

Energy Programme



The **Energy Programme** supports the transition of India's energy sector on the supply as well as the demand sides: by ensuring adequate, reliable, affordable, and sustainable supplies of clean and renewable energy and by developing and promoting energy efficient technological solutions for end-users.

Building on TERI's experience of nearly five decades in developing and promoting clean energy solutions across social and economic sectors in India, as well as other developing countries, the Programme forms strong and synergetic partnerships with a range of stakeholders—policy, institutional, financial, academia, industry, community—at every level, to maximize the effectiveness and sustainability of its initiatives.



Themes

The Energy Programme addresses issues and challenges related to energy transition and modelling, energy efficiency, and clean technology options, in the following thematic domains:

- Industrial Energy Efficiency
- Electricity and Renewables
- Energy Assessment and Modelling

Industrial Energy Efficiency (IEE)

The IEE division works with industry stakeholders—from shop floor to policy levels—to identify, develop, and promote clean (low or zero-carbon), energy efficient technological solutions. IEE works closely with the corporate sector and provides services to both large and small industries in terms of improving their energy and environmental performance.

Conducting studies to help decarbonize emissions-intensive, 'hard-to-abate' industrial sectors (like cement, iron and steel, chemicals, etc.) through technological and policy options, including adoption of new and innovative technologies like green hydrogen and electrification, is a recent focus area of the division.

Thrust areas and expertise

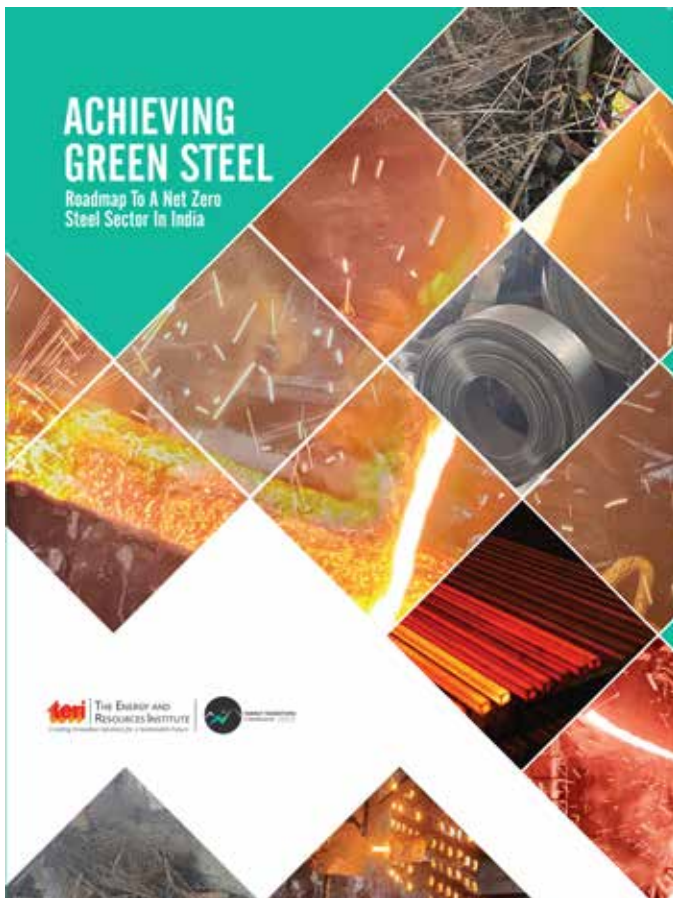
- Undertaking energy audits for Indian and international clients: large industries, power plants, commercial complexes, water pumping installations, among others
- Promoting energy efficient technologies (EETs) such as furnaces, pumps, motors, etc., and best operating practices (BOPs) in micro, small, and medium enterprises (MSME) sector; energy assessments at plant level, cluster level studies, implementation support, and the like
- Conducting in-depth analytical studies, technology assessments, and roadmaps for decarbonizing industrial sub-sectors
- Enabling awareness creation, knowledge sharing, and capacity building (workshops, conferences, training programs, newsletters, etc.)



Energy audit at Indorama Europort, Rotterdam, Netherlands

Recent accomplishments

- Energy audits were conducted for many large industries, including support for the Perform Achieve and Trade (PAT) scheme of Bureau of Energy Efficiency (BEE) via mandatory energy audits and verification audits of Designated Consumers.
- Energy and resource mapping studies were done for 10 MSME clusters in India: five each in the chemical sub-sector and glass & refractory sub-sector in India.
- Capacity building services and clean energy solutions provided for clients in countries like Guyana, Grenada, Cambodia, and other countries in the central Asian region.
- Undertook a detailed analysis on the potential role of green hydrogen in India
- Released a report titled '**Achieving Green Steel—Roadmap for a Net Zero Steel sector**' in 2022. Our analysis clearly highlighted that significant emission reductions can be achieved through technologies and measures that are available today, including energy efficiency and resource efficiency. Beyond these measures, it is important for India to start deploying deep decarbonization options like green hydrogen, electrification, and CCUS.



- Advocating for just transition through extensive field research/work
- Capacity building to promote the use of renewables and furnish a skilled workforce



Roundtable Discussion on Concentrated Solar Thermal Plants

Electricity and Renewables

The Electricity and Renewables division aims to continually build strong capabilities in the electricity and renewables sector and provides advisory services on technical and policy issues related to conventional as well as renewable energy sources, like solar PV, solar floating, solar thermal, wind, hydro, and green hydrogen.

Thrust areas and expertise

- Facilitating energy transition by promoting low carbon pathways through:
 - » integrated demand-supply studies at national and state levels
 - » storage solutions including pumped storage hydro, CSP, battery energy storage, hydrogen, etc.
 - » smart distribution with storage
 - » electric vehicles
- Promoting demand side management and smart grids
- Promoting solar PV, solar thermal products, and other applications through research, testing, development, third party inspection, and deployment
- Research and development in the field of smart grid, BESS, e-mobility, DSM & EE, mapping of demand and supply centres for potential green hydrogen opportunities in India, etc.
- Conducting policy and regulatory analyses in the field of renewables

Recent accomplishments

- In-depth studies exploring Indian electricity-mix scenarios up to 2030, at the national and state level were conducted.
- Pilot implementation of battery energy storage was carried out for managing distribution transformer overload, energy arbitrage, and virtual power plant, among others.
- Prepared a discussion paper on '**Pumped Storage Plants—Essential for India's Energy Transition**'.
- Prudence check of CAPEX for electricity transmission and distribution companies was carried out as part of the tariff revision process for a state Electricity Regulatory Commission.
- Capacity building programme for 500 senior officials of a power utility was conducted through 10 online webinars on topics such as: power sector scenario, power markets, GIS implementation in power utilities, etc.
- Developed a long-term vision roadmap and institutional framework for implementing '*One Sun One World One Grid*'.
- Successfully tested lightweight, flexible, low-cost third-generation thin film solar PV modules under Indian conditions.
- A draft national-level Just Transition framework has been formulated post extensive field work in the coal regions of India.

Energy Assessment and Modelling (EAM)

The EAM division provides policy inputs based on modelling related to the energy sector and its inter-linkage with the economy and the environment. EAM primarily works with national level energy modelling, as well as its related macro and socio-economic modelling. Various aspects of energy demand, energy supply, demand-supply interaction, energy trade, along with energy sector decarbonization and its impact on economy and environment are explored.

EAM provides inputs to various ministries and departments at the national level. The division also works closely with international partners and national/international corporate houses, focusing on the domain of national decarbonization strategies.

Thrust areas and expertise

- Forecasting alternative scenarios for decarbonization of the Indian energy sector:
 - » National and sector specific (energy consuming sectors like industry, transport, agriculture, residential, commercial, and power supply sector)
 - » Estimation of optimal energy-mix at various scenarios
 - » Estimation of total and sectoral emissions (CO₂ equivalent)
- Socio-economic impact assessment for decarbonization
- End-use demand estimation for major energy consuming sectors
- Studying cross-country energy trade and its implications

Recent accomplishments

- Completed a study on '**Renewable Energy Transition in South Asia: Role of Regional Energy Trade**' in collaboration with the Economic Research Institute for ASEAN and East Asia (ERIA). The study delves into the implications of regional energy trade on increasing the proportion of renewable energy consumption within the overall energy usage, or the shift away from fossil fuel-centric economies in South Asia. The study employed data from seven nations, using the Global Trade Analysis Project (GTAP) model to evaluate the consequences on economic growth



High-level panel discussion to discuss policy options for the Indian power sector

- and societal well-being within these analysed countries.
- Completed a study on '**Long Term Strategy for Low Carbon Development for India**' for Ministry of Environment, Forest, and Climate Change (MoEFCC). The study developed a roadmap for energy sector decarbonization in India, encompassing the specific role of different policies and end-use activities in various sub-sectors.
- TERI is a lead in the NITI Aayog India Climate Energy Modelling Forum Taskforce 1: Long Term Decarbonization.

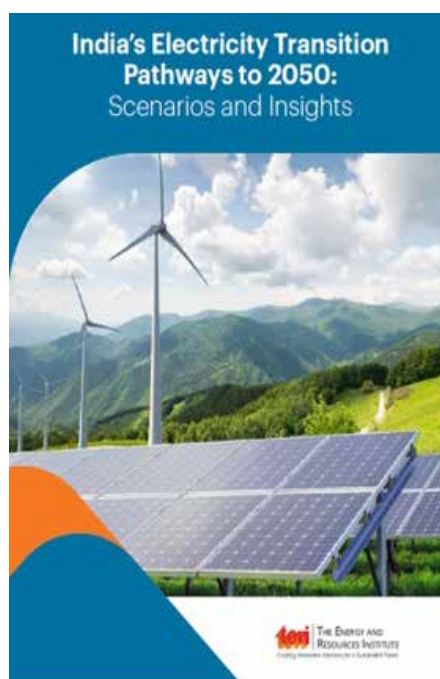
Impactful work

- Our discussion paper '**Roadmap to India's 2030 Decarbonization Targets**' examined the challenges and pathways to achieve the ambitious 2030 targets and suggested PSPs, CSPs, BESS, and hydrogen energy storage technologies as recommendations.



Release of 'Roadmap To India's 2030 Decarbonization Targets' discussion paper

- We conducted a study, titled: '**India's Electricity Transition Pathways to 2050: Scenarios and Insights**', to develop insights into the contribution of clean energy in the supply mix to meet the anticipated demand, role of various technologies, impact on system cost, emissions, etc.



- We have worked extensively with the Government of the Republic of Guyana to increase their energy efficiency and encourage adoption of clean energy systems for the past couple of years.
- We help state governments achieve their decarbonization targets. Our report, '**Low carbon pathways for the state of Madhya Pradesh**', for the Department of Energy, Government of Madhya Pradesh helped in discovering the least cost investment in new generation technologies and generation dispatch to meet the anticipated electricity demand in 2025 and 2030.

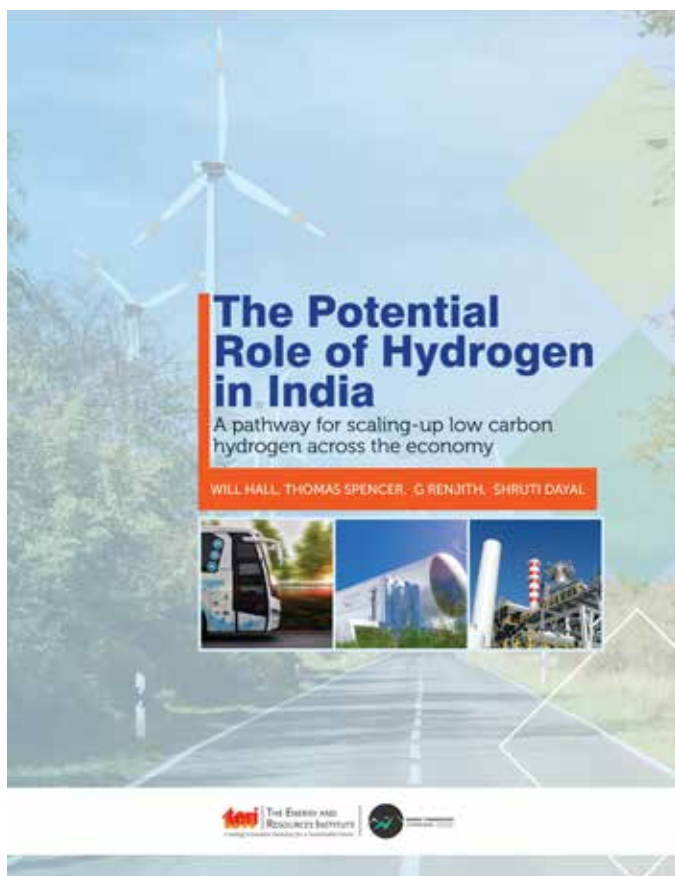


- A report, titled '**India transforming to a Net Zero emission energy system by 2030: A call to action to 2030**' was published in collaboration with Shell. What needs to be done in the sectors of power, transport, buildings, and agriculture till 2030, in order to achieve our eventual net zero target of 2070 was highlighted in this report.
- Our study in collaboration with SIMA (Small Iron Manufacturers Association) on '**Low carbon growth of Direct Reduced Iron (DRI) production in India**' explored the potential for hydrogen based DRI production and recommended policy measures and next steps to accelerate the transition.

- With the support of the West Bengal Transport Corporation, we also conducted a study on '**Accelerating Net Zero Transition of Public Transportation in Kolkata**' to develop a comprehensive understanding of charging infrastructure, technologies, financial models, and administrative measures needed to implement the transition to EVs in public transportation.
- '**The potential role of hydrogen in India-A pathway for scaling-up low carbon hydrogen across the country**' was the first comprehensive analysis on green hydrogen in India, published by TERI in 2020.



Just Transition fieldwork across the Eastern coal mining regions of India



- A report on '**Political economy of Net Zero: India**' was published, which stressed upon the importance of political will and synergies between central and state governments in India to achieve its net zero targets. Four key interventions to achieve energy sector decarbonization—namely, technology, just transition, access, and affordability and finance—were elaborated.
- We release a bi-annual Just Transition newsletter titled '**Vichar-Vimarsh**', that captures our work, reports released, as well as perspectives from other policy makers, researchers, and important stakeholders.

Way Forward

Mirroring the world's efforts to achieve net zero emissions, the Energy Programme will scale up its efforts, which are primarily focused on achieving **SDG 7** (Affordable and Clean Energy). Additionally, our work will also have an impact on **SDG 8** (Decent Work and Economic Growth), **SDG 9** (Industry, Innovation and Infrastructure), **SDG 11** (Sustainable Cities and Communities), and **SDG 12** (Responsible Consumption and Production).

On the supply side, our focus will remain on facilitating the growth of the renewable energy sector, including integration of various storage options; promoting new age

technological solutions like green hydrogen; and unlocking the vast potential of smart grid opportunities. Whereas, on the demand side, the Programme will continue its emphasis on the industry sector, which is the largest consumer of energy in the Indian economy. Integrated energy sector modelling at the national and regional levels will feed into and inform policy-making at national and state levels, as well as contribute to the international efforts around clean energy transition and greenhouse gas reduction.

TERI's Energy Programme also aims to expand on its existing efforts to promote clean energy solutions in other parts of the world, with a specialized focus on developing countries in Africa, Caribbean, and Asia.



Energy audit measurements by TERI teams

