africa	Collaborative research
International Growth Center	International Research Organization	Cities	Funder
International Institute for Applied Systems Analysis	Research Institute - International	Air pollution research	Toyota PM Project partners
International Institute for Applied Systems Analysis	Research Institute - International	Research and capacity building	Research network
International Institute for Applied Systems Analysis	International Research Organization	Regional low-emission pathways from global models	Partnership and networking
International Institute for Sustainable Development	Research Institute - International	Research on subsidies and energy access in India	Funding agency for projects on direct benefit transfer of subsidies.
International Transport Forum	International inter-governmental organization	Transport statistics	Funding support
Kendriya Vidyalaya Sangathan	Central Government - India	Enhancing environmental knowledge of students	Endorsement
KIIT University, Bhubaneswar	University - India	Knowledge sharing	Exchanges and discussions
London School of Hygiene and Tropical Medicine	University - International	Health research	Collaborative research
Mahatma Education Society's Pillai College of Architecture	Academic Institute - India	Green buildings	Client
Mahatma Gandhi Institute of Rural Energy and Development	Central Government - India	Capacity building and awareness programmes in the areas of rural energy and sustainable rural development	Board Member

Partner	Profile	Focus Area	Type of Association
Manipal Group of Institutions	Academic Institute - India	Jury review and research collaborations	Memorandum of Understanding
Michigan State University, USA	University - International	Research in the field of integrated pest management	Collaborative research
Ministry of Environment, Forest and Climate Change	Central Government - India	GHG mitigation options for the energy and non-energy sectors in India	Knowledge partner
Ministry of External Affairs	Central Government - India	South–South cooperation, training programmes; energy	Funding support partner
Mitsubishi Research Institute (MRI)	Research Institute - International	Climate change	Funding
Mizoram University	Academic Institute - India	Knowledge preservation	Knowledge partner
Monash University	Academic Institute - International	Research on infectious disease, epidemiology, public health, and preventive medicine	Collaborative research
MS Swaminathan Research Foundation	Research Institute - India	Agricultural research	Collaborative research
National Bureau of Agriculturally Important Microorganisms	Academic Institute Government - India	Genetic modifications to improve biological nitrogen fixation for augmenting nitrogen needs of cereals	Collaborative research
National Centre for Medium Range Weather Forecasting	Research Institute Government - India	Atmospheric modelling	Collaborative research
National Cleaner Production Center, Sri Lanka	Research Institute - International	Consultancy and advisory services, information dissemination, training and capacity building, policy advocacy	Collaborative research
National Climate Change Strategy Center, Beijing	Research Institute - International	Low-carbon development and innovations	Research partner
National Environmental Engineering Research Institute	Central Government - India	Research and developmental studies in environmental science and engineering	Collaborative research
National Health Medical Research Council, Australia	Research Institute - International	Expert body supporting health and medical research	Support for projects
National Institute for Plant Genome Research	Research Institute Government - India	Early detection of phytopathogens	Collaborative research

Partner	Profile	Focus Area	Type of Association
National Institute for Plant Genome Research	Research Institute Government - India	Early detection of phytopathogens	Collaborative research
National Institute of Environment Science, Japan	Research Institute - International	Air pollution research	Collaborative research
National Institute of Hydrology, Belgaum	Research Institute Government - India	Water resource management	Knowledge partner and funding agency
National Institute of Interdisciplinary Science and Technology, Thiruvananthapuram	Academic Institute - India	Lignocellulosic residue hydrolysate assimilation using microalgae	Collaborative research
National Institute of Technology Karnataka, Surathkal	University - India	Consultancy	Collaborative research
National Institute of Technology, Rourkela	University - National	Algal research	Project partner
National Institute of Technology, Surathkal	Research Institute Government - India	Water resource management	Knowledge partner and collaborators
National Renewable Energy Laboratory, USA	Research Institute Government - International	Algal thermochemical processing	Collaborative research
National Research Center for Plant Biotechnology (New Delhi)	Research Institute Government - India	Genetic modifications to improve biological nitrogen fixation for augmenting nitrogen needs of cereals	Collaborative research
National University of Singapore	Academic Institute - International	Higher education and research	Collaborative research
Natural Resources Defense Council	International Research Organization	Climate change research	Collaborative research
Navodaya Vidyalaya Samiti	Central Government - India	Enhancing environmental knowledge of students	Endorsement
New Climate Institute	International Research Organization	Climate change	Collaborative research
New Energy and Technology Development Organisation	Research Institute - International	Energy efficiency, smart grids	Partnership
Norwegian Centre for Transport Research	International Research Organization	Climate change and transport research	Collaborative research

Partner	Profile	Focus Area	Type of Association
Norwegian Institute for Urban and Regional Research	International Research Organization	Resilience to climate extreme events in rural India	Research partner
Norwegian Institute for Water Research (NIVA)	Research Institute - International	Climate change research	Collaborative research
Oxford Policy Management	International Research Organization	Climate change	Collaborative research and funding
Pacific Northwest National Laboratory	Research Institute - International	Research and capacity building	Research and academic partnership (N–S)
Pacific Northwest National Laboratory	International Research Organization	Regional low-emission pathways from global models	Partnership and networking
Phycospectrum Environmental Research Centre and Central Salt and Marine Chemicals Research Institute (CSIR-CSMCRI), Bhavnagar	Research Institute Government - India	Whole of supply chain approach for algal biofuel production	Collaborative research
Punjab Agricultural University (Ludhiana)	Academic Institute Government - India	Genetic modifications to improve biological nitrogen fixation for augmenting nitrogen needs of cereals	Collaborative research
Punjab Agricultural University, Ludhiana	Academic Institute Government - India	Testing of joint biofertilizer product	Contractual research
Queensland University of Technology (QUT)	Academic Institute - International	Pentose sugar assimilation by algae	Collaborative research
RTI International, USA	Research Institute - International	Algal thermochemical processing	Collaborative research
Saint Gobain Research Institute	Corporate Research Institute - India	Indoor air quality studies in tropical climate	Collaborative research
School of Planning and Architecture, Vijayawada	Academic Institute - India	New opportunities	Workshops
Society for Environmental and Economic Development, Nepal	Research Institute - International	Providing solutions for enhancing productivity, preventing industrial pollution, providing better working environment, and improving the quality of life	Collaborative research

Partner	Profile	Focus Area	Type of Association
South Asia Network of Economic Research Institutes	Research Institute - International	Trade	Funding support
Spanish National Research Council (CSIC)	International Research Organization	Research in the field of bioprospecting	Collaborative research
Technology Information Forecasting and Assessment Council	Central Government - India	Environment and resources	Funding support partner
The Energy Conservation Center, Japan	Research Institute - International	Energy efficiency	Funding
The Institute of Energy Economics, Japan	Research Institute - International	Research and capacity building	South–South cooperation
The James Hutton Institute	Research Institute - International		Exchanges and discussions
The Research Council of Norway	International Research Organization	Climate change	Funding
Toyota Central R&D Labs	Research Institute - International	Air pollution research	Toyota PM project partners
Tsinghua University	University - International	Air pollution research	Toyota PM project partners
University of Agricultural Sciences (Dharwad)	Academic Institute Government - India	Genetic modifications to improve biological nitrogen fixation for augmenting nitrogen needs of cereals	Collaborative research
University of Agricultural Sciences Bangalore	University - India	Agricultural research	Collaborative research
University of Agricultural Sciences, Dharwad	University - India	Agricultural research	Collaborative research
University of Calcutta, West Bengal	University - India	Knowledge sharing	Exchanges and discussions
University of California, Davis, USA	University - International	Metabolomics	Collaborative research
University of California, San Diego	University - International	Air pollution research	Technical support for research
University of Delhi, South Campus	Academic Institute Government - India	Control of Anthracnose disease in chilli/tomato by RNAi technology	Collaborative research

Partner	Profile	Focus Area	Type of Association
University of Dusseldorf, Germany	University - International	Research in the field of agriculture	Collaborative research
University of Eastern Finland	University - International	Partnership for the mid-career training programme for IFS officers Sustainable Bioenergy Solution for Tomorrow - Rural Biomass Survey	Network partnership
University of Guyana	University - International	Feasibility study for Biodiversity Centre at the University of Guyana	Funding support
University of Jammu	University - State Government	Biodiversity	Project partner
University of Laguna, Spain	University - International	Research in the field of bioprospecting	Collaborative research
University of Leicester, United Kingdom	Academic Institute - International	Effects of air pollution on microbes	Collaborative research
University of Leiden, The Netherlands	University - International	Training and workshop	Collaborative research
University of Maribor, Slovenia	University - International	Chemistry and chemical engineering	Collaborative research
University of Melbourne, Australia	University - International	Research in the field of biotechnology	Collaborative research
University of Rhode Island	Academic Institute - International	Water resources management	Collaborative research
Uttarakhand University of Horticulture and Forestry	University - State Government	Biodiversity	Project partner
Vasantrao Naik Marathwada Krishi Vidhyapeeth (VNMKV), Parbhani	Academic Institute - India	Science, education, research, and development	Knowledge sharing and exchange partner, collaborative research, and project implementation
VDEh-Betriebsforschungsinstitut (BFI)	Research Institute - International	Recycling technology for metal finishing industries	Collaborative research
Verein zur Förderung von Recycling und Umweltschutz in Österreich	Research Institute - International	Research in resource efficiency and recycling	Collaborative research
Virginia Tech, USA	University - International	Research in the field of integrated pest management	Collaborative research
VPM's B N Bandodkar College of Science, Thane	Academic Institute - India	Science, education, research and development	Knowledge sharing and exchange partner, collaborative research

Partner	Profile	Focus Area	Type of Association
Wageningen University Research Institute, The Netherlands	International Research Organization	Independent research to the realisation of a high quality and sustainable green living environment	Partner
World Resources Institute	International Research Organization	Climate change research	Collaborative research
Wuppertal Institute for Climate, Environment and Energy	Research Institute - International	Development of the web-based knowledge platform for Bridging the gap on information on energy efficiency in buildings in India	Knowledge partner and funding support
Yale University	University - International	Partnership for the mid-career training programme for IFS officers	Network partnership
Zhejiang University	University - International	Low-carbon development and finance and sub-national initiatives	Research partner

Banks and Financial Institutions

Partner	Profile	Focus Area	Type of Association
National Bank for Agriculture and Rural Development	Central Government - India	Capacity building	Support for projects
Small Industries Development Bank of India	Central Government - India	Energy efficiency and cluster development in MSME sector	Funding
YES Bank	Bank	Environment	Knowledge partnership for Yes Bank Natural Capital Awards

Domestic and Multinational Corporations

Partner	Profile	Focus Area	Type of Association
Accenture	Multinational Company	Skill building and renewable energy	Partnership agreement for implementing CSR projects
AzkoNobel	Corporate - Domestic	Wastewater treatment	Funding support and networking

Partner	Profile	Focus Area	Type of Association
Bengaluru Electricity Supply Company Ltd	Corporate State Government - Indian	School sensitization on Energy efficiency and its conservation	Funding support
Bentley Systems India Pvt Ltd	Corporate - Indian	Community development	Partnership agreement for implementing CSR projects
Bharati Infratel Ltd	Corporate - Indian	Sensitizing and capacity building for schools on issues related to water, sanitation and hygiene	Funding support
Bioproperty Strategy Group, Inc., New York	Corporate - International	Promotion of TERI's Bollcure biopesticide in USA	Technology transfer
CGCRI	Corporate	Technology demonstration and stakeholder consultation workshop on biomass gasifier technology for the benefit of the glass and ceramic industry in the region	Training workshop
Chemfab Alkalis Ltd	Corporate - Domestic	Carbon sequestration through plantation activities	Funding support
Dell Global Giving	Corporate - Multinational	Awareness generation and training of students and teachers on climate change issues through ICT learning	Funding support
Dempo Group of Companies	Corporate - Indian	Sustainable schools initiative with schools and neighbouring communities	Funding support
Fomento Resources Group	Corporate Private - India	Sustainable/Green building construction	Funding support
Genpact	Corporate - Indian	Youth initiative on leadership and sustainability	Funding support
GKN Sinter Metals Pvt Ltd	Corporate Private - India	Malnourishment, livelihood, and education	Funding support
GKN Sinters Metal Pvt Ltd	Corporate - Indian	Community development	Partnership agreement for implementing CSR projects

Partner	Profile	Focus Area	Type of Association
GlaxoSmithKline Consumer Healthcare Ltd	Corporate - International	Climate change, global warming	Assessment, review, evaluation
Hindalco industries Ltd	Corporate - Domestic	Reclamation of back filled area of Bauxite mines through afforestation activities at HINDALCO, Lohardaga, Jharkhand	Funding support
Indian Jute Mills Association	Corporate - Indian	Jute value chain	Funding support partner
Indian Oil Corporation Ltd	Corporate - Indian	Lignocellulosic residue hydrolysate assimilation using microalgae	Collaborative research
Indus Towers	Corporate - Indian	Livelihood, renewable energy, and community development	Partnership agreement for implementing CSR projects
ISHAAN Industries	Corporate - Indian	Indigenous building materials and technologies	Research collaboration
ITC Ltd	Corporate - Indian	Development of clonal propagation techniques	Funding support
Jain Irrigation Systems Ltd	Corporate - Indian	Manufacturers of drip and sprinkler irrigation systems and components	Collaborative research
JAPEVA Engineering Pvt Ltd	Corporate - Indian	Indigenous building materials and technologies	Research collaboration
JSW Ltd	Corporate Private - India	Community empowernemnt, Sustainable livelihoods, Malnourishment	Funding support
Krishi Rasayan Group, Kolkata	Corporate - Indian	Research on development and field trials of encapsulation and sustained release of micronutrients	Collaborative research
Larson & Toubro Ltd	Corporate Private - India	Sustainable /Green building construction	Funding support
Lavasa Corporation Ltd	Corporate - Domestic	Biodiversity compliance document for Lavasa	Funding support
Mecpro Heavy Engineering Ltd	Corporate - Domestic	Research on utilization of oil seed waste	Research partner

Partner	Profile	Focus Area	Type of Association
M/s Brisanzia Technology Pvt Ltd	Corporate	Technology promotion agreement for TEAM technology	Technology transfer
M/s Omni Agro	Corporate	Technology license agreement for manufacture and dissemination of TERI's novel biopesticide	Implementation and technology transfer
M/s Phoenix Products	Corporate	Operation and maintenance of biomass gasifiers in Belgaum	Training workshop
National Buildings Construction Company	Corporate Government - India	Awareness on green design and construction	Funding support
National Buildings Construction Corporation	Corporate Government - India	Green buildings	Client
Nirmal Seeds Pvt Ltd	Corporate - Domestic	Development of nutritionally improved mustard	Research partner
Reliance Communications Ltd	Corporate Private - India	Commuity empowerment and Education	Funding support
Rio Tinto	Corporate - International	Energy	Funding support partner
SABMiller India	Corporate - Indian	Manufacturers of beverages	Collaborative research
Salesforce Foundation	Information Technology Company	Livelihood, renewable energy, community development and Sanitation	Partnership agreement for implementing CSR projects
Shell Group of Companies	Corporate - Multinational	Modelling and scenario analysis of the energy sector	Knowledge partner
Somany Ceramics Ltd	Corporate - Indian	Ceramics and allied products	Collaborative research
Somfy India Pvt Ltd	Corporate Private - India	Visual and thermal monitoring of roller blinds in Indian context	Funding support
Tata Motors Ltd	Corporate - Indian	Workshops for creating awareness on environment in Uttarakhand	Funding support
Tetra Pak India Pvt Ltd	Corporate - Indian	Sensitizing and capacity building for schools on waste management issues	Funding support

Partner	Profile	Focus Area	Type of Association
TLG India Pvt Ltd	Corporate - Indian	Community development	Partnership agreement for implementing CSR projects
United Technologies Corporation	Corporate - Multinational	Energy efficiency in existing building sector	Funding support
VTT Technical Research Centre of Finland Ltd	Corporate - International	Develop new smart technologies, profitable solutions, and innovation services	Collaborative research

NGOs/Foundations

Partner	Profile	Focus Area	Type of Association
Bancroft Arnesen Explore (BAE)	Foundation - International	Awareness generation and sensitization of River Ganga with schools from select cities	Funding support
ClimateWorks Foundation	Foundation - International	Funding	Funding
Dhaka Chamber of Commerce and Industry	Industry Association	Promote private sector enterprises and businesses with advocacy, awareness and policy inputs to government	Collaborative research
Digital Empowerment Foundation	Non-Governmental Organization	Social media	Knowledge partner
Global March Against Child Labour	Non-Governmental Organization	Community-based natural resource management	Funding support
Global Reporting Initiative (GRI)	NGO - International	Transparency and sustainability reporting	Organizational stakeholder
Gramin Vikas Trust	NGO aided by KRIBHCO	Rural development	Implementation partner
InsPIRE Network for Environment	Non-Government Organization	Funding	Funding
Konrad-Adenauer-Stiftung	Foundation - International	Sustainable development and developing countries	Knowledge partner
Natural Resources Defense Council	NGO - International	Sharing of global practices on climate actions	Partnership and networking

Partner	Profile	Focus Area	Type of Association
Petroleum Federation of India	Association - India	Impacts of structural adjustments and distributional effects of energy policy, fossil fuel prices	Knowledge partner and consortium member
Progressive Engineers	Consultancy services	Water and wastewater treatment	Networking and partnership
Progressive Engineers Network	Consultancy services	Policy analysis in the waste sector	Capacity building and knowledge partner
Ramboll-Environ Foundation, USA	Foundation - International	Environmental, health, and social issues	Supports for projects
Robert Bosch Stiftung	Foundation - International	Pan India competition of undergraduate students on integrated water resources management issues	Funding support
Shakti Foundation	National Foundation	Railway freight	Funding support
Shakti Sustainable Energy Foundation	Foundation - India	Low carbon development	Research collaboration
Shakti Sustainable Energy Foundation	Foundation - India	Climate change	Funding
Shakti Sustainable Energy Foundation	Foundation - India	Energy efficiency, demand side management	Partnership
Shramik Bharti	Non-Governmental Organization	Rural development	Implementation partner
Society of Indian Automobile Manufacturers	Association - India	Apex industry body representing vehicle and vehicular engine manufacturers in India	Collaborative research
Southern African Development Community	Non-Governmental Organization	South–South cooperation	Capacity building and knowledge partner
Southern African Development Community	Non-Governmental Organization	Poverty eradication and economic development	Partner
STENUM Asia	Non-Governmental Organization	Consulting in resource efficiency for industries	Collaborative research
The Mountain Institute	Non-Governmental Organization	Biodiversity, sustainable development, Eastern Himalayas	Partner

Partner	Profile	Focus Area	Type of Association
The Rockefeller Foundation	International Foundation	Urban climate resilience policy	Funding support
Toyota Foundation	Foundation - International	Community empowerment	Support for projects
Wangari Maathai Foundation, Nairobi	Foundation - International	Sustainable/green development	Knowledge partner and funding support
We Mean Business	NGO - International	Sharing India Inc. thought leadership in area of energy efficiency and renewable energy	Project sponsor
Wellcome Trust	International Foundation	Biomedical research	Funding support
WWF South Africa	International Funding Organization	Policy research and capacity building	South–South cooperation

Multilateral and Bilateral Organizations

Partner	Profile	Focus Area	Type of Association
Asian Development Bank	Multilateral Organization	Low carbon transport	Funding support
Asian Development Bank	Multilateral Organization	Low carbon development in China and India	Research collaborator
British Council Division	Bilateral Organization	A unique platform for young leaders to enhance their knowledge and exchange ideas on sustainable development	Knowledge partner
Climate Technology Centre and Network (CTCN)	International Organization	Climate change	Collaborative partner
Department for International Development	Multilateral Organization	Natural resource revenue management	Funding support
Department for International Development	Multilateral Funding Organization	Policy formulation and implementation	Capacity building and knowledge partner
Department for International Development	Multilateral Funding Organization	Modelling and scenario analysis of a sustainable and secure energy future for India	Knowledge, research partner, and consortium member

Partner	Profile	Focus Area	Type of Association
Department for International Development	Bilateral Organization	Rural development	Funding partner
Department for International Development	Multilateral Organization	Funding	Funding
Department for International Development	Bilateral Organization	Promoting MDGs and clean energy access	Partnership agreement
European Commission	Multilateral Organization	Low carbon development and emission strategy	Knowledge partnership and consortium member
Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH	Bilateral Organization	Resource efficiency, environmental and resource use management	Funding support
Global Green Growth Institute	Intergovernmental Funding Organization	Integrated technoeconomic modelling at national and state level	Knowledge and consortium partner
Global Green Growth Institute	International Funding Organization	Green growth and development	Research collaboration and stakeholder engagement
International Development Research Centre	Multilateral Organization	Funding	Funding
International Energy Agency	Multilateral Organization	Development of the India Energy Outlook, which is a part of the World Energy Outlook	Funding for a workshop and consultancy services
International Finance Corporation	Multilateral Organization	Climate resilient housing and private sector participation in adaptation	Client: Consultancy for Nepal and Bangladesh
International Network for Bamboo and Rattan	International Organization	Feasibility study on livelihood and market potential of Bamboo in north east India	Funding support
International Union for Conservation of Nature and Natural Resources	International Organization	Best practices for watershed development in Indian Himalayan region	Funding support
Japan International Cooperation Agency	Bilateral Organization	Carrying out JICA funded projects in UP, Arunachal Pradesh, etc.	Funding support

Partner	Profile	Focus Area	Type of Association
Sustainable Energy for ALL (SE4ALL)	Multilateral Organization	Energy efficiency in industry sector, capacity building, renewable energy, energy access	Partnership
Swiss Agency for Development and Cooperation	Bilateral Organization	Promoting energy efficiency in the MSME sector	Partnership agreement
Swiss Agency for Development and Cooperation	Bilateral Organization	Climate change adaptation and promotion of renewable energy technologies	Partnership agreement
UN-Habitat - United Nations Human Settlements Programme	Multilateral Organization	Incorporation of energy, RE & Resource Efficiency in existing building regulation/codes of Nigeria	Knowledge partner
United Nations Development Programme	Multilateral Organization	Low carbon development	Knowledge sharing and outreach
United Nations Development Programme	Multilateral Organization	Webinars on low carbon development	Knowledge sharing and outreach
United Nations Development Programme	Multilateral Organization	Sustainable development	Collaborative research
United Nations Economic Commission for Africa	Multilateral Organization	Policy research and capacity building	South–South cooperation
United Nations Economic Commission for Africa	Multilateral Organization	Modelling network	Funding support
United Nations Educational, Scientific and Cultural Organization	Multilateral Organization	Enhancing environmental knowledge of students	Endorsement
United Nations Environment Programme	Multilateral Organization	Sustainable tourism	Funding support
United Nations Environment Programme	Multilateral Organization	Green growth knowledge platform annual conference	Knowledge sharing and outreach
United Nations Environment Programme	Multilateral Organization	Energy efficiency	Funding, partnership
United Nations Environment Programme	Multilateral Organization	Policy and regulatory framework for promoting energy efficiency and renewable energy in buildings and appliance sector	Knowledge partner and funding support

Partner	Profile	Focus Area	Type of Association
United Nations Industrial Development Organization	Multilateral Organization	Policy research and capacity building	South–South cooperation
United Nations Industrial Development Organization	Multilateral Organization	Modelling network	Funding support
United Nations Industrial Development Organization (UNIDO)	Multilateral Organization	Energy efficiency, Renewable energy	Funding support and partnership
United Nations Industrial Organization	Multilateral Organization	South-South collaborative training programme on issues pertaining to sustainable energy for all	Knowledge exchange partner for South-South collaboration
United States Agency for International Development	Multilateral Organization	Training and capacity building of teachers, youth and urban local bodies on WASH issues	Funding support
USAID Low Emissions Asian Development Program	International Funding Organization	Green growth and development	Knowledge sharing and outreach
World Bank	Multilateral Organization	Funding	Funding
World Bank	Multilateral Organization	Consultancy services for baseline survey for UDWDP and GEF-SLEM project in Uttarakhand and MHWDP in Himachal Pradesh aided by World Bank	Funding support
World Wildlife Fund, USA	International Organization	Food security	Collaborative research
WWF Central Africa Regional Programme Office	International Organization	Cross-regional fundraising and partnerships network	Networking and partnership

6 Knowledge Contributions

Representation in National and International Expert Group Committees

- Adholeya A. Chair, Policy Committee. International Mycorrhiza Society, Canada (www.mycorrhizas.org).
- Adholeya A. Chairman, Expert Committee — Biological Agents for Agriculture, DBT (Department of Biotechnology), Ministry of Science and Technology, New Delhi.
- Adholeya A. Member, Advisory Committee to the Executive Board of the Louis Dreyfus Foundation.
- Adholeya A. Member, Editorial Board, *Indian Journal on Microbiology,* published by The Association of Microbiologists of India, IARI, India.
- Adholeya A. Member, Editorial Board, *International Journal of Ecology & Development (IJED),* published by Indian Society for Development and Environment Research (ISDER), Roorkee, India.
- Adholeya A. Member, Experts Committee on the Application of Nanotechnology in Agriculture and Medicine, Department of Biotechnology, Ministry of Science and Technology, Government of India, New Delhi.
- Adholeya A. Member, International Advisory Board for Bloomsbury Qatar Foundation Journals, Qatar, since 2010.
- Adholeya A. Member, Sectoral Innovation Council for the Fertilizer Sector, Department of Fertilizers, Ministry of Chemicals and Fertilizers, Government of India, New Delhi.
- Adholeya A. Member, The Economic Research Institute of ASEAN and East Asia (ERIA).
- Adholeya A. Member, Working Group on Implementation of National Policy on Biofuels, Ministry of New and Renewable Energy, Government of India, New Delhi.
- Adholeya A. Secretary, International Symbiosis Society.
- Anshuman. Member, 'Solutions Exchange' network and 'India water portal' (as Water quality expert) to Disseminate Information, Hold Discussions with Different Stakeholders on Water Related Issues.
- Anshuman. Member, Sectional Committee for Water Quality for Industrial Purposes, CHD 13, under the Bureau of Indian Standards (BIS).
- Anshuman. Member, Steering Committee of Aquatech India.
- Anshuman. Member, Technical Advisory Committee (TAC) of National Institute of Hydrology (NIH) (Under Ministry of Water Resources, Government of India), Roorkee, Uttarakhand (India).
- Bhadwal S. Member, Expert Committee on the Mission on Health constituted by the Ministry of Health and Family Welfare, Government of India.
- Bhadwal S. Member, Scientific Committee of Training Workshop on Climate Change and Human Health constituted by NIH, US, and TARU.
- Bhadwal S. Member, UNDP–NCSP Regional Roster of Expert on Vulnerability and Adaptation.
- Bhardwaj S. Member, 2nd ISRO—National Information System for Climate and Environment Studies (NICES) Program Management Council (PMC) Meeting.
- Bhattacharjya S. 2014–till date. Member, Environmental Management Sectional Committee of the Bureau of Indian Standards.
- Bhattacharjya S. 2014–till date. Member, Environmental Management Sectional Committee of the Bureau of Indian Standards (BIS).
- Bhattacharjya S. 2015. Member, Scientific Committee of the World Resources Forum-Asia Pacific—2015, organized by CSIRO, University of Technology Sydney.
- D'Souza F. Member, Ad-hoc Board of Studies in Biochemistry, Goa University, Goa.
- D'Souza F. Member, Technical Advisory Committee (TAC) of Goa State Pollution Control Board (GSPCB), Goa.
- Datt D. 2013–till date. Member, Advisory Group on 'Sustainable Public Procurement and Eco-Labelling (SPPEL)' of United Nations Environment Programme constituted by Ministry of Environment, Forest and Climate Change, Government of India.
- Datt D. August 2014–till date. Member, India Advisory Council for the UNEP Inquiry on the Design of a Sustainable Financial System for India.
- Dhingra S. Member, Study Steering Committee constituted by TIFAC for Overall Steering and Guidance of the Study on 'Biofuels: Current Status and R&D Roadmap'.
- Ghate A T. 2014–till date Member, Expert Committee on Urban Transport Planning constituted by the Institute of Urban Transport (India) under the aegis of Ministry of Urban Development, Government of India.

- Ghate A T. 2015–17. Member, G3 Committee on Reduction of Carbon Footprint in Road Construction and Environment constituted by the Indian Road Congress.
- Ghate A T. 2015–17. Member, G4 Committee on Mechanization and Instrumentation Committee constituted by the Indian Road Congress.
- Ghate A T. 2015–till date. Member, Expert Review Committee for the Study on 'Child Friendly Urban Mobility' conducted by Institute of Urban Transport (India).
- Ghate A T. Member, Advisory Committee, Knowledge Management Centre at Institute of Urban Transport under Component 1A of SUTP of Ministry of Urban Development, Government of India.
- Ghate A T. Member, Institute of Urban Transport (India).
- Ghosh S N. Member, India Sanitation Coalition, FICCI.
- Ghosh S N. Member, India School WASH Committee.
- Ghosh S N. Member, Save Water Campaign Committee, MDWS.
- Gopal L. TERI Representative in the Governing Council and Board of Mahatma Gandhi Institute for Renewable Energy and Development, Government of Karnataka.
- Goswami A. 2005 – till date. Life Member, Indian Society for Ecological Economics.
- Goswami A. 2005–till date. Life Member, The International Society for Ecological Economics.
- Grover S. Member, Task Force Member of India Sanitation Coalition.
- Jain, R. Member, Fiscal Instruments Research Committee, Green Growth Knowledge Platform.
- Kahlon L. Member, GIZ ESD International Experts Network comprising of members from India, Mexico, South Africa, and Germany.
- Kaushik N. Member, Expert Committee on Development of Biopesticide Strategy Paper.
- Kaushik N. Member, IUPAC Plant Protection Committee.
- Kedia S. Co-Chair, Inclusiveness Research Committee, Green Growth Knowledge Platform.
- Kedia S. Lead Author, Finance, Economics and Private Sector, Second Assessment Report on Climate Change and Cities.
- Kedia S. Member, Indian Society for Ecological Economics (INSEE).
- Kedia S. Member, Indo-German Expert Group on Green and Inclusive Economy, coordinated by Deutsche Gesellschaft für Internationale (GIZ).
- Kedia S. Member, Taskforce on Greening Rural Development. Ministry of Rural Development, Government of India.
- Kedia S. Member, The International Society for Ecological Economics (ISEE).
- Kumar A. 2001–till date. Life Member, Solar Energy Society of India (Indian chapter of International Solar Energy Society).
- Kumar A. 2009–till date. Member, Economic Research Institute for ASEAN and East Asia (ERIA), Working Group for Energy Saving Potential.
- Kumar A. 2012–till date. Executive Committee Member (Indian Representative), IEA Greenhouse Gas R&D Programme
- Kumar R (Delhi), S M Kazi (Goa), and P Barua (Mumbai). Lead Member, Regional Centre of Expertise of UNU in Delhi, Goa, and Mumbai and partner in the International RCE UNU (United Nations University) IAS network.
- Kumar R, Kazi S M, and Barua P. Lead Member, Regional Centre of Expertise (RCE) of UNU in Delhi, Goa, and Mumbai and Partner in the International RCE UNU (United Nations University) IAS Network.
- Kumar S Vijay. 2015. Chairman, Task Force on Poverty Reduction in Madhya Pradesh.
- Kumar S Vijay 2015. Co-Chair, Review Committee, to select potential 'Champion Employers' to partner with the DDU-GKY Programme, Ministry of Rural Development, Government of India.
- Kumar S Vijay Consultant, Assessment Report on the Prime Minister's Rural Road Programme Pradhan Mantri Gram Sadak Yojana (PMGSY), Ministry of Rural Development, Government of India/World Bank.
- Kumar S Vijay 2015. Senior Consultant, National Council of Applied Economic Research (NCAER) for their publication The Indian Steel Industry: Key Reforms for a Brighter Future.
- Kumar S Vijay 2015–18. Member, International Resource Panel, United Nations Environment Programme (UNEP).
- Kumar S Vijay Member, Board of Governors, Institute of Rural Management, Anand (IRMA), Gujarat.
- Kumar S. Member, CED-30, Sectional Committee, BIS.
- Mathur R. 2015–17. Co-Lead, Sustainable Growth Working Group of the US–India Energy Dialogue led by Niti Aayog (formerly Planning Commission of India).

- Mathur R. 2015–till date. Member, Board of Climate Strategies (CS): An International Research Platform with its Secretariat based in the UK.
- Mehta T and Kumar R. UNESCO Key Partners of the Global Action Programme on ESD.
- Mehta T and R Kumar. EEA is One of the UNESCO's Key Partners of the Global Action Programme on ESD.
- Nanda Nitya 2009–till date. Member, Expert Group on Trade and Environment for the Ministry of Commerce and Industry.
- Nanda Nitya. 2009–till date. Member. Expert Group on Trade and Environment for the Ministry of Commerce and Industry.
- P Raman P. Member, International Academy of Business and Economics (IABE).
- Pal P. Member, Empanelment Committee for Empanelment of Energy Auditors on PCRAs Panel. Petroleum Conservation Research Association (PCRA).
- Pal S. Member, Sustainable Growth Working Group on the India–US Energy Modeling Dialogue.
- Palit D. Jury Member, Mahindra Rise Prize Solar Challenge .
- Palit D. Member, Steering Committee, Energy for All Partnership, Asian Development Bank.
- Palit D. Member, Technical Committee, Implementation of Decentralized Distributed Generation under Deendayal Upadhyaya Gram Jyoti Yojana.
- Panandiker A. Member, Goa State Expert Appraisal Committee (SEAC) endorsed by the Ministry of Environment, Forest and Climate Change (MoEFCC), New Delhi.
- Pandey S. 2007–till date. Member, Research Advisory Committee of Central Pollution Control Board.
- Pandey S. 2007–till date. Member, Standard setting Committee on Waste constituted by Bureau of Indian Standards (BIS).
- Pandey S. 2007–till date. Member, Research Advisory Committee of Central Pollution Control Board.
- Pandey S. 2007–till date. Member, Standard Setting Committee on Waste constituted by Bureau of Indian Standards.
- Pandey S. 2012–till date. Member, Expert Group on Critically Polluted Area constituted by Ministry of Environment, Forest and Climate Change, Government of India.
- Pandey S. 2015–till date. Member, Expert Advisory Committee on Waste Management Under Technology Systems Development Programme of DST.
- Pandey S. Life Member. Indian Association for Environment Management.
- Pawar P. Non-Resident Fellow, Environmental Security, Stimson Center, Washington, DC.
- Prakash S. Fellow, Institute of Rail Transport.
- Prakash S. Member, Centre for Transportation Research and Management, Delhi.
- Ramakrishnan A. Member, Bangladesh China India Myanmar (BCIM)-Economic Corridor Joint Study Group.
- Ramanathan K. Member, Central Advisory Committee of the Central Electricity Regulatory Commission of India.
- Ramanathan K. Member, State Advisory Committee of the Delhi Electricity Regulatory Commission.
- Rehman I H. Member, Advisory Board on Environment, NHPC, New Delhi.
- Rehman I H. Member, Core Committee on the New Cookstove Initiative, Ministry of New and Renewable Energy, Government of India, New Delhi.
- Rehman I H. Member, International Steering Committee of Alliance, CSO for Clean Energy Access (ACCESS).
- Rehman I H. Member, Working Group on MGNREGA & NRLM constituted by the Planning Commission for the Twelfth Five Year Plan.
- Rehman I H. Steering Board Member of Roundtable on Sustainable Biofuels, EPFL, Lausanne, Switzerland.
- Rehman I H. Member, Quality Circle (Capacity Building Hub) for Sustainable Energy for ALL (SE4ALL) Initiative of the UN.
- Sehgal M. 2015. Member, National Expert Group on Climate Change and Human Health.
- Senthilkumar T. Member, Technical Advisory Group for Production Units of Indian Railways.
- Sethi G. Member, Energy Management Sectional Committee of Bureau of Indian Standards (BIS).
- Sethi G. Member, Examination Advisory Committee for Energy Managers and Energy Auditors, Bureau of Energy Efficiency, Ministry of Power, Government of India.
- Sethi G. Member, Screening Committee of Petroleum Conservation Research Association (PCRA).

- Sethi G. Member, Steering Committee on Technology and Quality Upgradation Support to MSMEs, Ministry of MSME, Government of India.
- Shardul M. 2015–till date. Member, Students and Alumni Advisory Council (SAAC), Global MDP, MDP Secretariat, The Earth Institute, Columbia University.
- Shardul M. Member of the Alliance of CSOs for Clean Energy Access (ACCESS).
- Shardul M. Representative for South Asia at Youth Assembly of UN Sustainable Development Solutions Network (UNSDSN).
- Sharma A. Author, 'Importance of Quality Assurance for Offgrid Lighting Systems'm, *Lab World* Magazine.
- Sharma A. Speaker, National Conference on Sustainable, Affordable and Efficient Rural Electrification Systems.
- Shrivastava M. Co-Chair, Co-Benefits Working Group of LEDS Partnership.
- Shrivastava M. Steering Committee Member, Galvanizing Groundswell of Climate Action Network.
- Singh S. Member, Multilateral Joint Study for LNG Market, Economic Research Institute for ASEAN and East Asia (ERIA).
- Sundar S. Member, Board of Directors of the Sustainable, Low Carbon Transport (SLoCaT), Foundation.
- Sundar S. Member, Committee constituted by the Hon'ble Supreme Court of India on Road Safety.
- Sundar S. Member, Expert Committee, Asian Environmentally Sustainable Transport Forum set up by UNCRD.
- Sundar S. Member, High Level National Transport Development Policy Committee.
- Tayal S. Member, Indus Forum as Part of South Asia Water Initiative (SAWI) supported by The World Bank.
- Tayal S. Member, Third Pole Environment Group.
- Vasudevan N. Member, Committee of BEE for Revision of Syllabus for Energy Managers and Energy Auditors Examination.
- Vasudevan N. Member, Committee of BEE, for Preparation of Material on Energy Efficiency and Conservation for Textbooks of Classes 6–10.

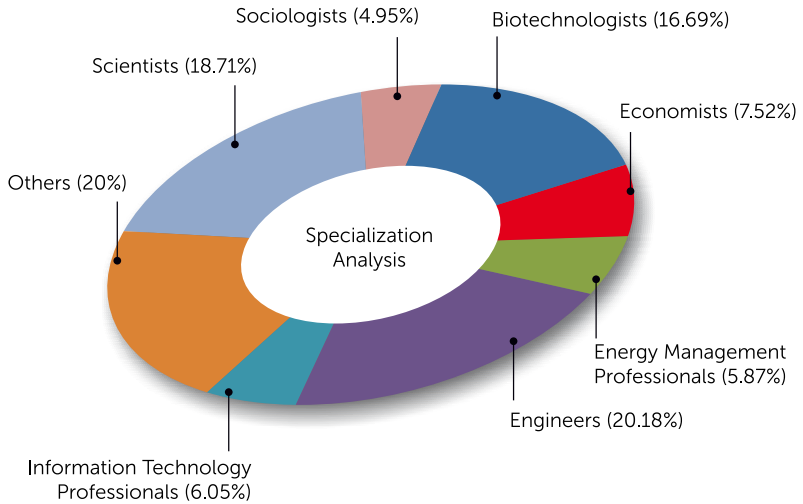
Representation in National and International Journals

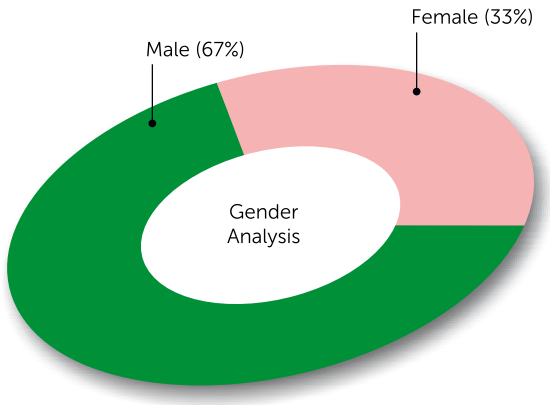
- Bhattacharjya S. 2014–till date. Coordinating Lead Author (CLA), for the Asia Pacific Regional Outlook, Under the GEO-6 Flagship Report of UNEP.
- Dube S K. August 2011–till date. Review Panel, *Journal of Energy Engineering*, USA.
- Dube S K. May 2013–till date. Editorial Board Member and Review Panel, *International Journal of Scientific and Research Publication (IJSRP)*.
- Goswami A. 2015. Editorial Advisory Board Member, *Journal of World Economy Studies*.
- Goswami A. 2015. Reviewer, *The Energy Journal*.
- Kedia S, M Anand, N Jain, Editor, *The International Journal on Green Growth and Development*. New Delhi: TERI.
- Kedia Shailly. Contributing Author, *Green Growth Best Practice Initiative*.
- Kumar A. 2005–till date. Reviewer, *Energy Policy; Energy Strategic Review;* Renewable Energy*; Energy Economics*.
- Mathur R. 2000–till date. Reviewer, *Energy Policy; Energy Economics*.
- Mathur R. 2014. Reviewer, *Journal of Environmental Policy and Governance*.
- Mathur R. 2015. Reviewer, *The Energy Journal*.
- Nitya N. 2009–till date. Member, Review Panel, South Asia Economic Journal.
- Pandey S. Member, Editorial Board, ICE: *Waste and Resource Management*.
- Pandey S. Member, Review Panel, *Waste Management*, Elsevier.
- Pawar P S. Reviewer, *International Journal Agriculture and Forest Meteorology*, Elsevier Publications.

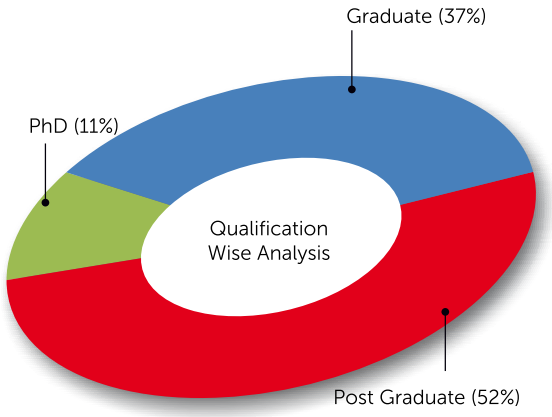
7 Human Capital and Infrastructure Facilities

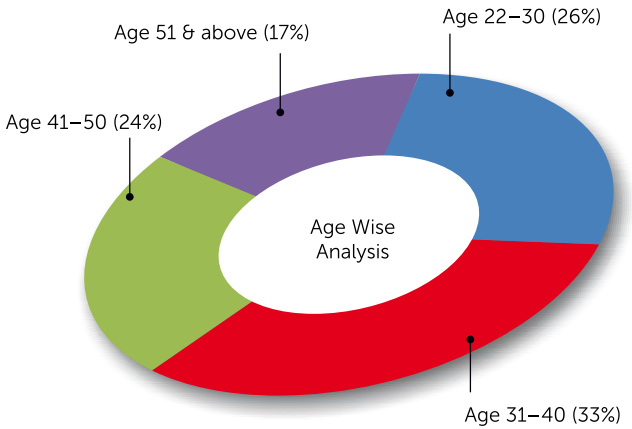
Human Capital

At TERI, we consider all TERI-tes to be of utmost value and the key resource for success of the Institution. The synergy brought about by our human resources is a result of the freedom and flexibility that the Institute provides to its research professionals. 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.









Infrastructure Facilities

An Institute of the calibre and spread of TERI requires the presence of state-of-the-art, modern, and vital infrastructure facilities, which are instrumental in facilitating research and development on a large scale. TERI has developed a host of infrastructure facilities, across the length and breadth of the country, which continued to propel the Institute towards greater success and achievement in the year 2015–16.

CMCC Germplasm Bank

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

In Vitro Mass Production Technology

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

Film and Television Unit

The Film and Television Unit has been producing some award-winning documentaries and owns the basic infrastructure to execute a film or television shoot end-to-end. It has been constantly producing high-quality DV output meant for television broadcast and theatre screenings.

Solar Lighting Laboratory

The Solar Lighting Laboratory is involved in design customization, lab- and field-based performance assessment, and training on distributed generation-based systems for various applications. These include solar lighting systems, solar multi-utility charging stations for charging lanterns, mobile phones, and e-bikes.

DNA Fingerprinting and Molecular Breeding Lab

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

Herbal Garden at Supi

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

Plant Genetic Transformation and Functional Genomics Laboratory

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

TERI–Deakin Nanobiotechnology Research Centre

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

Micropropagation Technology Park

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

Fermentation Technology and Research Centre

The Centre is a state-of-the-art fermentation facility with a pilot-scale platform to carry out studies. It has a series of fermentors of working volume ranging from 3.5 litres to 10,000 litres. Apart from mass-scale production of indigenously developed oil degrading bacterial cultures, the facility has capacity to carry out research on anaerobic fermentation processes. The facility also has the necessary analytical infrastructure for quality control and analysis of various fermentation products.

Supercomputer to Enhance Climate Modelling Capabilities

TERI has acquired supercomputing facility to boost its activities on climate modelling. The supercomputer consists of 512 cores that can draw a peak performance of 5.5 T Flops. Total RAM is 1,000 GB with 32TB of storage space and about 24TB of backup storage. Models posted on the HPC system are CESM, CCSM, NorESM, WRF, and PRECIS.

TERI Water Laboratory

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

Microbial Biotechnology Laboratory

The laboratory is an experimentation facility for the exploration of microbial diversity to provide biotechnological solutions in the field of environmental restoration and biofuels. The facility has state-of-the-art molecular biology set up with automated facility and real-time PCR systems. Infrastructure for both aerobic and anaerobic microbiology facility is available. The laboratory is supported by analytical facility that is equipped with necessary GC (with TCD and FID), GCMS, HPLC (with diode array and RI detector) systems with other requisite instrumentations.

Smart Mini/Micro Grid Facility at RETREAT, Gual Pahari

It demonstrates the use of smarter control of distributed energy sources, combined with intelligent management of loads to improve the efficiency and reliability of the overall mini-grid system.

Solar Power Pack

It is an integrated solar multi-utility charging station for charging lanterns, mobile phones, and e-bikes.

TRISHA

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

TERI's Research Facility in Bengaluru

The TERI Southern Regional Centre building is a judicious blend of technology and tradition that promotes energy efficiency and sustainable development.

Library and Information Centre

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

TERI Gram

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

Test Bed Facility, Gual Pahari

The Energy and Resources Institute (TERI) and Somfy India Pvt Ltd have come together to set up a Test Bed Facility at Gual Pahari in the year 2015–16. The main objective of setting up this facility is to derive the benefits of Somfy Roller Blinds in test building.

8 Appendices

Contributions to Journals and Proceedings

Biotechnology and Management of Bioresources

- Adholeya Alok, Singh Reena, Das Manab, Jakkula Vijay S, and Dube Shiv Kumar. 2015. **Enhanced sustainable management of ash ponds/dykes and other avenues through biotechnological intervention**. In IPS 2015: Fuel Adequacy (International Power Plant O & M conference), session 7c: Strategy for balance of plant, paper 1 "Enhanced sustainable management of ash ponds/dykes and other avenues through biotechnological intervention".
- Das M and Adholeya A. 2015. **Potential uses of immobilized bacteria, fungi, algae and their aggregates for treatment of organic and inorganic pollutants in wastewater**. In *Water Challenges and Solutions on a Global Scale* (S Ahuja et al., eds), ACS symposium series, American Chemical Society, 1206, pp. 319–337.
- Davison J, Moora M, Öpik M, Adholeya A. Ainsaar L, Bâ A, Sashidhar B, Diedhiou AG., Hiiesalu I, Jairus T, Johnson NC, Kane A, Koorem K, Kochar M, Ndiaye C, Pärtel M, Reier Ü, Saks I, Singh R, Vasar M, and Zobel M. 2015. **Global diversity of arbuscular mycorrhizal fungi — everything is almost everywhere**. *Science* **349** (6251): 970–973.
- Dwivedi Neeraj, Kumar Rajesh, Paliwal Rajneesh, Kumar Uttam, Kumar Sanjeet, Singh Major, and Singh Rakesh Kumar. 2015. **QTL mapping for important horticultural traits in pepper (*Capsicum annuum* L.)**. *Journal of Plant Biochemistry and Biotechnology* **24**(2): 154–160.
- Johny Leena, Conlan Xavier, Cahill David, and Adholeya Alok. 2015**. In vitro and in situ screening systems for morphological and phytochemical analysis of *Withania somnifera* germplasms**. *Plant Cell, Tissue and Organ Culture* **120** (3): 1191–1202.
- Minhas Amritpreet Kaur, Hodgson Peter, Barrow Colin J, Sashidhar Burla, and Adholeya Alok. 2016. ***The isolation and identification of new microalgal strains producing oil and carotenoid simultaneously with biofuel potential:*** *In process Bio Resource Technology*, doi: 10.1016/j.biortech.2016.03.121.
- Prasad P, Varshney D, and Adholeya A. 2015. ***Whole genome annotation and comparative genomic analyses of bio-control fungus Purpureocillium lilacinum. BMC Genomics.*** 2015-16(1): 1004.
- Srivastava Shivani, Conlan XA, Adholeya Alok, Cahill DM. 2016. **Elite hairy roots of Ocimum basilicum as a new source of rosmarinic acid and antioxidants**. *Plant Cell, Tissue and Organ Culture (PCTOC): Journal of Plant Biotechnology*.
- Srivastava Shivani, Conlan XA, Adholeya Alok, and Cahill DM. 2016. **Acidic potassium permanganate chemiluminescence for the determination of antioxidant potential in three cultivars of *Ocimum basilicum*.** *Plant Foods for Human Nutrition* **71**(1): 72–80.
- Sure S, Torriero AAJ, Gaur A, Li LH, Chen Y, Tripathi C, Adholeya A, Ackland ML, and Kochar M. 2016. **Topographical and electrical characterization of pili-like structures produced** by *Nostoc punctiforme*, Antonie Van Leeuwenhoek, 2016, doi 10.1007/s10482-015-0644-7
- Sure S, Torriero AAJ, Gaur A, Li LH, Chen Y, Tripathi C, Adholeya A, Ackland ML, and Kochar M. 2015. **Inquisition of Microcystis aeruginosa and *synechocystis* nanowires: Characterization and modelling**. *Antonie Van Leeuwenhoek* yu108 (5): 1213–1225.
- Sunar K, Ahuja P, Ghorui M, and Adholeya A. 2015. **Morphotaxonomy of Glomus hoi (accession–CMCC/AM–1301)**. *Mycorrhiza News* **27**(4): 13–17.
- Sunar K, Ahuja P, Ghorui M, and Adholeya A. 2015 **Morphotaxonomy of *Funneliformis coronatum/ Glomus coronatum* (accession–CMCC/AM–1504)**. *Mycorrhiza News* **27**(3): 18–24.
- Sunar K, Ghorui M, and Adholeya A. 2015. **Morphotaxonomy of *Diversispora spurca* (accession–CMCC/AM–1806)**. *Mycorrhiza News* 27(2): 15–19.
- Sunar K, Ghorui M, and Adholeya A. 2015 **Morphotaxonomy of *Claroideoglomus etunicatum* (accession CMCC/AM-1206)**. *Mycorrhiza News* **27**(1): 13–16.

Earth Science and Climate Change

Centre for Environmental Studies

- Baars Holger, Kanitz Thomas, Engelmann Ronny, Althausen Dietrich, Heese Birgit, Komppula Mika, Jana Preißler,b, Matthias Tesche,c, Albert Ansmann, Ulla Wandinger, Jae-Hyun Lim, Joon Young Ahn, Iwona S. Stachlewska, Vassilis Amiridis, Eleni Marinou, Patric Seifert, Julian Hofer, Annett Skupin, Florian Schneider, Stephanie Bohlmann, Andreas Foth, Sebastian Bley, Anne Pfüller, Eleni Giannakaki, Heikki Lihavainen, Yrjö Viisanen, Rakesh Kumar Hooda, Sérgio Nepomuceno Pereira, Daniele Bortoli,Frank Wagner, Ina Mattis, Lucja Janicka, Krzysztof M Markowicz, Peggy Achtert, Paulo Artaxo, Theotonio Pauliquevis, Rodrigo A F Souza, Ved Prakesh Sharma, Pieter Gideon van Zyl, Johan Paul Beukes, Junying Sun, Erich G Rohwer, Ruru Deng, Rodanthi-Elisavet Mamouri, and Felix Zamorano. 2016. **An overview of the first decade of PollyNET: An emerging network of automated Raman-polarization lidars for continuous aerosol profiling**. *Atmos. Chem. Phys.* 16: 5111–5137.
- Chauhan Rita, Datta Arindam, Ramanathan AL, Adhya TK. 2015. **Factors influencing Spatio-**

temporal variation of methane and nitrous oxide emission from a tropical mangrove of eastern coast of India. *Atmospheric Environment* 107: 95–106.

- Cheng Zhen, Luo Lina, Wang Shuxiao, Wang Yungang, Sharma Sumit, Shimadera Hikari, Wang Xiaoliang, Bressi Michael, Maura de Miranda Regina, Jiang Jingkun, Zhou Wei, Fajardo Oscar, Yan Naiqiang, and Hao Jiming. 2016. **Status and characteristics of ambient PM2.5 pollution in global megacities**. *Environment International* 89–90: 212–221.
- Datta VP, Sharma T, Gaine M Sehgal. 2016. **Mitigation of domestic indoor air pollution in a pristine rural area of India**. *Management of Environmental Quality.*
- Kwatra Swati, Kumar Archna, Sharma Prateek, Sharma Sumit, and Singhal Shaleen. 2016. **Benchmarking sustainability using indicators: An Indian case study**. *Ecological Indicators* 61: 928–940.
- Malik Jai Kishan and Sharma Sumit. 2016. **To Fix Bad Air, Look Beyond the Cars or Delhi**. *The Economic Times*, April 24.
- Sehgal Meena, Gautam Sumit Kumar, Bajaj Priyanka, Guha Mayukhmala, and Pandey Suneel. **Sustaining health: A case study from South 24 Parganas, West Bengal**. *Journal of Water, Sanitation and Hygiene for Development*.
- Sehgal Meena, Tyagi Sushil K, and Gautam Sumit Kumar. 2016. **Air quality in Delhi: Status and concerns**. *International Journal of Environmental Studies* (Peer Reviewed). Available at <http://dx.doi.org/10.1080/00207233.2016.1144378>.
- Sehgal Meena and Gautam Sumit. 2016. **Odd–even story of Delhi traffic and air pollution**. *International Journal of Environmental Studies* (Peer Reviewed).
- Sharma S, Sharma P, Khare M, Kwatra S. 2016. **Statistical behavior of ozone in urban environment**. *Sustainable Environment Research*.
- Sharma Sumit, Chatani Satoru, Mahtta Richa, Goel Anju, Kumar Atul. 2016. **Sensitivity analysis of ground level ozone in India using WRF-CMAQ models**. *Atmospheric Environment* 131: 29–40.
- Sharma Sumit and Ghosh Prodipto. 2016. **At sixes and seven with odd and even**. *The Financial Express*, April 20.
- Yang Y, Li P, He H, Zhao X, DattaA, Ma W, Zhango Y, Liu X, Han W, Fang J. 2015. **Long-term changes in soil pH across major forest ecosystems in China**. *Geophysical Research Letter.*

Centre for Global Environmental Studies

- Agarwal S and Bhardwaj S. 2015. *TERI Energy & Environment Data Diary and Yearbook 2014/15*, Chapter 12, pp. 327–328. New Delhi: TERI.
- Agarwal S and Mathur M. 2015. **Curbing consumption is the only way out to avoid climate change**. Available at <http://thewire.in/2015/10/06/curbing-consumption-is-the-only-way-out-to-avoid-climate-change-12382/>.
- Agarwal S and Mathur M. 2015. **Sustainable development and de-growth**. Available at <http://www.scidev.net/south-asia/sdgs/opinion/sustainable-development-and-de-growth.html>.
- Agarwal S. 2016. **Coal Conundrum: Will coal cess boost India's clean energy program**. Climate Home Online Journalism.
- Bhadwal S and Veldore V. 2015. **Heat Waves**. *TerraGreen*.
- Bhardwaj S, Kedia S, Pawar PS, Goswami A, Madhusoodanan MS, Sharma A, Singh KN, Das S, Senger A, Jain N, Palwa K, Jain R, G Vadivelu A, and Chauhan S. 2015. **Climate resilient green growth strategies for Punjab**. Implemented by The Energy and Resources Institute in collaboration with the Global Green Growth Institute and nodal support from Department of Science, Technology & Environment, Government of Punjab and Punjab State Council for Science and Technology. Available at <http://www.teriin.org/projects/green/pdf/Punjab_Tech-report.pdf>.
- Bhardwaj S, Kedia S, Pawar PS, Goswami A, Madhusoodanan MS, Sharma A, Singh KN, Das S, Syiemlieh JD, Jain N, Bineesan MK, D Souza SM, and G Vadivelu A. 2015. **Climate resilient green growth strategies for Himachal Pradesh**. Implemented by The Energy and Resources Institute in collaboration with the Global Green Growth Institute and nodal support from Department of Environment, Science & Technology, Government of Himachal Pradesh. Available at <http://www.teriin.org/projects/green/pdf/HP_Tech-report.pdf>.
- Marie-Jeanne Kurdziel et al. 2015. *Summary Report: Good Practice Analysis 2.0 on INDCs, LEDS, NAMAs and MRV*. Available at <http://mitigationpartnership.net/sites/default/files/ws15223_gpa2015_summaryreport_final_web.pdf>.
- Mathur M and Agarwal S. 2015. **Sustainability Dynamics of Economic Growth & Resource Use Efficiency**. *Karelian Journal on Economic Sciences*, December.
- Mathur M and Sharma K. 2016. **Modelling urban carrying capacity and measuring quality of life using system dynamics**. New Delhi: TERI.
- Mishra A and Pahuja N. 2016. **Cooperation on climate change mitigation — An Indian perspective**. In *China-India Relations: Cooperation and Conflict* (Bajpai K, Jing H, Mahbubani K, eds). London & New York: Routledge Contemporary Asia Series.
- Shrivastava MK. 2015. **India's INDC goals require investments**, December 2. Available at <http://www.scidev.net/south-asia/climate-change/opinion/india-s-indc-goals-require-investments.html>.
- Shrivastava MK. 2015. **Web-based GHG Management System of the Republic of Korea**. Available at <http://mitigationpartnership.net/gpa/web-based-ghg-management-system-republic-korea>.
- Srivastava Leena and Shrivastava MK. 2015. **Towards a climate-resilient economy**. *The Financial Express*, April 22.

- Thomas Spencer et al. 2015. Beyond the Numbers: Understanding the Transformation Induced by INDCs, IDDRI Study N°05/15 OCTOBER 2015 | CLIMATE, A Report of the MILES Project Consortium, (**Shrivastava, M.K., co-author**).
- Upadhyay H, Kelman I, and Mohan D. 2015. **Everyone likes it here**. In *Disasters and displacement in a changing climate. Forced Migration Review Issue* 49: 65–66.
- Varma N, Kelkar U, Bhardwaj S, Singh P, and Mishra A. 2015. **Climate, disasters and development — Testing the waters for adaptive governance in India**. *Vision* **18**(4): 327–338, Available at <http://vis.sagepub.com/content/18/4/327.abstract>.
- Varma N and Mishra A. 2015. **Uncertainty challenge for governance: Insights from social-ecological dynamics of the Upper Brahmaputra Valley**. In Hazarika S, and Banerjee R (eds). *Climate change in the Eastern Himalaya: Impact on livelihoods, growth and poverty*. New Delhi: Academic Publishers.
- Varma N. 2015. **Blurring boundaries for desirable and feasible solutions—Use of social learning process in a context of Brahmaputra Basin in India**. Sixth Annual Conference of International Society for Integrated Disaster Risk Management (IDRIM), New Delhi.

Energy Environment Technology Development

Biomass Energy Technology Applications (BETA)

- Banerjee Manjushree and Raman P. 2016. **Factors influencing grid interactive biomass power industry**. *International Journal of Engineering Research & Science* **2**(1): 124–135.
- Baruah PK, Dutta P, Kalita P. 2015. **Cage like Al-KIT-5 mesoporous materials for C-C bond formation reactions under solvent free conditions**. *Catal Lett* 145: 2037–2045. Impact Factor: 2.307.
- Joshi SS, Bhatnagar A, Ranade VV. 2016. **Catalysis for Fine and Specialty Chemicals**. In *Industrial Catalytic Processes for Fine and Specialty Chemicals* (Sunil S Joshi and Vivek V Ranade, eds), pp. 317–373. Elsevier.
- Kalita P, Baskar AV, Choy J-Ho, Lakhi KS, El-Newehy M, Lawrence G, Al-deyab SS, and V V, Balasubramanian A Vinu. 2016. **Preparation of highly active triflic acid functionalized SBA-15 catalysts for the synthesis of coumarin under solvent free condition**. *ChemCatChem* 8: 336–344.
- Raman P. 2015. **Investment opportunities in biomass-based power generation**. *Akshay Urja* **8**(4): 28–32.

Resource Efficient Process Technology Application (REPTA)

- Bajwa Anjali, Balakrishnan Malini, Svensson Gunnar, and Batra Vidya S. 2015. **Removal of volatile organic compounds over bagasse ash derived activated carbons and monoliths**. *Journal of Environmental Chemical Engineering* 4: 1561–1573.
- Bharath Kumar BR, Doddamani Mrityunjay, Zeltmann Steven E, Gupta Nikhil, Uzma Gurupadu S, and Sailaja RRN. 2015. **Effect of particle surface treatment and blending method on flexural properties of injection-molded cenosphere/HDPE syntactic foams**. *Journal of Material Science* 51: 3793–3805.
- Mehta Neha, Basu Subhankar, and Kumar Arun. 2015. **Separation of zinc oxide nanoparticles in water stream by membrane filtration**. *Journal of Water Reuse and Desalination*, pp. 148–155.
- Narsimha Rao G Rudra, Ahmed Sabreen, Sailaja RRN, and Sharma KV. 2015. **A decision-making approach for energy efficiency improvement in municipal water pumps during water scarcity scenario**. *Energy Efficiency* 9: 141–151.
- Shruthi SB, Roy Pratik, Sailaja RRN, and Sengupta Chandan. 2015. **Encapsulation and release characteristics of marigold oleoresin in chitosan grafted sodium acrylate-co-acrylamide**. *Advanced Materials Letters*.
- Shruthi SB, Bhat Chandan, Bhaskar SP, Preethi G, and Sailaja RRN. 2015. **Microwave assisted synthesis of guar gum grafted acrylic acid / nanoclay superabsorbent composites and its use in Crystal Violet dye absorption**. *Green and Sustainable Chemistry* 6: 11–25.

Environmental and Industrial Biotechnology

- Bhardwaj Daya and Kaushik Nutan.2015. **Proceedings of national conference on recent trends in Instrumentation and Electronics** (RITE-2015), pp. 49–58.
- Chowdhary Kanika and Kaushik Nutan. 2015. **Fungi antiphytopathogenic metabolites derived from endophytic fungi**. In *Applications of Fungi and their Management Strategies*, (Sunil Deshmukh *et al.*, eds.). USA: CRC Press, Taylor & Francis Group.
- Chowdhary K and Kaushik N. 2015 Fungal endophyte diversity and bioactivity in the Indian Medicinal Plant Ocimum sanctum Linn. *PloS ONE*. Nov **3**; 10(11):e0141444.
- Deka AC and Sinha SK 2015a. **Mycogenic silver nanoparticle biosynthesis and its pesticide degradation potentials**. *International Journal of Technology Enhancements and Emerging Engineering Research* **3**(5): 108–113.
- Deka Alak Chandra, Kalita Jogen Chandra, Mishra Koushik. 2015. **Biocontrol potentiality of entomopathogenic fungi against larvae of dengue fever vector,** *Aedes aegypti* **(Diptera: Culicidae)**. *Journal of Bioresources* **2**(1): 16–27.
- Goswami NK, Saharia D and Kar A. 2015. **Role of seed and kernel size, thickness and weight on oil content in** *Jatropha curcus* L.,**—A study with Northeast India accessions**. *Paripex—Indian Journal of Research* **4**(1): 1–3.

- Goswami NK, Nath P and Saharia D. 2015. **A study on socio-economic assessment and adoption of scientific technologies by the muga rearers of Assam**. *International Journal of Scientific Research* **4**(2): 349–353.
- Ibrahim Mutiat Bolanle Kaushik Nutan, Sowemimo Abimbola Adepeju, and Odukoya Olukemi A. 2016. **Review of the phytochemical and pharmacological studies of the genus markhamia**. *Pharmacognosy Reviews* 10 (19).
- Jain P, Sharma M, Kumar M, Dureja P, Singh MP, Lal B., and Sarma PM. 2015. **Electrochemical removal of sulfate from petroleum produced water**. *Water Science & Technology* 72.2: 284–292.
- Kar A, Goswami NK and Saharia D. 2016. **Loss due to man–elephant conflict in Assam: A preliminary study**. *Paripex—Indian Journal of Research* 5 (2): 188–190.
- Kumari A and Kaushik N. 2016. **Oviposition deterrents in herbivorous insects and their potential use in integrated pest management**. *Indian Journal of Experimental Biology* 54: 163–174.
- Kaushik Nutan, Kumar Sushil and Chowdhary Kanika. 2016. **Antiphytopathogenic Metabolites Derived From Endophytic Fungi**. Applications of Fungi and their Management Strategies.
- Lavania Meeta, Cheema Simrita, and Lal Banwari. 2015. **Potential of viscosity reducing thermophilic anaerobic bacterial consortium TERI B#90 in upgrading heavy oil**. Fuel. 144: 349–357**.**
- Mazumdar H, Goswami NK and Saharia D. 2015. **Removal of Lignin from aqueous solution using Fe_3O4 Nanoparticles as an effective adsorbent**. *Int. Journal of Engineering Research and Applications* 5(6): 58–65.
- Pathak M, Devi A, Bhattacharyya KG, Sarma H K, Subudhi S and Lal B. 2015.**Production of a non-cytotoxic bioflocculant by a bacterium utilizing petroleum hydrocarbon source and its application in heavy metal removal**. *Royal Society of Chemistry,* pp. 1–3.
- Priya A, Dureja P, Talukdar P, Rathi R, Sarma P M and Lal B. 2015. **Microbial production of 2,3-butanediol through a two-stage pH and agitation strategy in 150 l bioreactor**. *Biochemical Engineering Journal* 105: 159–167.
- Priya A, Mandal AK, Ball A, Manefield M, Sarma PM and Lal B. 2015.**Mass culture strategy for bacterial yeast co-culture for degradation of petroleum hydrocarbons in marine environment**. *Marine Pollution Bulletin*.
- Rathi R, Lavania M, Swale M, Kukreti V, Kumar S and Lal B. 2015. **Stimulation of an indigenous thermo-phillic anaerobic bacterial consortium for enhanced oil recovery**. *Royal Society of Chemistry* 5: 88115–88124.
- Rathi Rohit, Priya Anchal, Vohra Mustafa, Lavania Meeta, Lal Banwari, Sarma Priyangshu M. 2015. **Development of a microbial process for methane generation from bituminous coal at thermophilic conditions**. *International Journal of Coal Geology* 147–148:25–34.
- Sarma Indrani and Deka Alak Chandra. 2015. **Microrhizome production protocol for Indian curcuma: Medicinal herbs**. Omniscriptum GmbH & Co. K G, Deutschland, Germany: Scholars' Press.
- Sinha SK and Gupta A.2015b.**Acclimatization strategy of *Chlamydomonas sp*. BTA 4152 for growing in natural rubber latex processing wastewater**. *International Journal of Science and Research* (IJSR) **4**(2): 1080–1085.
- Sinha SK, Gupta A, and Bharalee R. 2016a. **Production of biodiesel from freshwater microalgae and evaluation of fuel properties based on fatty acid methyl ester profile**. *Biofuels* **7**(1): 105–126.
- Sinha SK and Deka AC.2016b. **Effect of osmotic stress on in vitro propagation of *Musa* sp. (Malbhog variety)**. *African Journal of Biotechnology* **15** (12): 451–457.
- Sharma M, Bisht V, Singh B, Jain P, Mandal AK, Lal B, and Sarma P. 2015. **Bioleaching of nickel from spent petroleum catalyst using *Acidithiobacillus thiooxidans* DSM-11478**. *Indian Journal of Experimental Biology* 53: 388–394
- Subudhi Sanjukta, Batta Neha, Bisht Varsha, Pathak Mihirjyoti, Devi Arundhuti, and Lal Banwari. 2015. **Purification and characterization of exopolysaccharide bioflocculant produced by heavy metal resistant** *Achromobacter xylosoxidans*.*Carbohydrate polymers*.
- Vohra MH, Jain P, Jha T, Sharma M, Dureja P, Sarma, PM and Lal B. 2015. **Separation of acetone and butyric acid for simultaneous analysis of sugars, volatile fatty acids, acetone and alcohols by HPLC using flow programming**. *Anal. Methods* 7: 7618–7624.

Green Growth and Resource Efficiency

Centre for Resource & Env. Governance

- Aggarwal V and Mohanty P. 2015. **Smart systems and smart grids for effective governance of electricity supply in India**. In *E-Governance for Smart Cities*. Edited by TM Vinod Kumar. Springer.
- DSouza S M and Syiemlieh JD. 2015. **Coal and lignite.** In *TEDDY (TERI Energy Data Directory and Yearbook) 2015/16*, pp. 24–71. New Delhi: TERI.
- Manasi S, Nayak BP, and Latha N. 2015. **E-waste management in cities: A situation analysis of Bangalore**. *Social and Economic Change Monographs 39*. Bangalore: Institute for Social and Economic Change.
- Nayak BP and S Manasi. 2016. **Performance of Participatory irrigation Management in Odisha: A Study of Pani Panchayats in Two Irrigation Projects.** In *Indian Agriculture: Performance, Growth and Challenges* (Kumar P and S Mohan kumar, eds), pp. 329–354. London & New York: Routledge.

- Nayak BP, Werthmann C, and Aggarwal V. 2015. **Trust and cooperation among urban poor for transition to cleaner and modern cooking fuel**. *Environmental Innovation and Societal Transitions* 14: 116–127.
- Meenawat H. 2015. Policy dialogue on **'Environmental governance for sustainable Development in India'**, July 15.
- Meenawat H. 2015. **5th TERI-KAS environmental governance policy dialogue — Environmental governance in the context of sustainable development in India: A synthesis.** TERI Policy Paper, July, pp. 20.
- Syiemlieh JD. 2015. **Dead and dying rivers of Meghalaya- The Myntdu and Lukha**. *The Shillong Times*, December 8. Available at <http://www.theshillongtimes.com/2015/12/08/dead-and-dying-rivers-of-meghalaya-the-myntdu-and-lukha/>.

Centre for Research on Energy Security

- Joshi M and Ganeshan S. 2015. ***EU-India energy relations—Towards closer cooperation? Challenges of European External Energy Governance with Emerging Powers.*** Edited by Michèle Knodt and Nadine Piefer, Ashgate Publications, United Kingdom
- Pal S, Singh S, Wilson S, and Joshi M. 2015. **Outlook for transport sector energy demand in India**. *OPEC Energy Review*.
- Parekh S. 2016. **What next after odd–even?** *Business Standard*, February 17.
- Parekh S. 2016. **Twitter is in trouble: How can it be rescued?** *Business Standard*, January 25.
- Parekh S. 2015. **Why alcohol bans don't work**. *Business Standard*, December 29.
- Parekh S. 2015. **Let's be done with subsidies already**. *Business Standard*, November 13.
- Ramakrishnan A and D'souza S. 2016. **Powering up: Coal pricing in India**. *NTPC NETRA Technical Journal*.
- Singh S. 2016. **Budget 2016: What it means for the oil & gas sector**. *Business Standard*, March 2.
- Singh S. 2016. **Pollution levels in Delhi high despite odd-even traffic rule**. *Climate Home*, January 18.
- Singh S. 2016. **Why Delhi's pollution problem is a problem of pricing**. *Business Standard,* January 12.
- Singh S. 2015. **The changing power dynamics of energy**. *Business Standard,* December 10.
- Singh S. 2015. **Climate justice and the Paris Conference**. *Business Standard,* November 9.
- Singh S. 2015. **Where is India's fracking revolution**. *Business Standard*, October 21.
- Singh S. 2015. **Is nuclear energy the deadliest of them all?** *Business Standard*, October 7.

Centre for Global Agreements, Leg. and Trade

- Arora N. 2015. **Book review: *A Planet for Life: Building the Future We Want.*** *Journal of Resources Energy and Development* **12**(1&2): 78–80.
- Garimella Arvind, Palit Debajit, Chaudhary Saswata, and Shardul Martand. 2015. **Institution as the catalyst for productive use of electricity in livelihood cluster: A case for energy plus approach from Andhra Pradesh, India**. *Proceedings of Third International Conference: Micro Perspectives for Decentralized Energy.*
- Johri R and Pandey S. 2016. **Options for rural sanitation in different geographical and climatic conditions of India,** pp. 143–161. In *Swachh Bharat Abhiyan (A Clean India)* (Mridula Sinha and R K Sinha, eds). New Delhi: Prabhat Prakashan.
- Nanda Nitya. 2015. **Curbing Delhi pollution**. *Business World*, December 24.
- Nanda Nitya and Dwivedi Krishna. 2015. **Sustainable infrastructure Development: The role of environment and forests clearances**. *Theme Paper, Conference on Environment & Forest Clearances*. New Delhi: ASSOCHAM.
- Nanda Nitya, Khan Abu Saleh and Dwivedi Krishna. 2015. **Hydro-politics in GBM Basin: The case of Bangladesh–India water relations**. New Delhi: TERI.
- Nanda Nitya. 2015. **Energy market integration and cooperation**. RIS (Ed.) *ASEAN-India Development and Cooperation Report 2015*. New Delhi: Routledge.
- Tyagi B. 2015. **Book review: *Ecological meltdown: Impact of unchecked growth on the earth's natural systems.*** *Journal of Resources Energy and Development* **12**(1&2): 75–77.

Centre for Resource Security & Development Policy

- Bakshi SK. 2015. **Moving towards a more sustainable production and consumption pattern**. *The Financial Express*, June 5.
- Bakshi SK. 2015. **Do people care and think about the environment?** *TERI Environmental Survey 2015*. *TerraGreen*, July.
- Bhattacharjee U and Govindan M. 2016. **Grid parity of Solar PV Rooftop Systems for the Commercial and Industrial Sectors**. New Delhi: TERI.
- Chakraborty T and Bakshi SK.2016. **English language premium: Evidence from a policy experiment in India**. *Economics of Education Review* 50: 1–16.
- Datt D.2015. **Inter-governmental political relations in a federation and illegal mining of natural resources**. *Environmental Economics and Policy Studies*.
- Dube SK. 2015. **Analysis debate on new emission norms for power plants—Getting tough**. *PowerLine* 19 (10): 44–46.
- Kedia S and Sathpathy I. 2016. **Sustainable development goals and implications for India**. In Senger A, Kedia S and Jain R (eds), *TERI Energy & Environment Data Diary and Yearbook 2015/16*. New Delhi: TERI.

Green Growth Strategies

- Anand M. 2015. **Green growth and agriculture in Himachal Pradesh**, TERI Background Paper, New Delhi: TERI: 28 pp. Available at <http://www.teriin.org/projects/green/pdf/HP-Agriculture.pdf>, last accessed on April 30, 2016.
- Anand M. 2016. **The biologist's imagination: Innovation in the biosciences**, Book Review, NY: Oxford University Press, William Hoffman and Leo Furcht, *Asian Biotechnology and Development Review* **17**(3): 71-75.
- Anand M. 2016. **Innovation and sustainable development: A bioeconomic perspective**, Brief for Global Sustainability Development Report (GSDR)-2016. Available at <https://sustainabledevelopment.un.org/content/documents/982044_Anand_Innovation%20and%20Sustainable%20Development_A%20Bioeconomic%20Perspective.pdf>, last accessed on April 30, 2016.
- Anand M, Dhawan N, and Kedia S. 2015. **Science, technology and innovation for low carbon development in India**, Discussion Paper, New Delhi: TERI, p. 74. Available at <http://www.teriin.org/projects/locci/pdf/res/Discussion_Paper_LCD_STI.pdf>, last accessed on April 30, 2016.
- Anand M, and Kedia Shailly.2015. **Innovation policy andsustainabledevelopment.PolicybriefforUnited Nations global sustainable development report 2015**. Available at <https://sustainabledevelopment.un.org/content/documents/6559119-Anand_Innovation%20Policy%20and%20Sustainable%20Development.pdf>.
- Anand M, Deshpande Sarma S, and Pawar P S. 2016. **Agriculture**. pp. 197–210. In *TEDDY (TERI Energy Data Directory and Yearbook) 2015/16*. New Delhi: TERI.
- Anand M. and Kedia S. 2015. **Innovation policy and sustainable development**, Brief for Global Sustainability Development Report (GSDR) – 2015. Available at <https://sustainabledevelopment.un.org/content/documents/6559119-Anand_Innovation%20Policy%20and%20Sustainable%20Development.pdf>, last accessed on April 30, 2016.
- Deshpande Sarma S. 2015, **Organic agriculture: An option for fostering sustainable and inclusive agriculture development in India**. Discussion paper. New Delhi: TERI.
- Deshpande Sarma S, and Sharma A. 2015. **Green growth and agriculture in India**. TERI Background Paper, pp. 27. New Delhi: TERI.
- GGSDI. 2015. **Green growth and sustainable development in India**. **(Lead Authors:** Shailly Kedia, Anandajit Goswami, Atul Kumar, Ajith Radhakrishnan, Prasoon Agarwal, Aparna Vashisht, Rinki Jain, Saswata Chaudhury, Illika Mohan, Ashutosh Senger, Nishant Jain, Shyamasis Das, Sarbojit Pal, Saptarshi Das, Aastha Sharma; **Contributing Authors:** Saahil Parekh, Siddharth Singh, Hina Zia, Charu Sharma, Jai Kishan Malik, Shilpanjali A Sarma, Girija K Bharat, Jonathan Donald Syiemlieh, Swati Mitchelle DSouza, Chinmay Kinjavdekar, Ashish Aggarwal, Yogesh Gokhle, Suresh Chauhan, Sandhya Sundararaghavan, Akshima Tejas Ghate, Seema Singh, Richa Mahtta, Upinder Singh Dhingra, Karnika Palwa, Kanwal Nayan Singh, Swati Agarwal, Divya Mohan, Ashish John George). Implemented by The Energy and Resources Institute (TERI) and Global Green Growth Institute (GGGI). New Delhi: TERI.
- CRGGS-HP. 2015. **Climate resilient green growth strategies for Himachal Pradesh**. **(Authors:** Shailly Kedia, Prakashkiran S Pawar, Anandajit Goswami, Madhusoodanan MS, Saurabh Bhardwaj, Shyamasis Das, Jonathan Donald Syiemlieh, Aastha Sharma, Kanwal Nayan Singh, Nishant Jain, M K Bineesan, Swati Mitchelle D Souza, and G Ananda Vadivelu). Implemented by The Energy and Resources Institute (TERI) in collaboration with the Global Green Growth Institute and nodal support from Department of Environment, Science & Technology, Government of Himachal Pradesh. New Delhi: TERI.
- CRGGS-PB.2015. **Climate resilient green growth strategies for Punjab**. (Authors: Shailly Kedia, Prakashkiran S Pawar, Anandajit Goswami, Madhusoodanan MS, Saurabh Bhardwaj, Aastha Sharma, Kanwal Nayan Singh, Shyamasis Das, Nishant Jain, Aparna Vashisht, Karnika Palwa, Rinki Jain, Santosh Muriki, G Ananda Vadivelu, Suresh Chauhan). Implemented by The Energy and Resources Institute (TERI) in collaboration with the Global Green Growth Institute and nodal support from Department of Science, Technology & Environment, Government of Punjab and Punjab State Council for Science and Technology. New Delhi: TERI.
- Deshpande Sarma S and Sharma A. 2015. **Green Growth and Agriculture in India**, TERI Background Paper, pp. 27. New Delhi: TERI.
- Deshpande Sarma S. 2015, **Organic Agriculture: An option for fostering sustainable and inclusive agriculture development in India** Discussion paper. New Delhi: TERI.
- GGSDI.2015. **Green Growth and Sustainable Development in India**. **(Lead Authors:** Shailly Kedia, Anandajit Goswami, Atul Kumar, Ajith Radhakrishnan, Prasoon Agarwal, Aparna Vashisht, Rinki Jain, Saswata Chaudhury, Illika Mohan, Ashutosh Senger, Nishant Jain, Shyamasis Das, Sarbojit Pal, Saptarshi Das, Aastha Sharma; **Contributing Authors:** Saahil Parekh, Siddharth Singh, Hina Zia, Charu Sharma, Jai Kishan Malik, Shilpanjali A Sarma, Girija K Bharat, Jonathan Donald Syiemlieh, Swati Mitchelle DSouza, Chinmay Kinjavdekar, Ashish Aggarwal, Yogesh Gokhle, Suresh Chauhan, Sandhya Sundararaghavan, Akshima Tejas Ghate, Seema Singh, Richa Mahtta, Upinder Singh Dhingra, Karnika Palwa, Kanwal Nayan Singh, Swati Agarwal,

Divya Mohan, Ashish John George). Implemented by The Energy and Resources Institute (TERI) and Global Green Growth Institute (GGGI). New Delhi: TERI.

- Goswami A and Mishra A. 2016. ***Economic Modeling, Analysis, and Policy for Sustainability*** (pp. 1-323). Hershey, PA: IGI Global.
- Goswami A and Ram Mohan MP. 2015. **An exploratory analysis of occupational accidents and risks from nuclear reactors in India**. *Safety Science* 78: 155–162.
- Goswami A and Mishra A. 2016. **Nonlinearity of energy transition in India and implications for sustainability science: An exploratory insight**. *Economic Modeling, Analysis, and Policy for Sustainability*, pp. 1–323. Hershey, PA: IGI Global.
- Jain R, and Palwa K. 2016. **Air pollution and health**. *TERI Energy Environment Data Diary and Yearbook 2015/16*.New Delhi: TERI.
- Jain R, Vashisht A, Palwa K, and Senger A. 2015. **Sustainable Energy**. In Vashisht, A, and Senger, A (eds), *TERI Energy & Environment Data Diary and Yearbook 2014/15*. New Delhi: TERI.
- Kedia Shailly. 2016. Prakash Javadekar on Vision for Environmental Sustainability in India. *The International Journal on Green Growth and Development*. 2 (1). New Delhi: TERI.
- Kedia Shailly. 2015. **India on the path to green growth**. *The Pioneer*, December 25.
- Kedia Shailly. 2015. **Sustainable Development Goals** (Samaveshi Vikas ka Lakshya - Hindi). *Dainik Jagran*, December 10.
- **Kedia Shailly and Sathpathy Ipsita. 2016. Sustainable development goals and implications for India**. In Senger A, Kedia S, and Jain, R (eds), *TERI Energy & Environment Data Diary and Yearbook 2015/16*. New Delhi: TERI.
- Kedia Shailly, Anand Manish, and Jain Nishant (eds). 2016. *The International Journal on Green Growth and Development* (January–June) **2** (1). New Delhi: TERI.
- Kedia Shailly, Anand Manish, and Jain Nishant (eds). 2015. *The International Journal on Green Growth and Development* (July–December) **1** (2). New Delhi: TERI.
- Kumar SN and Senger A. 2016. Power. In Senger A, Kedia S, and Jain R (eds), *TERI Energy & Environment Data Diary and Yearbook 2015/16*. New Delhi: TERI.
- Malik J, and Senger A, *et al.*2016. **Environment**. In Senger A, Kedia S, and Jain R (eds), *TERI Energy & Environment Data Diary and Yearbook 2015/16*. New Delhi: TERI.
- Masawi R. 2015. **Africa rising: What does it mean for African citizens?** *The International Journal on Green Growth and Development.* New Delhi: TERI.
- Mathur M and Sharma K. 2016. ***Modelling Urban Carrying Capacity and Measuring Quality of Life Using System Dynamics.*** New Delhi: TERI.
- Mathur M and Sharma K. ***Modelling Economic Policies for Sustainable Consumption of Natural Resources: A System Dynamics Approach.*** New Delhi: TERI.
- Sarma Shilpanjali and Sharma Aastha. 2015. ***Green Growth and Agriculture in India.*** New Delhi: TERI. 27 pp.
- Senger A. 2015. **Coal and lignite**. In Vashisht A, and Senger A (eds), *TERI Energy & Environment Data Diary and Yearbook 2014/15*. New Delhi: TERI.
- Senger A. 2015. **Paris Agreement brings hope of green investments**. Available at <SciDev. Net: http://www.scidev.net/south-asia/climate-change/opinion/paris-agreement-green-investments-COP21.html>.
- Senger A. 2016. *TERI Energy & Environment Data Diary and Yearbook (TEDDY). TerraGreen*.
- Senger Ashutosh, Kedia Shailly, and Jain Rinki (eds).2016.*TERI Energy & Environment Data Diary and Yearbook 2015/16*. New Delhi: TERI.
- Senger A and Jain R. 2016. **Energy and Environment: An overview**. In Senger A, Kedia S, and Jain R (eds), *TERI Energy & Environment Data Diary and Yearbook 2015/16*. New Delhi: TERI.
- Sharma Aastha and Deshpande Sarma Shilpanjali. 2015. **Resource Efficiency Roadmap for Agriculture in Punjab**. New Delhi: TERI. 26 pp.
- Sharma S, Chatani S, Mahtta R, Goel A, and Kumar A. 2016. **Sensitivity analysis of ground level ozone in India using WRF-CMAQ models**. *Atmospheric Environment* 131 (1): 29–40.
- Sharma A and Deshpande Sarma S. 2015. **Resource Efficiency Roadmap for Agriculture in Punjab**, TERI Background Paper, New Delhi: TERI.
- Sharma S, Goel A, Gupta D, Kumar A, Mishra A, Kundu S, Chatani S, and Klimont Z. 2015. **Emission inventory of non-methane volatile organic compounds from anthropogenic sources in India**. *Atmospheric Environment* **102**(2): 209–219.
- Sinha KAP, Jerath N, Kedia S, Ladhar SS, Jain R, and Vadivelu A. 2015. **Action Plan for Green Budgeting in Punjab, India**. *The International Journal on Green Growth and Development* 1(2): 121–124. New Delhi: TERI.
- Spencer T, and Pierfederici R, *et al*. 2015. **Beyond the numbers: Understanding the transformation induced by INDCs**, Study N°05/15, IDDRI - MILES Project Consortium, Paris, France, 80 p.
- TERI. 2016. *TERI Energy and Environment Data Directory and Yearbook 2015/16* (Editors: Ashutosh Senger, Shailly Kedia, and Rinki Jain). New Delhi: TERI.
- Vashisht A Jain R, and Kinjavdekar C. 2015. **Greening businesses: Sustainability initiative in Mahindra Sanyo Special Steel Private Limited**. *The International Journal on Green Growth and Development*. New Delhi: TERI.
- Vashisht A and Senger A. 2015 (eds).*TERI Energy & Environment Data Diary and Yearbook 2014/15*. New Delhi: TERI.
- Vashisht A and Senger A. 2015. **Energy and Environment: An Overview**. In Vashisht A, and Senger A (eds), *TERI Energy & Environment Data Diary and Yearbook 2014/15*. New Delhi: TERI.

Modelling and Scenario Building

- Bery S, Ghosh A, Mathur R, Basu S, Ganesan K, and Owen-Jones R. 2016. **Energising India: Towards a resilient and equitable energy system**. Joint publication of TERI, Shell and CEEW. New Delhi: SAGE.
- Spencer T and Pierfederici R. 2015. **Beyond the numbers: Understanding the transformation induced by INDCs, Study N°05/15, IDDRI - MILES Project Consortium, Paris, France**, pp. 45–50.
- Sharma S, Goel A, Gupta D, Kumar A, Mishra A, Kundu S, Chatani S, and Klimont Z. 2015. **Emission inventory of non-methane volatile organic compounds from anthropogenic sources in India**. *Atmospheric Environment* **102**(02): 209–219.
- Sharma S, Chatani S, Mahtta R, Goel A, and Kumar A. 2016. **Sensitivity analysis of ground level ozone in India using WRF-CMAQ models**. *Atmospheric Environment* **131** (01): 29–40.
- Mathur M and Sharma K. 2016. **Modelling Urban Carrying Capacity and Measuring Quality of Life Using System Dynamics.** New Delhi: TERI.
- Goswami A and Mishra A. 2016. ***Economic Modeling, Analysis, and Policy for Sustainability,*** pp. 1–323. Hershey, PA: IGI Global.
- Goswami A and Ram Mohan MP.2015. **An exploratory analysis of occupational accidents and risks from nuclear reactors in India**. *Safety Science* 78: 155–162.
- Goswami A and Mishra A. 2016. **Nonlinearity of energy transition in India and implications for sustainability science: An exploratory insight, economic modeling, analysis, and policy for sustainability,** pp. 1–323. Hershey, PA: IGI Global.

Industrial Energy Efficiency

- Dhingra Upinder Singh. 2015. Section on "Industry" in *Green Growth and Sustainable Development in India*. New Delhi: TERI and Global Green Growth Institute (GGGI).
- Dhingra Upinder Singh. **The energy efficiency imperative in the Indian MSME Sector**. Indian *Industries Association (IIA) News*, Volume 6.
- Gopal E N. 2016. **Monitoring: Strategy to diminish energy cost in foundry**. *Foundry Review* **4** (1).
- Gopal E N. 2016. **Sensitivity analysis of cupola and induction furnace for power demand and CO_2 emissions: Case study from Coimbatore, India**. International Conference Paper: Indian Foundry Congress, January.
- Kumar S, Das S, and Malhotra S. 2015. **Energy demand sectors: Industry**. In *Energy Security Outlook* (Soni A, Mohan I, Joshi M, and Kumar A, eds), pp. 87–102.
- Nonita T Yap, Vaidyanathan Geeta, Pal Prosanto, Sethi Girish, and Joshi Veena. 2016. **Diffusion of low carbon innovation among Indian foundries: Lessons from the improved divided blast cupola**. *International Journal of Innovation and Sustainable Development* **10** (3): 281–299.
- Pal P, Sethi G, Sekimoto K, and Rabhi A. 2015. **Best operating practices in induction furnaces: Experiences from research partnership with Japan**. *SOURECON 2015 Souvenir* (IIF, Belgaum Chapter).
- Pal Prosanto, Nand Gopal E, Sangole Chetankumar, Shedge Nilesh and Sharma Vivek. 2015. **Energy efficiency and best operating practices guide for foundries**, for GEF-UNIDO-BEE Project. COINDIA.
- Ramanathan K. 2015. **Cross-border cooperation in hydropower: Emerging vistas**. *Power Watch* 6 (5): 34–35.
- Ramanathan K. 2016. **Powering the North East: Challenges and opportunities**. *Yojana*, April, pp. 41–43.
- Ramanathan K and Sundararagavan Sandhya. 2015. **Demand side management in Indian power utilities**. *Energy Science and Technology: Energy Management* Volume 12: 98–118. USA: Studium Press LLC.

Knowledge Management

Library and Information Centre

- Bhattacharya P K, Khan M A, Ahmed S S, and Jha A A. 2015. Application of Social Media in Innovative Knowledge Services, 2015: Proceedings of National Conference on Application of Social Media in Innovative Knowledge Services, Organized by CCRUM and Society for Information Research and Studies, New Delhi, December 19.
- Shukla P. 2016. **India's 'Smart Cities' mission**. *Energy Future* (April–June): 34–39.
- Shukla P. 2016. **India's urban challenges: 100 smart cities initiatives**. *TerraGreen* (March): 34–36.

Social Transformation

- Arora P, and Jain S. 2016. **A review of chronological development in cookstove assessment methods: Challenges and the way forward**. *Renewable and Sustainable Energy Reviews* 55: 203–220.
- Arora P, and Jain S. 2015. **Morphological characteristics of particles emitted from combustion of different fuels in improved and traditional cookstoves**. *Journal of Aerosol Science* 82: 13–23.
- Arora P, and Jain S. 2015. **Estimation of organic and elemental carbon emitted from wood burning in traditional and improved cookstoves using controlled cooking test**. *Environmental Science & Technology* **49**(6): 3958–3965.
- Banerjee M, Prasad Rakesh, Rehman IH, and Gill Bigsna. 2016. **Induction stoves as an option for clean cooking in rural India**. *Energy Policy* 88: 159–167. Elsevier.
- Banerjee Manjushree and Prasad Rakesh. **Engaging community-based organizations in**

marketing of improved cookstoves in a hill state of India. *Boiling Point* Issue 55: 37–39.

- Banerjee Manjushree and Raman P. 2016. **Factors influencing grid interactive biomass power industry**. *International Journal of Engineering Research & Science* 2 (1): 124–135.
- Bhattacharyya Subhes, Palit Debajit, and Sarangi Gopal K. 2015. **Towards scaling up of electricity access: Summary and policy recommendations from OASYS South Asia project report**, pp 1–72. New Delhi: TERI.
- Garimella A, Shardul M, Chaudhury S, and Palit Debajit. 2015. **Institution as the catalyst for productive use of electricity in livelihood cluster: Case for energy plus approach from Andhra Pradesh**. In *Micro Perspectives for Decentralized Energy Supply: Proceedings of the International Conference*, pp 142–146. Edited by Martina Schafer.
- Garimella Arvind, Palit Debajit, Effah Rita, and Assefa Etsub. 2015. **An inclusive strategy to trigger solar technology market: Case studies of rural distribution models from Ethiopia**. In *Micro Perspectives for Decentralized Energy Supply: Proceedings of the International Conference*, pp 90–94. Edited by Martina Schafer.
- Gill Bigsna, Srivastava Alok, Pal Ramchandra, Singh Lokendra, and Rehman IH. 2015. **The value of engaging women in the energy provisioning process: Energy provisioning through inclusive collaboration (EPIC). Case Report**. New Delhi: TERI.
- Gill Bigsna. 2015. **Lighting a Billion Lives: A local approach to a global problem—sustainability**. *The Journal of Record*, pp 245–253.
- Gill Bigsna. 2015. **Advancing access to sustainable, affordable and reliable clean energy: Lighting a Billion Lives**. Available at <http://www.circul-r.com/LIGHTING-BILLION/>.
- Gopal Lasya and Rao Swaroop. 2015. **Lighting a Billion Lives: Social impact in Karnataka**. *The International Journal of Green Growth and Development* 1(2), July–December: 155–164.
- Muok Benard O, Willis Makokha and Palit Debajit 2015. **Solar PV for Enhancing Electricity Access in Kenya: What Policies are Required?** TERI Policy Brief.
- Murali Rashmi, Malhotra Sangeeta, Palit Debajit, Sasmal Krishnapada. 2015. **Socio-technical assessment of solar photovoltaic systems implemented for rural electrification in selected villages of Sundarbans region of India**. *AIMS Energy* **3** (4): 612–634.
- Palit Debajit and Malhotra Sangeeta. 2015. **Energizing rural India using micro grids: The case of solar DC micro-grids in Uttar Pradesh State, India**. In *Micro Perspectives for Decentralized Energy Supply: Proceedings of the International Conference*, pp 56–60. Edited by Martina Schafer.
- Palit Debajit, Malhotra Sangeeta, Pandey Manish K, and Bankoti Nikita. 2015. **Solar lighting for rural households: A case of innovative model in Bihar, India**. In *Micro Perspectives for Decentralized Energy Supply: Proceedings of the International Conference*, pp 77–81. Edited by Martina Schafer.
- Palit Debajit. 2015. **OASYS South Asia project brightens up remote areas**. *Akshay Urja* **8** (5): 36–39.
- Palit Debajit, Malhotra Ramit and Mande Sanjay. 2015. **Enhancing viability of biofuel-based decentralized power projects for rural electrification in India**. *Environment Development and Sustainability*, pp 1–21.
- Moving Forward with a World-class Mineral Policy for National Mineral Security. June 2015.
- Suggestions for an Appropriate Environmental Governance Architecture for India (February 2016).
- Ramanathan Nithya, Rehman, IH, and Ramanathan Veerabhadran. 2015. **Clean energy access for all – A scalable solution**, Our Planet, May.
- Ramanathan Tara, Ramanathan Nithya, Mohanty Jeevan, Rehman IH, Graham Eric, Ramanathan Veerabhadran. 2016. Clean Energy Access for the Bottom Three Billion: A Sustainable Scientific Approach – Submitted to *Nature*, January 05.
- Sreekumar Arun, Rehman Ibrahim, Gill Bigsna, Malhotra Sangeeta. 2016. **Lighting a Billion Lives - Developing pathways for energy access**. New Delhi: TERI.
- Sreekumar Arun. 2015. **Bundling improved cooking and lighting technology for clean energy access**. New Delhi: TERI. Available at <http://www.teriin.org/policybrief/index.php?a=30>.
- Sreekumar Arun. 2015. **Mainstreaming gender in improved cookstoves value chains**. New Delhi: TERI. Available at <http://www.teriin.org/policybrief/index.php?a=29>.
- Sreekumar Arun. 2015. **Selecting the appropriate improved cooking technology — what matters?** New Delhi: TERI. Available at <http://www.teriin.org/policybrief/index.php?a=28>.
- Sreekumar Arun. 2015. **Supply-side financing of improved biomass cookstoves in India**. New Delhi: TERI. Available at <http://www.teriin.org/policybrief/index.php?a=27>.
- Sreekumar Arun. 2015. **Can subsidies be a tool for strengthening the improved cookstoves market?** New Delhi: TERI. Available at <http://www.teriin.org/policybrief/index.php?a=26>.
- Sreekumar Arun. 2015. **Capacity needs of government officials for integration of energy and human development**. New Delhi: TERI. Available at <http://www.teriin.org/policybrief/index.php?a=25>.
- Shardul M and Gill B. 2016. **Household energy**. *TERI Energy & Environment Data Diary and Yearbook (TEDDY) 2015/16*. New Delhi: TERI.

Sustainable Habitat

- Dehadani Ashu. 2016. **Green Building footprint has increased significantly**, *Power-watch India*, February.

- Dehadani Ashu. **Sustainable development of cities of the future**, IBN Live. Available at <http://www.ibnlive.com/news/india/sustainable-development-of-cities-of-the-future-1208134.html>.
- Ghate AT. 2016. **Achieving sustainable mobility– What is the right question for Indian cities – 'to shift' or 'to retain'?** *Economic & Political Weekly* 51 (9).
- Ghate AT. 2016.**Travelling against all Odds'**. *The Asian Age*, March 8. Available at <http://www.asianage.com/columnists/travelling-against-all-odds-289>.
- Ghate AT. 2015. **Odd–even scheme: Need complementary measures, robust public transport and public sensitization**. *The Economics Times*, December 14. Available on <http://economictimes.indiatimes.com/news/politics-and-nation/odd-even-scheme-needcomplementary-measures-robust-public-transport-public-sensitization/articleshow/50167522.cms>.
- Ghate AT. 2015. **The virtuous cycle**. *The Hindu Business Line*, May 12. Available at <http://www.thehindubusinessline.com/opinion/the-virtuous-cycle/article7198308.ece>.
- GRIHA Magazine – Shashwat, 2016. Cities of the Future. Volume 2, Issue 2, February.
- Jindal Ashish. 2015. **Daylight Integration as per ECBC-2007**, CPWD symposium, Delhi, May.
- Kumar M, Ghate AT, Singh S Pal, S and Wilson, S. 2016. **Informal public transport modes in India: A case study of five city regions**. *International Association of Traffic and Safety Sciences Research Journal* 39 (2): 102–109.
- Pal S. 2016. **Financing India's smart cities mission—The special purpose vehicle**. *Cities Today*, Issue 20.
- Pal S Singh, Wilson SS and Joshi, M. 2015.**Outlook of energy demand from the transport sector in India**. *OPEC Energy Review* 39 (4): 376–401.
- Rani Sonia. 2016. **Water efficient products and water saving potentials**. *Quality Edge Magazine* March.
- Singh R. 2016. **Smart cities need smart urban governance.** *Cities Today Magazine*, pp 81–82.
- Singh S and Akalkotkar M. 2015.**Promoting walking and cycling in Indian cities: Lessons from Netherlands, Denmark and Germany**. SPANDREL (*Journal of School of Planning and Architecture, New Dimensions in Research of Environments for Living*), Issue 9.
- Sharma Dand Singh S. 2016. **Instituting climate resilience agenda into the governance process—Exploring potential of the new urban development schemes in India**. *SAGE Journals (International Area Studies Review 2016* **19**(1): 90–103.
- Singh S. 2015. **Smart cities must be safe cities**. *Urban Resilience and Children's Right*, Issue 139, All India Disaster Mitigation Institute (AIDMI).

Sustainable Habitat, Bengaluru

- D E V S Kiran Kumar and Puranik Sanket. 2015. **Thermal performance evaluation of cement tile as a roofing material**. *Journal of Indoor and Built Environment*. New Delhi: SAGE.
- D E V S Kiran Kumar, Apoorv Vij, and Mohini Singh. 2015. **Heat island tool for evaluating site level developments-experience of developing heat island calculator for GRIHA LD**. *Proceedings of Building Simulation Conference*, 7–9 December, International Institute of Information Technology, Hyderabad.
- Majumdar Mili and Sastry Minni. 2015. **Nepal: Constructing quake-proof houses**. *Deccan Herald*, May 13.
- Sahoo Kiriti and DEVS Kiran Kumar. 2015. **Feasibility study analysis for radiant cooling system in housing for hot and humid climate in India**. Proceedings of National Conference on Refrigeration and Air Conditioning, 28–30 October, IIT Madras & Rajyalakshmi College of Engineering, Chennai.
- Sastry Minni. 2015. **Karnataka not following TERI's energy-saving guidelines**. *The Hindu*, September 17.
- Varma Hara Kumar and Sree Santhi. 2015. **Straw bale construction: A study of thermal performance and climate suitability in India**. PLEA Conference.

Water Resources and Forestry

- Agrawal A and Tayal S. 2015. **Mass balance reconstruction since 1963 and mass balance model for East Rathong glacier, Eastern Himalaya, using Remote Sensing methods, Geografiska Annaler: Series A**. *Physical Geography* xx: 1–14.
- Anshuman. 2016. **Cleaning Ganga with an Integrated Approach**. In *Swachh Bharat (A Clean India)*, Mridula Sinha and Dr RK Sinha, eds.
- Anshuman. 2015. **Water–Energy–Nexus; Water efficiency interventions in thermal power plants in India**. *Water and green growth: Case studies from Asia and The Pacific*. Jointly published by UNESCAP (United Nations Economic and Social Commission for Asia and the Pacific) and K-water, South Korea.
- Anshuman and Grover Sonia. 2015. **Ensuring water availability in a changing climate**. *Reinforcing India's Commitments, Delhi to Paris: Corporate Vision on Climate Change*. New Delhi: TERI.
- Chauhan S, Wali SA, Sharma JV, Upadhyay S, and Tiwari BC. 2016. **Afforestation/Reforestation clean development mechanism projects in the state of Uttar Pradesh: Information Guide**. New Delhi. TERI.
- Gokhale Y, Reddy V, and Rama GS. 2015. **Forests and biodiversity in directions**, **innovation and strategies for sustainable development in Goa**, pp 209–230. New Delhi: TERI.

- Grover Sonia and Malla Fayaz Ahmed. 2016. **Tapping water management**. *The Financial Express*, March 23.
- Natarajan Karthikeyan, Latva-KäyräPetri, ZyadinAnas, Chauhan Suresh, Singh Harminder, Pappinen Ari, and Pelkonen Paavo. 2015. **Biomass resource assessment and existing biomass use in the Madhya Pradesh, Maharashtra, and Tamil Nadu States of India**. *Challenges* 6: 1–10.
- Panandiker Ashwini and Chachadi AG. 2015. **Hydrogeological evaluation of a watershed with mining activities: Case study of Salaulim reservoir in Goa, India**. In *Proceedings of National Workshop on Water Conservation, Water Security*. Ministry of Water Resources & Ganga Rejuvenation, Government of India.
- Patil K, and Boving TB. 2016. **Mitigation measures for stormwater drain clogging and street flooding through best management practices: Case studies from India**. In *Proceedings of National Seminar on Avhaan-Making Construction Disaster Resilient*, February 26, organized by Government Polytechnic Panaji, Goa.
- Patil K, Boving TB, and D'Souza F. 2016. **Illustrating the potential of riverbank filtration technology: Case studies from Southern India**. In *Proceedings: International Conference on innovations in sustainable water and waste water treatment systems (ISWATS)*, Yashada, Pune, April 21–23, 2016, organised by India–EU Science and Technology Research Collaboration Projects.
- Sarkar SK and Rammohan MP. 2015. **UN Law can help India and China share Himalayan waters**. *SciDev.Net's South Asia desk*, May 15.
- Sarkar SK. 2016. **The water link to job creation**. *The Statesman*, March 7.
- Sarkar SK. 2015. **Will it be Teesta's turn next**. *The Statesman*, June 6.
- Sarkar SK. 2015. **Ground water management is critical**. *The Statesman*, September 17.
- Sarkar SK. 2015. **Way ahead for water security**. *The Statesman*, November 12.
- Sarkar SK. 2016. **Some distance travelled, but a long way to go**. *The Statesman*, January 20.
- Sharma Brij Mohan, Nizzetto Luca, Bharat Girija K, Tayal Shresth, Melymuk Lisa, Sanka Ondrej, Pribylova Petra, Audy Ondrej, and Larssen Thorjørn. 2015. **Melting Himalayan glaciers contaminated by legacy atmospheric depositions are important sources of PCBs and high- molecular- weight PAHs for the Ganges floodplain during dry periods**. *Environmental Pollution* 206: 588–596.
- Sharma BM, Tayal S, Chakraborty P, and Bharat Girija K. 2015. **Chemical Characterization of Rathong Chu Glacier Meltwater Vis-à-Vis Western Himalayan Meltwater Streams**. *Dynamics of Climate Change and Water Resources of Northwestern Himalaya, Society of Earth Scientists Series*, pp. 181–190. Springer.
- Sharma Brij Mohan, Bharat Girija K, Tayal Shresth, Larssen Thorjørn, Becanová Jitka, Karásková Pavlína, Whitehead Paul G, Futter Martyn N, Butterfield Dan, Nizzetto Luca. 2015. **Perfluorinated compounds (PFCs) in surface and ground/drinking water of the Ganges River basin: Emissions and implication for human exposure**, Environmental Pollution (Peer Reviewed).
- Tayal Shresth and Grover Sonia. 2015. **The need to create blue revolution**. PHD Chamber, December.
- Vaishnaw V, Mohammad N, Wali SA, Kumar R, Tripathi SB, Negi MS, and Ansari SA. 2015. **AFLP markers for analysis of genetic diversity and structure of teak (Tectona grandis) in India**. *Canadian Journal of Forest Research* 44: 297–306.
- Vir Sharma Jitendra, Gokhale Yogesh, Chauhan Suresh, and Tyagi Aparna. 2015. **Forest Right Act and climate change vulnerability: Impact on forests and forest dwelling communities in Maharashtra**. *India Forester* ***141***(12): 1230–1236.
- Zyadin Anas, Natarajan Karthikeyan, Chauhan Suresh, Singh Harminder, Hassan Kamrul, Pappinen Ari, and Paavo Pelkonen. 2015. **Indian farmers' perceptions and willingness to supply surplus biomass to an envisioned biomass-based power plant**. *Challenges* 6: 42–54.

CONFERENCES/SEMINARS/ PRESENTATIONS

Biotechnology and Management of Bioresources

- Kochar Mandira. 2016. **Global Biotechnology Summit**, Department of Biotechnology, February.
- Sure Sandeep, Torriero Angel AJ, Gaur Aditya, Li Lu Hua, Chen Ying, Tripathi Chandrakant, Adholeya Alok, Ackland M Leigh, Kochar Mandira. 2015. **Cyanobacterial Nanowires - Nature's Electric Nanotool**. International Symposium on Translational Research, Deakin University-TERI, December.
- Sure Sandeep, Torriero Angel AJ, Gaur Aditya, Li Lu Hua, Chen Ying, Tripathi Chandrakant, Adholeya Alok, Ackland M Leigh, Kochar Mandira. 2015. **Cyanobacterial Nanowires - Nature's Electric Nanotool**. EMBO | EMBL Symposium: New Approaches and Concepts in Microbiology, Heidelberg, Germany, October.
- Upadhyay A, Kochar M, Rajam MV and Srivastava S. 2015. **Zinc biosorption mediated by exopolysaccharide in plant growth promoting *Pseudomonas fluorescens* Psd . Rhizosphere 4**. Maastricht, Netherlands, June.
- Koul Vatsala, Adholeya Alok and Kochar Mandira. 2015. **Indole acetic acid biosynthesis and Nitric oxide metabolism crosstalk in *Azospirillum brasilense* SM**. 6th FEMS Congress, Maastricht, Netherlands, June.
- Deshmukh SK. 2015. Guest Speaker at "Natural Products From Endophytic Fungi For Pharmaceutical Uses" at **National Workshop on Cell and Molecular Biology** on September 21–22 at Centre for Scientific Research and Development, Peoples University, Bhopal.

- Deshmukh SK. 2015. **Why pharmaceutical industry should work on fungal endophytes**. Asian Mycological Congress, October 7–10, Department of Botany, Goa University, Taleigaon Plateau, Goa.
- Deshmukh SK. 2015. **Fungal endophytes: A potential source of bioactive compounds**. International Symposium on Translational Research, Deakin University- TERI, December.
- Deshmukh SK. 2015. **Designing the consortia for degradation of Phthalate and related aromatic compounds using fungal model** at National Conference on 'Fungal Diversity & their applications' on 11 & 12 December, Guru Nanak College of Arts, Science & Commerce, Mumbai.
- Samanta Sreeparna, Deshmukh SK, Barrow C, and Adholeya Alok. 2015. **Biomechanistic approaches for controlled Au and Ag nanoparticles biosynthesis**. TIIKM Second International Conference on Nano science and Nanotechnology, 2–4 September, Colombo, Sri Lanka.
- Bedi Ankita, Deshmukh SK, Barrow Colin, and Adholeya Alok. 2015. **Aspergillus terreus mediated bioleaching and nano-bioconversion of Jarosite waste material for development of novel Zn-Fe nanonutrient fertilizer**. International Symposium on Translational Research, Deakin University- TERI, December.
- Das M. 2015. **Attenuation of Se from soil through biological route**. Annual DIRI Symposium 2015, International Symposium on Translational Research, Deakin University- TERI, December.
- Samanta Sreeparna, Deshmukh SK, Barrow C and Adholeya Alok. 2015 **Biofilm Inhibition and Anti quorum sensing activities of biosynthesized gold nanoparticles (AuNPs)**, International Symposium on Translational Research, Deakin University-TERI, December.
- Choudhary Rita, Kong Lingxue, and Adholeya Alok. 2015. **Development of a novel formulation for seed coating with biologicals, fungicides and nanonutrients**, International Symposium on Translational Research, Deakin University-TERI, December.
- Aggrawal Shivankar, Deshmukh SK, Barrow Colin, and Adholeya Alok. 2015. **A cosmeceutical potential and biological activities of Marine Fungi Isolated From west coast and Island, India**, International Symposium on Translational Research, Deakin University- TERI, December.
- Minhas Amritpreet Kaur, Hodgson Peter, Barrow Colin J, Sashidhar Burla, Adholeya Alok. 2015. **The isolation and identification of new oil and carotenoid producing microalgal strains with biofuel potential**, International Symposium on Translational Research, Deakin University-TERI, December.
- Deshmukh SK. 2016. **Why pharmaceutical industry should work on fungal endophytes** at Second International Symposium on New Process & Application for Plants and Microbial Products on 1–2 March, TERI, India Habitat Centre, New Delhi, India.

Earth Science and Climate Change

- Mathur M, Sharma K, Parekh S, and Bisht A. 2016. **Modelling economic policies for sustainable consumption of natural resources: A system dynamics approach**. In Indian Society for Ecological Economics Conference at IISc Bangalore on the theme 'Urbanization and Environment': Review of MBBR models for treatment of Municipal and Industrial Wastewater, *EPCJ*, 19 (2).
- Muriki SK, Bhardwaj S, Madhusoodanan MS, and Kumar Sathish G. 2015. Scientific poster on **Diurnal variability of summer monsoon Rainfall in global forecast models** presented at TROPMET 2015: Weather and Climate Extremes, Chandigarh, 15–18 February. Available at <http://www.tropmet2015.org/mausam/tropmet2015/images/Technical%20Prog%20.pdf>

Energy Environment Technology Development

Biomass Energy Technology Applications

- Kalita P. 2016. **A critical review study: Waste materials to value-added products**, full paper accepted in National Conference on RENCON 2016, IIT Roorkee, February 12–13.
- Das P. 2015. **Densification of Biomass Energy by Conversion to Liquids** in the Session-"Frontiers in Refining & Petrochemical Technology" as invited speaker in the "India Oil & Gas Review Summit (IORS 2015) Summit", Mumbai, September 9–10.
- Raman P. 2015. **Importance of metrics, methods of measurement and equipment in evaluation of biomass cookstoves**. "2015' Forum of Renewable Energy Promotion in Developing Countries, (FREPDC), October 19–27, China Agricultural University, Beijing, China.
- Raman P. 2016. **Areas need to be focussed for making gasification as a viable technology for power generation**, Gasification India 2016, New Delhi, India, February 11–12.

Centre for Distributed Generation

- Stephen Richie, Sharma Arvind, Lakshita, Parmar Piyush. 2015. Paper on **A study of absorption correction in lighting products by an integrating Sphere**, Lux Pacifica 2015 Conference.

Environmental and Industrial Biotechnology

- Remediation and Biofuel Biomass Production Efficiency of Freshwater Algae in Textile Dye Wastewater. AMI Conference, December 9, 2015, Jawaharlal Nehru University, New Delhi.

- Bisht Varsha, Batta Neha, Lal Banwari and Subudhi Sanjukta. 2015. **Optimization and characterization of bioflocculant produced by Achromobacter sp Teri-N and its heavy metal adsorption activity.** The 56th Annual Conference of Association of Microbiologists of India (AMI) Jawaharlal Nehru University (JNU), New Delhi from December 7–10.
- **Isolation, purification and Characterization of photo - Hydrogen producing purple non-sulphur bacteria from brackish water, Chilika Lake, Odisha.** The 56th Annual Conference of Association of Microbiologists of India (AMI), Jawaharlal Nehru University (JNU), New Delhi, December 7–10, 2015.
- **Production of Lactic acid by a newly isolated Lactobacillus paracasei strain TERI D3**. 56th Annual Conference of Association of Microbiologists of India (AMI) Jawaharlal Nehru University (JNU), New Delhi, December 7–10.
- **Isolation and identification of lactic acid bacteria from camel milk at Association of Microbiology (AMI)**, Jawaharlal Nehru University, New Delhi, December 7–10, 2015.
- **Potential of natural biocide on control of microbial induced corrosion (MIC) in oil pipelines at Association of Microbiology (AMI)**, Jawaharlal Nehru University, New Delhi, December 7–10, 2015.
- **Development of a microbial process for methane generation from bituminous coal at thermophilic conditions at Association of Microbiology (AMI)**, Jawaharlal Nehru University, New Delhi, December 7–10, 2015.
- **Impact of bacterial diversity on viscosity reduction of heavy oil at New Horizon in Biotechnology NHBT 2015**, Trivandrum, Kerala, November 22–25, 2015.
- **Potential and application of thermophillic anaerobic bacterial consortium for enhanced oil recovery** at 6th World Congress on Biotechnology Conference, New Delhi, October 5–7, 2015.
- Lal Banwari and Subudhi Sanjukta. 2015. **Microbial-based remediation of oil spill & oily sludge: A sustainable approach for environmental protection from oil contaminants**. 15th EuCheMS International Conference on Chemistry and the Environment, September 20–24, Leipzig, Germany.
- **An Eco-friendly Solution for restoration of oil lakes and soil remediation**. Seminar organized at Jeonju University by our Korean partner, Jeonju University, Jeonju, Korea, August 25.
- Lal Banwari and Subudhi Sanjukta. 2015. **Dark fermentative hydrogen production by Clostridium butyricum TM 9A: Performance in pilot scale.** Accepted for presentation in The 2015 World Congress on Advances in Aeronautics, Nano, Bio, Robotics, and Energy, Incheon, South Korea, August 23–26.
- Lal Banwari and Subudhi Sanjukta. 2015. **Microbial enhanced oil recovery from stripper oil wells: Laboratory to field scale.** Accepted for oral presentation in The 2015 World Congress on Advances in Aeronautics, Nano, Bio, Robotics, and Energy, Incheon, South Korea, August 23–26.
- **Creating Innovative Solutions for a Sustainable Future: Bioremediation**. Indian Power Stations O & M Conference, New Delhi/Noida, February 13–15 2016.

Plant Biotechnology

- Kaushik Nutan, Kaur Harpreet, and Chaudhury Kanika. 2016. **Role of neem plantations in reducing global warming**, Global Neem Conference.
- Bhardwaj Daya and Kaushik Nutan. **Chormatographic fingerprinting: An emerging tool for quality control and chemo-taxonomy of medicinal plants and their drugs**. Proceedings of National Conference on Recent Trends in Instrumentation and Electronics (RITE-2015) 49-58.
- Kaushik Nutan. 2015. **Isolation of bioactive compounds of endophytic fungi from Indian medicinal plants**. Indo-Spanish Mini Symposium, April 16, New Delhi.
- Kaushik Nutan. 2015. **Sustainable agricultural practices for pest management to increase crop productivity**, UNESCO-CEEEW Meeting, New Delhi, October 8.
- Kaushik Nutan. 2016. **Role of neem plantations in reducing global warming**, Global Neem Trade Fair, Mumbai, February 26.
- Kaushik Nutan. 2015. **Endophyte screening from Indo-Spanish medicinal plants: Biotechnological green crop protectants**, 250th ACS National Meeting & Exposition, August 16–20, Boston, Massachusetts, USA.
- Kaushik Nutan. 2015. **Chemical characterization of Jatropha species collected under DBT network for identification of trees with high oil content and variable fatty acid profile**, DBT- Inter Ministerial Workshop on Biodiesel Feedstocks, July 23, New Delhi.
- Kaushik Nutan. 2015. **Prospecting of oil & deoiled cakes of *Jatropha curcas* L. and *Pongamia pinnata* L. for pesticidal activity**, 250th ACS National Meeting & Exposition, August 16–20, Boston, Massachusetts USA.
- Kaushik Nutan. 2015. **By-products of oilseeds (rape and mustard) in food applications**, presentation in Best from the Rest, IGC Conference, New Delhi, October 9.
- Kaushik Nutan. 2015. **Pest management in organic farming**, Organic farming, Ghaziabad, September 29, New Delhi.
- Kaushik Nutan. 2015. **Biopesticide for sustainable agriculture ITEC**, Gual Pahari, New Delhi, December 7.
- Kaushik Nutan. 2015. **Food Chain Reaction Game: Panel Discussion, Food chain reaction game**, Washington USA, February 11.
- Kaushik Nutan. 2015. **Biochemical analysis of fruit development and ripening of *Hippophae***

***salicifolia* of Sikkim Himalayas using GC-MS and HPLC**, 7th Conference of International Association of Seabuckthorn (ISA-2105), New Delhi, November 25.

- Kaushik Nutan. 2016. **bioprospecting of biodiversity for Biomolecules**. International Conference on Emerging Biotechnologies" 28th -30th Jan, 2016, Kakatiya University, Warangal, Telangana, India. Warangal, India, January 30.
- Kaushik Nutan. 2015. **Diversity of entophytic fungus in *Aquilaria malaccensis* and their potential in agarwood development by artificial infection**. Indo-Spanish Mini Symposium, April 16, New Delhi.
- Kaushik Nutan. 2015. **Chromatographic fingerprinting: An emerging tool for quality control and chemo-taxonomy of medicinal plants and their drugs** in the UGC sponsored National Conference on Recent trends in Instrumentation and Electronics. (RTIE 2015) organized by SRCASW, June 9, New Delhi.
- Kaushik Nutan. 2015. **Food chain reaction game**, Washington, USA, November 9.
- Kaushik Nutan. **Desert agriculture and sustainable agricultural technologies**. First KISR-TERI Joint Workshop on Research Cooperation, New Dehi, May 25.
- Kaushik Nutan. 2016. **Bioprospecting of endophytic fungi of Indian medicinal plants for their antifungal activity to harness their potential as biocontrol of plant pathogenic fungi**. 6th International Conference on 'Plant, Pathogens and People, February 24.
- Kaushik Nutan. 2015. **Antifungal and antifeedant activity of nano-biopesticide synthesized by Eucalyptus plant extract**, 250th ACS National Meeting & Exposition, August 16–20, Boston, Massachusetts, USA.
- Kaushik Nutan. **Fungal endophyte diversity and bioactivity in the Indian medicinal plant Ocimum sanctum Linn**. 250th ACS National Meeting & Exposition, August 16-20, 2015, Boston, Massachusetts USA, August 16.
- Kaushik Nutan. **Endophytes from Indian medicinal plants and their chemical diversity**, Indo-Spanish Mini Symposium, April 16, New Delhi.
- Kaushik Nutan. 2015. **Cooperation opportunities in desert agriculture and sustainable protected environment agriculture research**, KISR workshop, May 25, New Delhi.

Green Growth & Resource Efficiency

- Anand M. 2015. **Innovation and sustainable development for the bioeconomy**. Presentation made at the Regional Dialogue on S&T Policy in the context of Biotechnology towards Sustainable Development, Faridabad, December 30, organized by Regional Centre for Biotechnology, NCR Biotech Science Cluster.
- Deshpande Sarma S. 2016. **Agroecology: Cultivating sustainability in agriculture**. Presentation made at *ITEC*, 16 March, organized by TERI, Gurgaon.

Centre for Research on Energy Security

- National Energy Policy organized in collaboration with NITI Aayog, November 9, 2015.
- Conference on World Energy Outlook- India Special organized in collaboration with International Energy Agency and NITI Aayog.
- IHS Power-Coal Dialogue Asia Coal Market Outlook 2015 organized by IHS, June 2015.
- Energy Security Conference organized by CII, December 2015.
- North East Energy Summit 2015; Towards a Hydrocarbon Fuelled Economy, December 2015.
- World Energy Policy Summit, October 2015.
- Raisina Dialogue, February 2016.
- Workshop for Ethiopian Delegates from the Petroleum Downstream Operations Regulatory Directorate (PDORD); Ministry of Water, Irrigation and Energy (MoWIE); The Federal Democratic Republic of Ethiopia; at TERI, April 2015.
- Workshop on 'India Energy Outlook', 13 April 2015.
- Policy Roundtable on "Exploring demand side concerns for an energy secure India" on November 9, 2015, NITI Aayog.
- Workshop on the India Energy Outlook as part of the World Energy Outlook, 2015, on April 13, 2015, India Habitat Centre, New Delhi.
- ITEC Course on Energy Access and Human Development, September 7–25, 2015, Gual Pahari, Gurgaon.
- TERI University— Guest Lecture on Rural Energy Transitions, TU Campus.
- Presentation by Harish Sagar, Chief Manager (TL), Delhi Terminal, Bijwasan; Indian Oil Terminal at Bijwasan, Indian Oil Terminal, Bijwasan.
- Presentation by Vinod Kumar Sharma, Research Manager and S. Nandi, Dy. General Manager (FUELS), IOCL R&D Centre, Faridabad.
- Workshop for Ethiopian Delegates from the Petroleum Downstream Operations Regulatory Directorate (PDORD); Ministry of Water, Irrigation and Energy (MOWIE), The Federal Democratic Republic of Ethiopia, April 2015, TERI.
- Analysing Energy Risks in India: Review Workshop for the Department of Atomic Energy, TERI, March 2016.

Centre for Resource & Env. Governance

- Meenawat H. 2016. ITEC Lecture on governance of natural resources: Concepts and issues, March 8, TERI-Gual Pahari.
- Aggarwal V. 2016. Presented paper on Independent Regulation of Electricity in India, Research at a workshop organized by Institute of Water Policy on February 26–27, at the Lee Kuan

Yew School of Public Policy, National University of Singapore.

- Nayak BP. 2016. Presented Public Expenditure for Tiger Conservation in India: Effectiveness Concerns in Roundtable Discussion on Conservation Finance in India, February 24, TERI.
- Nayak BP. 2016. Eighth Biennial INSEE Conference on Urbanization and the Environment, January 4–6, Bengaluru, India.
- Nayak BP. 2015. Three-day Economic Sociology Conference on Trust in Transactions, November 16–18, Institute for Development Studies, Kolkata. Presented the paper 'Trust and Reciprocity among Urban Slum Dwellers in India: Experimental Findings from A Trust Game in Hyderabad'.
- Aggarwal V. 2015. Participated in the Annual International Growth Centre Conference (IGC): Energy and growth conference: Challenges and opportunities for developing countries held on November 9–10, London.
- Nayak BP. 2015. ISI Delhi and University of Gothenburg Policy Workshop on Environment and Development, November 2–3, India Statistical Institute Delhi, India. Presented a paper 'Public Expenditure for Tiger Conservation in India: Understanding the Trends and Linkages'.
- Nayak BP. 2015. Third International Open Data Conference 2015 and Pre-Conference Events, May 25–29, Ottawa, Canada.
- Syiemlieh JD. 2015. One-Day Programme on Environmental Law Practice, April 25, New Delhi, India.

Sustainable Habitat

- Bhalla Ankit, Guleria Tavishi, and Pathak Ashutosh. 2016. **Green building materials and technologies - A need for future green buildings of India**, at Emerging Building Materials and Construction Technologies, New Delhi, March 21–22.

Water Resources and Forestry

- Panandiker Ashwini. 2015. Presentation on 'Climate resilience component for Panjim city' at Stakeholder Workshop on Smart city proposal of Panjim, Organized by City Corporation of Panjim.
- Panandiker Ashwini. 2015. Presentation on 'Enhancing sectoral water-use efficiency in Goa', at State level workshop on Goa State's Water Policy.
- Panandiker Ashwini. 2015. Presentation on 'Sustainable technologies' at Teacher's training workshop organized by Damodar College of Law & Commerce, Margao, Goa.
- Panandiker Ashwini. 2015. Presentation on 'Water Conservation' at seminar for students organized by Institute of Ship Building Technology, Vasco, Goa.
- Panandiker Ashwini. 2015. Presentation on 'Hydrogeological investigations at watershed level' at training workshop organized by Central Ground Water Board, GoI, Goa.
- Panandiker Ashwini. 2015. Presentation on 'Water Resource Management' at training workshop for teachers from technical colleges organized by NITTTR, Porvorim, Goa.
- Panandiker Ashwini. Presentation on 'Enhancing sectoral water-use efficiency in Goa' at State level seminar on 'Towards a Green Goa: Economic Growth & Environmental Concerns' organized by Caculo College, Mapusa, Goa.
- Panandiker Ashwini. Presentation on 'Water Resource management and conservation' at seminar for students organized by MES College, Vasco, Goa.
- Giriyan Asha. 2016. Presentation on 'Agritechnologies and sustainable farming' at training programme on the Economy-Ecology Interface: Role of Sustainable Technologies and Practices' on February 2, organized by National Technical Teachers Training & Research Institute.
- Gaonkar Chetan. 2016. Presentation on 'Technological intervention in Marine Ecology' at Presentation at Training Programme on- 'The Economy-Ecology Interface: Role of Sustainable Technologies and Practices' on February 2, organized by National Technical Teachers Training & Research Institute.
- D'Souza Fraddry. 2016. Presentation on 'Marine resources conservation & technologies'. Training Programme on 'The Economy-Ecology Interface: Role of Sustainable Technologies and Practices' on February 2, organized by National Technical Teachers Training & Research Institute.
- Patil K. 2016. Presentation on 'Overview of sustainable water technologies- RBF and Storm Water Management'. Training programme on The Economy-Ecology Interface: Role of Sustainable Technologies and Practices on February 2, organized by National Technical Teachers Training & Research Institute.
- Patil K, Boving TB, and D'Souza Fraddry. 2016. Poster Presentation on 'From Polluted Rivers to Clean Irrigation Water'. Poster Presentation at inaugural programme on project on January 27, at Mandopa, Navelim, organized by TERI.

BLOGS

Green Growth and Resource Efficiency

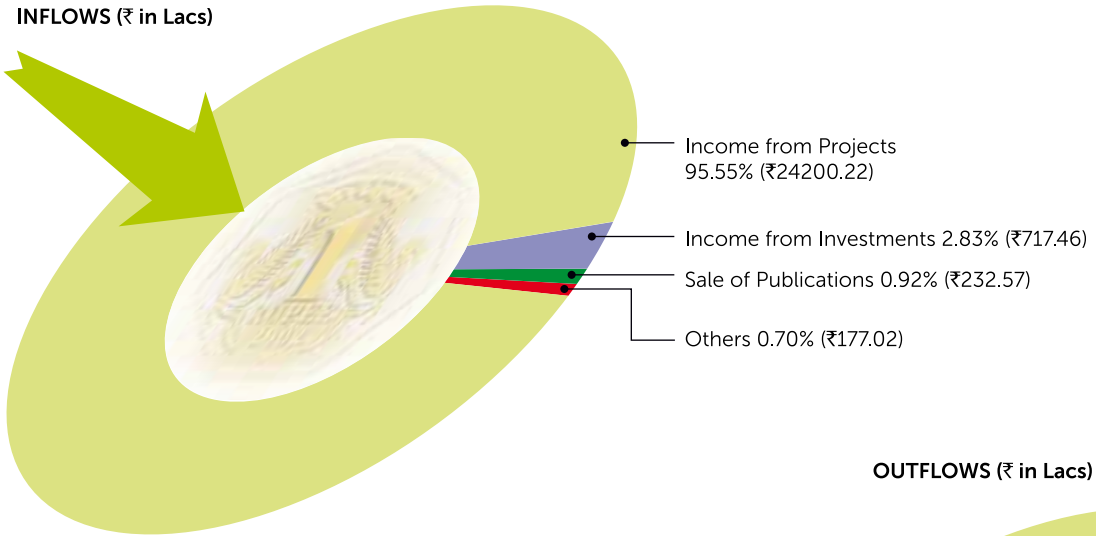
- Kedia, Agarwal, Goswami, and Radhakrishnan Ajith. **Can green growth interventions contribute to India's national policy vision?** Insights (Blog), Green Growth Knowledge Platform. Available at <http://www.greengrowthknowledge.org/blog/can-green-growth-interventions-contribute-india%E2%80%99s-national-policy-vision>.

9 Financial Summary

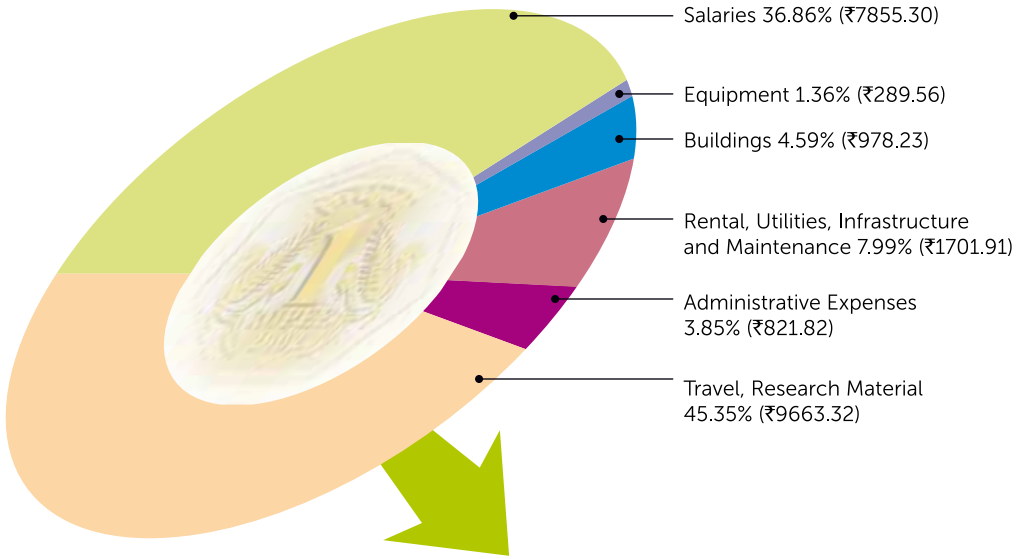
Financial Summary*

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.

INFLOWS (₹ in Lacs)



OUTFLOWS (₹ in Lacs)



* Please note that the figures mentioned against the inflows and outflows (₹ in lakh) are unaudited.

About TERI

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

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

Buoyed by more than 30 years of excellence in research and innovation, TERI is now poised for future growth, driven by a global vision and outreach, with a philosophy that assigns primacy to enterprise in government, industry, and individual actions.

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

Printed on recycled paper