

ANNUAL REPORT 2023-24



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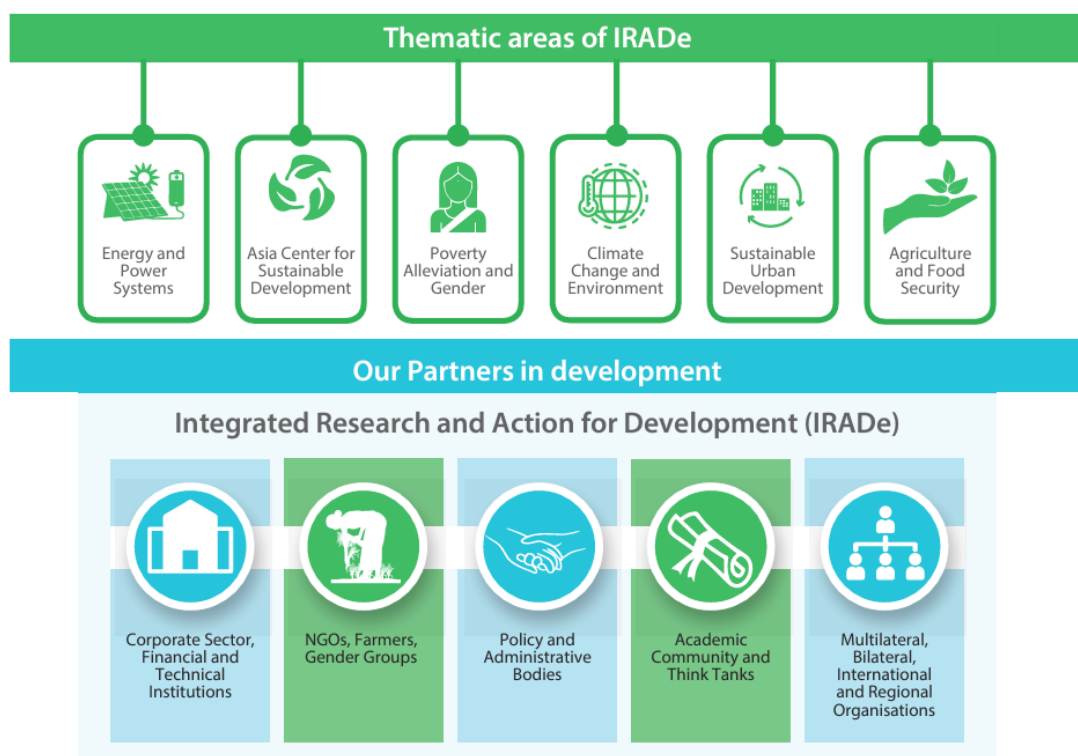


Dr. Anjana Das
Senior Advisor, IRADe

About IRADe

IRADe is an independent non-profit advanced research institute aimed at conducting research and policy analysis to engage stakeholders such as government, non-governmental organisations, corporations, academic and financial institutions. Energy, climate change, urban development, poverty, gender equity, agriculture, and food security are some of the challenges faced in the 21st century. IRADe's research covers these issues and the policies that affect them. IRADe focuses on effective action through multidisciplinary and multi-stakeholder research to arrive at implementable solutions for sustainable development policy research and effective

governance that considers techno-economic and socio-cultural issues. It also provides expertise to several ministries, national and international institutions, and partners with reputed organisations. IRADe was established under the Society's Act, 2002, in New Delhi. It is certified as a Research & Development Organisation by the Department of Scientific and Industrial Research (DSIR), Ministry of Science and Technology (MoST), Government of India. It has also been selected as a Centre of Excellence by the Ministry of Housing and Urban Affairs (MoHUA), Government of India, for urban development and climate change.



Our Vision

To be a leading global independent policy research think tank that provides and enables implementable policy solutions for sustainable and inclusive development.

Our Mission

To carry out policy analysis from multi-stakeholder and multi-disciplinary perspectives for decision-makers and vulnerable groups in the thematic areas of climate change and environment; energy and power systems; sustainable urban development; agriculture and food security; poverty alleviation and gender. This is accomplished using policy research and analysis, consensus building and dialogues, capacity building, and monitoring and evaluation.

Our Objectives

- Integrate multi-disciplinary and multi-stakeholder perspectives concerning issues of development
- Promote wider consensus on effective policies through research and analysis

- Engage and work at local, district, state, national, South Asia regional and global levels

- Provide research support to developing countries for development and the negotiation process for international agreements

- Conduct policy research that considers the political economy of the society and the effectiveness of governance

IRADe's activities in these areas encompass cross-cutting themes such as technology assessment and policy reforms. Key activities include:

1. Policy Dialogues and Dissemination
2. Training and Capacity Building
3. Research and Analysis for Decision Support
4. Research in Action, Monitoring, and Evaluation of Projects

From the Executive Director's Desk



We are pleased to present our Annual Report, highlighting our commitment to sustainable development through research, policy analysis, and stakeholder engagement. This year, we celebrated IRADe's 20th anniversary, culminating in a special dinner attended by esteemed guests including Dr Suman Bery, Vice Chairperson of NITI Aayog, and Shri Tarun Kapoor, Advisor to the Prime Minister. The evening featured a film showcasing IRADe's 20-year journey.

A standout event was IRADe hosting the T20/G20 workshop on "Challenges and Opportunities of Sustainable Energy Transition." The workshop contributed recommendations to Task Force 4 on "Refuelling Growth: Clean Energy and Green Transition." Over 300 participants from 32 countries, including officials from institutions like the World Bank Group, the Prime Minister's Office (PMO), Government of India, NITI Aayog, IPCC, IRENA, and the Secretaries from central and state ministries participated. We also launched the Festschrift titled "Axes of Sustainable Development and Growth in India: Essays in Honour of Professor Jyoti K. Parikh" during the event.

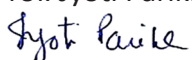
We also had the privilege to contribute to the International Solar Alliance (ISA)'s thematic event on "One Sun One World One Grid (OSOWOG)" at COP 28, Dubai. In the participation, our ADB-supported work highlighted the significant contributions of power and gas trade through regional connectivity in Asia. At the ADB meeting in Colombo, a major highlight was a session entirely devoted to IRADe's work on the BIMSTEC Electricity Grid Interconnection Masterplan.

Further, roadmaps were developed for the adoption of Zero Emission Vehicles and the progress of Green Hydrogen in India. We also made strides in crafting an economy-wide low-carbon pathway specific to India's challenges and opportunities. This involved evaluating fiscal policies supporting technology adoption for a Net Zero transition in the power sector and formulating long-term decarbonisation strategies for India's steel industry focussing on integrating hydrogen technologies.

Our initiatives in sustainable urban development included efforts to enhance disaster management guidelines and integrate community-led inclusive approaches to manage urban floods. We championed gender-sensitive heat action plans in South Asian cities to ensure resilience in the face of climate change impacts. IRADe also hosted Ms. Julie Delahanty, President of International Development Research Centre (IDRC), for a high-level policy roundtable discussing challenges of climate change and cities.

My heartfelt thanks to Prof. Kirit Parikh, Chairman of IRADe, and our governing council, collaborators, and partners for their unwavering support. I also thank Mr. Rohit Magotra, Ms. Neha Shukla, and Ms. Ananya Bhatia for their valuable efforts in producing this annual report. We look forward to your feedback as we continue our journey of innovation and impact together.

Prof. Jyoti Parikh



Executive Director, IRADe

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1 ENERGY & POWER SYSTEMS

1.1 Roadmap for Zero Emission Vehicles Adoption in India

IRADe is engaged in developing a Roadmap for Zero Emissions Vehicles (ZEV) adoption, projecting vehicle demand by type and assessing the impact of transitioning to ZEV in the transport sector on the economy and employment. The projection model is currently being fine-tuned; once completed, alternative strategies will be explored to develop a comprehensive roadmap.

We have estimated a national road transport model for India and projected mode-wise passenger and freight demand, mode-wise and fuel type-wise on-road vehicle stock and new vehicle sales, fuel-wise consumption, and emissions into the future up to 2070. The objective is also to assess the economic and social impact of ZEV adoption on automobile sector and other transport equipment and ancillary industries. To address this, the project has analysed the growth of employment indicators in the transport and road infrastructure sector. Further, the workforce engaged in servicing and repairing vehicles, encompassing transport and non-transport vehicles, has been studied to

assess the impacts of ZEV adoption on the economy and the workforce.

The sector comprised 5,910 factories (210 primary, 5,700 ancillary units) in 2019-20. The whole sector employed approximately 10.1 lakh people, of which 7.9 lakh were engaged in production and associated processes. More than 28 lakh workers were involved in servicing and repairing vehicles (two-wheelers, three-wheelers, motor vehicles) in 2022-23. The growth rates of these are summarised in the table below. Furthermore, a substantial workforce of more than 228 lakh workers was involved in servicing and repairing vehicles, including two-wheelers, three-wheelers, and motor vehicles, in 2022-23.

The project aims to guide policymakers and stakeholders towards a sustainable and equitable transition to zero-emission transportation systems through its multifaceted examination of transportation policies, demand dynamics, and labour market trends.

	Motor Vehicles	Ancillaries	2-wheelers
Factories	-0.41%	3.31%	-2.08%
Employees	6.03%	4.39%	4.92%
Workers	6.20%	4.41%	4.74%
Wages per worker	4.67%	7.11%	6.57%

Figure 1: CAGR (2010-11 to 2019-20) of Employment Indicators in the Motor Vehicle and Sector

Supported by: International Sustainable Energy Foundation (ISEF)

Duration: November 2022 - October 2024

1.2 Pathways for Green Hydrogen Development in India

The National Green Hydrogen Mission (NGHM) targets to build capabilities to produce at least 5 million tonnes (Mt) of green hydrogen per annum by 2030, with the potential to reach 10 Mt if there is an export market. Additionally, it aims to enable India to take technology and market leadership in the green hydrogen fuel chain.

An integrated least-cost modelling framework of the Indian power system and hydrogen fuel chain (using water electrolysis) analyses several scenarios for the development of the green hydrogen fuel chain and the power system that supplies electricity for final electricity demand (industry, residences, etc.) and hydrogen production, considering limited power generation resources over the time frame

2020-2070. It also assesses the maximum green hydrogen production potentials of the Indian power system at different prices.

The GRNGRIDH2 scenario considers a dedicated grid supplying green electricity from solar PV and wind plants coupled with battery storage to the electrolyzers. In contrast, the GRNSITEH2 scenario involves solar PV plants connected with battery storage supplying green electricity to co-located electrolyzers at the demand location. The NoH2BAU scenario is defined as the power system meeting only the final electricity demand, with no hydrogen production. Comparing the results of the hydrogen scenarios with those of the NoH2BAU scenario, the impacts on the power system (additional capacity,

investment, generation, technology mix, resource allocations) due to the introduction of hydrogen production are quantified.

Meeting the NGHM target of 5 Mt by 2030 requires an electrolyser capacity of 60-100 GW and 257 TWh of green electricity (Table E1). Compared with the NoH2BAU scenario, 9-10% more electricity needs to be generated in 2030 to meet the NGHM target. As green hydrogen demand grows, the additional electricity generation required increases even more significantly in subsequent years. Large hydro, nuclear, and renewable energy sources will supply the additional electricity requirement due to restrictions on new coal capacity, limited domestic gas availability, and high prices of imported gas. Alongside renewables, India needs to accelerate its nuclear power development, which has been slow in the past.

Comparing investments in power infrastructure (generation, storage, transmission, and distribution) to meet final electricity demand and hydrogen production, the GRNGRIDH2 scenario requires 29% (160 billion USD) more investment than

	Unit	2030	2050
Hydrogen demand/production target	Million tonne	NGHM target 5 Mt	28.7
Electrolyser capacity	GW	60-100	462-603
Green electricity	TWh	257	1320
Green power and storage	GW	150-155	Power 923-1075 GW; Storage 29 -114 GW
Investment:			
-Electrolysers	Billion USD	41-70	110-139
-Green power infrastructure	Billion USD	63-122	447-313

the NoH2BAU scenario during 2021-30. For the GRNSITEH2 scenario, the additional investment is 15%. Green hydrogen potential depends on the cost of H2 production and the availability (imposed upper limits) of green resources. The cost of green hydrogen production is higher in the GRNGRIDH2 scenario than in the GRNSITEH2 scenario. The hydrogen production cost for meeting the NGHM target in 2030 ranges between 4-5(+) USD/kgH2, and these costs are expected to decline over time.

Supported by: International Sustainable Energy Foundation (ISEF)

Duration: March 2023 - March 2024

Workshops:

1.2.1 Stakeholders' Consultation Meeting on Pathways for Green Hydrogen development in India (29th February 2024)



IRADe organised a stakeholders' consultation meeting, engaging the Ministry of New and Renewable Energy (MNRE), to present and discuss the outputs of the project "Pathways for Green Hydrogen Development in India." Mr. Ajay Yadav, Joint Secretary of MNRE, reiterated decarbonisation and digitisation as central themes, emphasising the strategic importance of electrolysis and green hydrogen in climate mitigation. Discussions focused on the role of green hydrogen in decarbonising sectors, scaling up renewable energy capacity, and integrating strategic policies to support hydrogen's growth.

1.2.2 Workshop on India's Green Hydrogen Supply Scenarios (17th August 2023)

IRADe organised a workshop on "India's Green Hydrogen Supply Scenarios," featuring experts discussing global trends in clean hydrogen, climate change urgency, India's green hydrogen potential, and the need for cost competitiveness. Dr. Anjana Das, Senior Advisor at IRADe, presented an



analysis on India's green hydrogen supply scenarios, covering electricity requirements, electrolyser technologies, investments, and export prospects. The workshop highlighted international collaboration, skilled workforces, integrated policy approaches, and hydrogen production infrastructure, with nearly 200 participants.

1.3 Development of an Economy-wide Low-Carbon Pathway for India

The project aims to chart a net-zero pathway for India by embracing clean technologies across various sectors. This involves leveraging a combination of macroeconomic and sectoral models, specifically IRADe's Macroeconomic, Power Systems, and Transport models. The Power Systems model, developed in TIMES MARKAL and utilising linear programming, optimises the long-term power system by considering 23 power-generating options currently or potentially available in India. This includes coal, gas, petroleum products, nuclear, hydro, and renewable technologies, aligning with forecasted electricity demand by the Central Electricity Authority (CEA). Under Reference and Net Zero scenarios, the model incorporates all planned future capacity additions under government policies.

Meanwhile, the India Transport Model is a tool in Microsoft Excel that projects long-term travel demand, analyses national transportation trends, evaluates emissions impacts from diverse low-carbon policy options, and formulates strategic plans for mitigating greenhouse gases and local air pollutants. The methodology used for the

estimation of parameters allows for the estimation of mode-wise transportation services, energy consumption, and emissions, and provides in-depth analyses for policy options. The model spans from 2015 to 2070, providing annual estimates for transportation activity, focusing on on-road vehicles.

The passenger and freight demand from the Transport model is shown below:

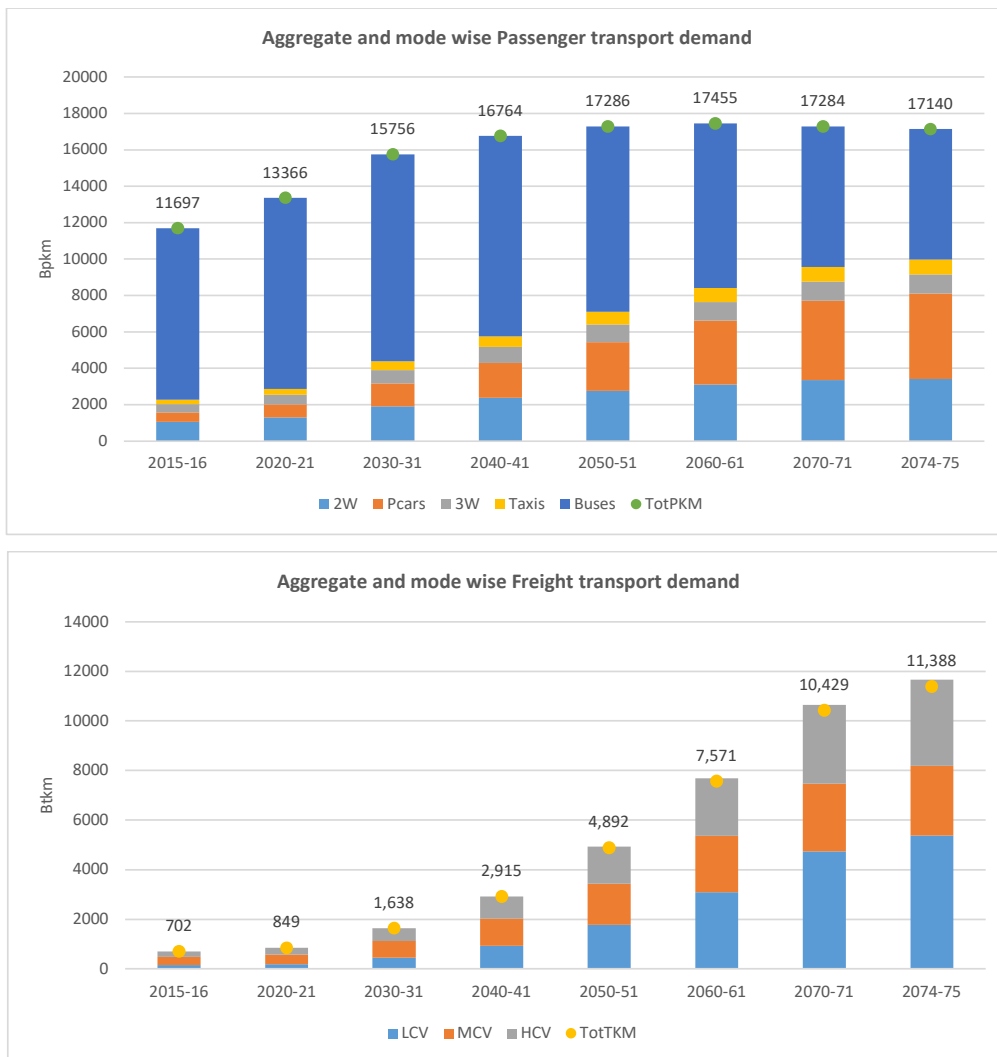


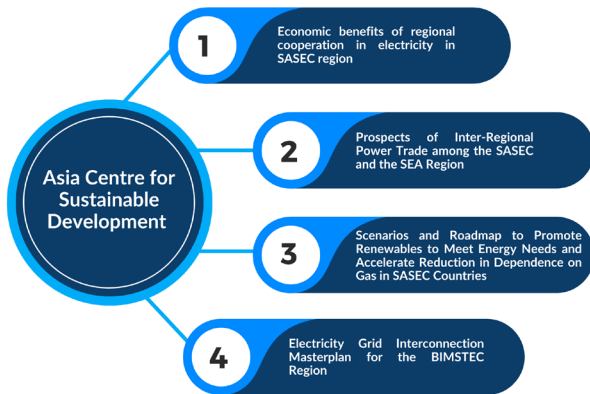
Figure 2: National Transport Demand Projection (IRADe’s Road Transport Sector Model)

The macroeconomic model integrates the results of these scenarios and assesses the impact on the economy, its GDP, and consumption by various consumer expenditure classes.

Supported by: International Sustainable Energy Foundation (ISEF)

Duration: March 2023 - December 2023

2 ASIA CENTRE FOR SUSTAINABLE DEVELOPMENT



IRADe works on sustainable development issues in South Asian Countries. We conduct policy research and its implementation for enabling socio-economic growth and chart pathways for sustainable development. Asia needs connectivity, common infrastructures, and cooperation mechanisms to achieve Sustainable Development Goals. Regional common perspectives require collaboration in several development areas like energy, infrastructure connectivity, climate change, agriculture, urban development, food security, and disaster management.

The Asian Development Bank (ADB) awarded four projects to address the issue of energy cooperation among the South Asia Subregional Economic Cooperation (SASEC)/ Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC) countries. These projects aim to strengthen cross-border energy trade through modelling-based results that provide

policy inputs for all involved stakeholders.

As these countries transition towards more integrated energy systems, the adoption of advanced economic modelling studies is crucial. The modelling results show that energy trade increases the contribution of hydroelectric power to South Asia's grid. In particular, they also indicate that energy trade can support the integration of renewable energy into the grid in the long term. Natural gas has a significant role in the medium term due to its fast ramp-up/ramp-down capabilities, efficiency, and relatively lower environmental impact compared to other fossil fuels.

Furthermore, the successful implementation of these projects hinges on the development of robust transmission infrastructure using various technologies like high voltage alternating current (HVAC)/ high voltage direct current (HVDC) for grid interconnections. The BIMSTEC Grid Interconnection Master Plan is the fourth project being executed by IRADe, which delves into this area, while also studying the generation and transmission Master Plans of the individual countries and their Grid Codes for harmonious interconnections. These elements are essential to facilitate seamless energy exchange and to ensure a reliable and sustainable energy supply across the region.

2.1 Study on Economic Benefits of Regional Cooperation in Electricity in SASEC Region

Electricity consumption is a crucial indicator of development and a necessary infrastructure for economic growth. The SASEC region experiences significant energy poverty with some of the lowest per capita electricity consumption globally. This study evaluates these SASEC countries, focusing on the implications of Cross Border Electricity Trade (CBET) for the power sector and the broader economy.

The Reference Energy System (RES) for the SASEC countries' power system is modelled using TIMES, a technology-rich, least-cost dynamic linear programming model that

simulates the energy system's operations. Conversely, the integrated SASEC model endogenously determines the direction, volume, and price of trade.

Several South Asian countries are shaping their electricity generation through policy initiatives. Bangladesh plans to import up to 30% of its electricity and allocate 23.25% of its annual oil input to Dual Fuel Power Plants. Nepal and Bhutan aim to exploit their hydro potential with targets of 26.53 GW and 42.133 GW, respectively. India is committed to achieving 50% non-fossil fuel-based capacity by 2030 with a focus on solar energy. The analysis compares two electricity trade scenarios in the SASEC region: Trade as usual (TAU), limited to 2017 trading capacity, and Accelerated Trade (AT).

Installed Capacity of SASEC Region

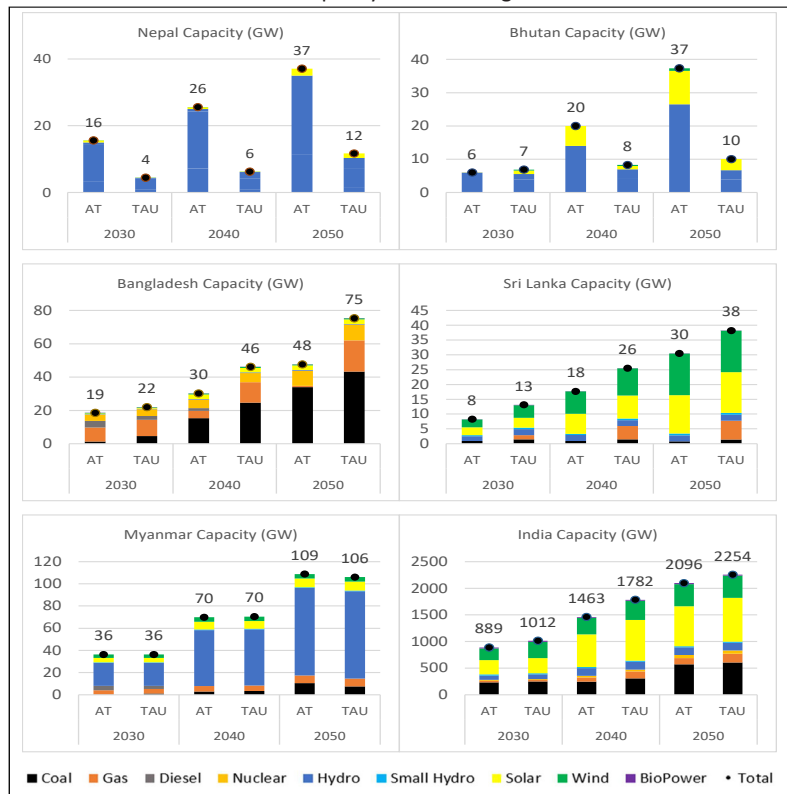


Figure 3: Installed Capacity of SASEC Region

CBET in the SASEC region reduces electricity demand for importing countries while increasing demand for exporting countries like Nepal and Bhutan. India transitions from a net importer until 2045 to a net exporter, with significant demand reduction up to 2045 in the AT scenario, which is approximately 60% lower from 2025 to 2045 compared to TAU. India's domestic final electricity demand eventually rises to approximately 7% higher than TAU in 2050.

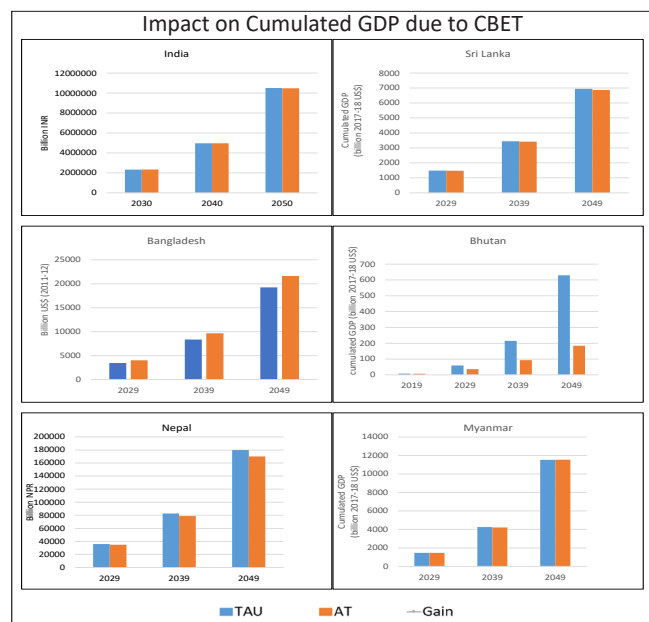


Figure 4: Impact on Cumulated GDP due to CBET

The CBET initiative within the SASEC region has significant effects on economies and power generation capacities across different countries:

Country	Demand Impact	Economic Impact
India	India's total capacity requirements moderately decrease to 889 GW (2030) and 2096 GW (2050), turning it into a net exporter by 2040-2045.	India's extensive power system sees a reduction in power capacity requirements by 14% and 46% in 2030 and 2050, respectively.
Bangladesh	CBET reduces Bangladesh's power capacity needs by 14% (2030) and 46% (2050). Per capita electricity consumption rises by 34 kWh/person (2030) and 147 kWh/person (2050).	With scarce domestic fossil fuels, these nations import electricity via CBET, relieving fuel import pressure.
Sri Lanka	Sri Lanka's power generation capacity decreases to 8 GW (2030) and 30 GW (2050).	
Nepal	Nepal experiences a surge in power capacity, harnessing 35 GW of hydro potential through CBET, which increases its GDP share from 19% to 28%.	
Bhutan	Bhutan's power capacity increases from 7 GW (2030) to 10 GW (2050) due to hydro run-of-river (ROR) projects. This boosts GDP share rising from 10% to 30% (2030) and 13% to 41% (2050).	Being hydro-rich nations, they gain capacity needs for power exports through CBET, primarily relying on hydro ROR capacities.
Myanmar	Myanmar's power generation capacity slightly rises to 91 GW (2045) and 109 GW (2050) due to CBET. Hydro depletion by 2050 leads to a shift from net exporter to importer.	Myanmar will shift to imports due to dwindling hydro potential by 2045.

Supported by: Asian Development Bank

Duration: March 2022 - September 2023

2.2 Prospects of Inter-Regional Power Trade among the SASEC and the SEA Region

IRADe, in collaboration with ADB, analysed the clean energy transition in the SASEC region and beyond through regional integration. The study explored the potential integration of South Asia and Southeast Asia. Integrating energy systems across these regions can help to reduce the

reliance on fossil fuels, stabilise prices, and make demand more elastic. Currently, both regions are at different levels of cooperation within and outside. In the SASEC region, BBIN is connected with 14 transmission lines trading 4,230 Megawatts (MW), which is expected to double and become trilateral soon. A small connection between India and Myanmar has been developed. Sri Lanka-India discussions are ongoing for developing undersea or overhead transmission lines for power trade. The total power trade (the total of either exports or imports) in the BBIN region in 2013 was less than 7 TWh and

already went up to 23 TWh by 2022. A long-term modelling exercise by IRADe showed that it could go up to 416 TWh by 2050 among all four countries. The BBIN region saves approximately 405 MT of annual CO₂ from the power sector by 2050. This change is primarily contributed by Bangladesh, as the country no longer has to establish coal or other fossil-based power.

To analyse the prospects of enhancing cross-border power trade between the SASEC and SEA regions, various drivers based on socioeconomic factors are examined. In the medium term, the present installed capacity (surplus/deficit), daily or seasonal load curves, price difference, time difference, and composition of power generation play a crucial role. However, in the long term, energy demand growth due to population growth, economic growth, urbanisation, availability of domestic resources, environmental and development goals, and investment in infrastructure are important. The electricity demand is expected to increase to 5,375 TWh and 5,465 TWh in the SA and the SEA regions respectively, as currently, they are both below the world average of 3,200 kWh/capita and are in a growing demand phase.

The SEA region is already interconnected through 26 transmission lines. A few additional interconnectors through Myanmar and Thailand are needed to connect both regions. Thailand, in turn, is connected to most of the SEA countries through 19 transmission lines. Recently, investment in renewable sources has been increasing, and power systems are gradually

transforming from fossil fuel-based to renewable energy (RE) power systems. More transmission linkages are needed to carry renewable power and develop power markets to ensure that the power supply is not curtailed due to a lack of ready buyers. Thus, intra-regional and inter-regional links must increase, and distribution systems need to strengthen to ensure that access to electricity increases for all in every country.

Supported by: Asian Development Bank (ADB)

Duration: March 2022 - September 2023

2.2.1 IRADe @ UNFCCC COP 28 in Dubai, United Arab Emirates (3rd December 2023)

Prof. Jyoti Parikh, Executive Director of IRADe, participated in COP28, Dubai as a panelist at the International Solar Alliance (ISA)'s thematic event on "One Sun One World One Grid (OSOWOG)." She highlighted regional connectivity in Southeast and South Asia, focussing on BBIN (Bangladesh, Bhutan, India, and Nepal).





IRADe’s modelling work indicated that BBIN and Southeast Asia could each evolve into large demand systems, of around 5000 kWh by 2050. This signals a need for a significant shares of renewables within the energy mix. She noted that cross-border trade leverages time, season, demand, resources, prices and costs. In the transition to renewable energy, connectivity and markets are crucial tools for maximising these benefits

2.2.2 IRADe’s Participation in the Workshop on Promoting Energy Cooperation in the SASEC Region in Colombo, Sri Lanka (4th–6th July 2023)

Prof. Jyoti Parikh, Mr. Pankaj Batra, Dr. Anjana Das and Dr. Probal Ghosh from IRADe attended the workshop organised by the Asian Development Bank and presented the final results of their consultancy studies.

Dr. Probal Ghosh highlighted the economic benefits of cross-border electricity trade, including impacts on aggregate and per capita GDP, household consumption, technological choices of generation, and reduction in power system costs for the participating countries in the SASEC

region. Dr. Anjana Das discussed scenarios for promoting renewables in the region through trade to replace natural gas in key gas-consuming sectors such as power, fertiliser and domestic sectors, and assessed the economic and environmental benefits/costs.

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2.2.3 IRADe’s Participation in Asia Clean Energy Forum (ACEF) organised by the Asian Development Bank in Manila, Philippines (13th-16th June 2023)



Prof. Jyoti Parikh and Mr. Pankaj Batra, Senior Advisor, IRADe participated in the Asia Clean Energy Forum (ACEF), organised annually by the Asian Development Bank (ADB). Prof. Parikh showcased IRADe's modelling work, supported by ADB, on intra-regional connectivity and highlighted that all countries benefit from electricity trade, and saves CO₂ emissions by increasing the shares of renewables in the energy mix. She further showed that if all 17 countries of South and Southeast Asia collaborate, the benefits would rise significantly. To achieve this, they need to strengthen institutions that can instil confidence in investors and reduce risks. Mr. Pankaj Batra moderated the session featuring representatives of South Asian countries who presented their country perspectives on regional grid cooperation

2.3 Scenarios and Roadmap to Promote Renewables to Meet Energy Needs and Accelerate Reduction in Dependence on Gas in SASEC Countries

The objective of this study is to assess the economic and environmental costs/benefits and develop a roadmap for replacing natural gas in the SASEC region with domestically produced or traded renewable electricity over the period 2020-2050. The economic and environmental impacts are assessed for power generation in the SASEC region as well as for non-power sectors (fertiliser and domestic sectors) in India and Bangladesh.

Using a least-cost regional power system model, the Reference scenario and Renewable scenario (including declining costs of emerging renewables and electricity

trade) are analysed. Key observations indicate that rapid exploitation of renewable resources in the region (including Nepal, Bhutan, Myanmar, etc.), supported by electricity trade, and would reduce both coal and natural gas consumption in the power sectors of India, Bangladesh, Myanmar, and Sri Lanka. A significant expansion of large hydro, solar PV, and wind onshore is projected for the region, with a substantial portion of electricity generated being traded. Investments on renewable power are expected to be significant, and electricity trade is forecasted to reduce electricity supply costs in the region (Figure 5).

Figure 5 highlights the financial aspects of these projections. The exploitation of renewables is expected to result in an 18% cumulative reduction in emissions.

Non-Power Sectors (India and Bangladesh):

In the Indian fertiliser industry, even at a cost of US\$ 2/kg for green hydrogen, replacing natural gas with hydrogen would impose additional costs. The viability threshold shifts favourably if the cost of green hydrogen declines to US\$ 1/kg by 2040. Bangladesh faces significant natural gas replacement requirements of 321 million m³ (mm³), 802 mm³, and 1604 mm³ in specific years, and economic benefits from green hydrogen become marginal only when its cost drops to USD 2/kg. Both countries stand to benefit from reduced CO₂ emissions through the application of green hydrogen, though urea production plants will need to procure CO₂ from other sources.

The projected natural gas demand for the domestic sector in India is 16.7 bcm, 24.5 bcm, and 30.3 bcm for the years 2030, 2040, and 2050, respectively. Replacing natural gas would require 119.8 TWh, 174 TWh, and 215.6 TWh of green electricity for those years. Transitioning to electric cooking at 0.05 cents/kWh could lead to significant cost savings for households, alongside substantial reductions in CO2 emissions. In Bangladesh, transitioning households with PNG connections to electric cooking at competitive prices (natural gas at 10 USD/MMBTU and green electricity at 7 BDT/kWh or 0.08 cents/kWh) could generate annual economic benefits of 327 million USD, 655 million USD, and 1,092 million USD in 2030, 2035, and 2040 respectively. This transition is also anticipated to reduce CO2 emissions by 7.2 million tonnes annually by 2040.

Supported by: Asian Development Bank (ADB)

Duration: March 2022 - September 2023

2.4 Electricity Grid Interconnection Masterplan for the BIMSTEC Region

IRADe has been commissioned by the Asian Development Bank (ADB) to develop an Electricity Grid Interconnection Masterplan for the BIMSTEC region, encompassing Bangladesh, Bhutan, India, Myanmar, Nepal, Sri Lanka, and Thailand. These countries form the Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation.

The primary objective of this project was to estimate the trading potential within the region and, based on these estimates, to

provide an optimal transmission plan for grid interconnections across the member states. This initiative aims to facilitate feasible trade by examining the policies and regulations governing cross-border electricity trade and promoting clean energy transitions in each country.

The project will also examine the existing national and cross-border transmission systems and planned developments up to the year 2040. It will outline a vision to add new interconnections and/or strengthen existing regional grid interconnections between and within the member countries. This strategic approach is designed to enhance regional energy cooperation and attract investment to make it a reality.

The High-level Grid Interconnection Master Plan was initially submitted in July 2023. After receiving feedback from the BIMSTEC countries and ADB, revisions were made, and the final draft High-Level Report was submitted to ADB. Subsequently, it was shared with the BIMSTEC countries through the BIMSTEC Secretariat.

The findings and recommendations of the report were disseminated at the BIMSTEC Grid Interconnection Masterplan Workshop on Cross-border Transmission Lines Optimisation, held from 18-20 February 2024 in Dhaka, Bangladesh.

Supported by: Asian Development Bank (ADB)

Duration: November 2022 - July 2024

Workshop:

2.4.1 BIMSTEC Grid Interconnection Masterplan Workshop on Cross-border Transmission Lines Optimisation; Dhaka, Bangladesh (18th-20th February 2024)

Mr. Pankaj Batra, Senior Advisor at IRADe, delivered a presentation on the critical aspects of the BIMSTEC Grid Interconnection Overview. He elucidated the key aspects

of the plan and fielded questions from participants. Subsequent workshop sessions were dedicated to presentations focusing on demand projection, planned generation, and transmission interconnections across the BIMSTEC Region, along with their verification by respective countries. The workshop welcomed representatives from all the BIMSTEC countries.



3 CLIMATE CHANGE & ENVIRONMENT

3.1 Assessing Fiscal Policies to Support Adoption of Technologies for a Net Zero Transition in the Power Sector using an Integrated Economy-Energy Model

In this study, IRADe has made significant enhancements to the MESSAGE-ix-based power system model in collaboration and consultation with International Institute for Applied Systems Analysis (IIASA). The model's projection period has been extended from 2015 to 2070, incorporating the latest data with updates to the input years and historic generation data until 2020. The capacity factors for renewable technologies—solar PV, solar thermal, offshore wind, and onshore wind—for each time slice have been integrated within the model's

Python input framework, streamlining the model's functionality. Furthermore, the model has been used to construct two distinct scenarios: The Reference Scenario, maintaining policy assumed until 2020 up to 2070, and the Net Zero Scenario, aligning with India's Nationally Determined Contributions (NDCs) targets. This involves achieving a minimum of 50% non-fossil fuel-based installed power generating capacity by 2030, aiming for an impressive 500 GW of non-fossil energy capacity (comprising large hydro, nuclear, and renewables), and adhering to a stringent carbon limit of 1.5 billion tonnes by 2070. These improvements are aligned with the targets and goals set by CEA and NITI Aayog to implement a net-zero pathway in India's power sector.

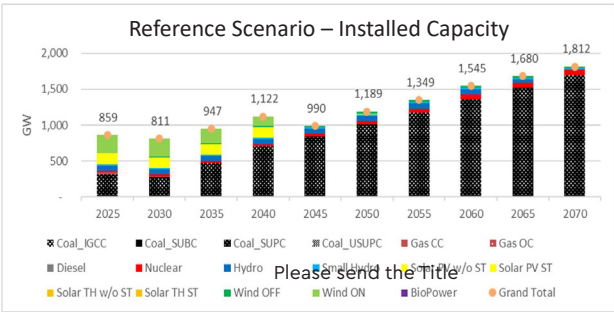


Figure 6: Reference Scenario – Installed Capacity

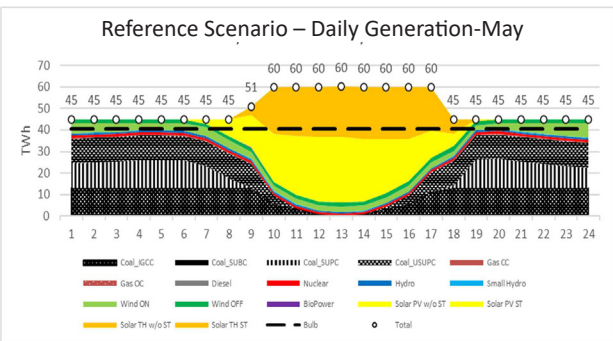


Figure 7: Reference Scenario – Daily Generation-May 2020

Supported by: European Union Climate Dialogues (EUCDs)

Duration: May 2023 – July 2024

3.2 Long-term Decarbonisation Strategies for the Indian Steel Sector with Hydrogen as an Option

With the partnership of the Federation of Indian Chambers of Commerce and Industry (FICCI), IRADe has undertaken a study to explore decarbonisation pathways for the Indian iron and steel industry, focusing on the role of green hydrogen. The Draft Vision 2047 aims to reduce the CO₂ intensity of the steel sector by 20% by 2030 and 50% by 2047. Two options for green hydrogen-based steelmaking technologies are considered:

1. Green hydrogen is produced on-site at the steel plant.
2. Green hydrogen is purchased from external green hydrogen suppliers.

By deploying Best Available Technologies (BAT) and enhancing scrap use in steel production, the target of 2030 can be achieved. However, meeting the 2047 target requires the deployment of green hydrogen-based steelmaking technologies starting from 2045. Despite these efforts, emissions from the industry are projected to reach almost 1 Gt by 2050.

To stabilise CO₂ emissions from steelmaking at 100 million tonnes by 2050 (STBL50 scenario) or 2060 (STBL60 scenario), the deployment of green hydrogen-based steelmaking technology needs to be advanced to 2035.

On average, 1 million tonnes of green hydrogen can produce about 13-14 million tonnes of crude steel. The green hydrogen demand, electricity, and electrolyser capacity in the two scenarios are presented in Table E1.

Supported by: Department of Science and Technology (DST), Government of India

Duration: April 2022 - September 2024

Table E1. Requirement of green hydrogen, electricity and electrolyser capacity for steel industry

Scenario	Unit	2035	2040	2050	2060	
STBL50	Green hydrogen	Mt	6.21	18	54	72
	Green electricity	TWh	280	821	2434	3237
	Electrolyser capacity (On-site only)	GW	40	40	40	40
STBL60	Green hydrogen	Mt	3	11	45	72
	Green electricity	TWh	132	512	2041	3237
	Electrolyser capacity (On-site only)	GW	19	18.786	19	19

4

SUSTAINABLE URBAN DEVELOPMENT

4.1 Policy Intervention for Enhancing Effectiveness of the Heat Early Warning Systems in India

IRADe initiated a project for enhancing the effectiveness of the heat early warning systems in India. The project aims to enhance the effectiveness of the heat early warning systems as a critical adaptation measure to increase the preparedness and management of health systems to reduce morbidity and mortality in the wake of increasing geography, number, and duration of heat wave events in India.

Heat Stress Index is proposed to be designed, tested, and developed through this project for selected locations, focusing on vulnerable communities.

Further, the policy solutions adopted through heat action plans will help safeguard the lives of citizens, particularly vulnerable groups (low-income groups), who are negatively impacted by heat waves. The project aims to support the Government of India's efforts in achieving climate adaptation goals through policy awareness for improving heat early warning systems that are climate-adaptive at both the national and sub-national levels. Additionally, the project aims to enhance the systemic capacity of disaster management agencies for heatwave management.

Supported by: International Sustainable Energy Foundation (ISEF)

Duration: February 2024 to July 2025

4.2 Supporting India's National Disaster Management Guidelines by Developing Community-led Templates for Managing Urban Floods

IRADe, in collaboration with the Mahila Housing Trust (MHT), worked to support India's National Disaster Management Guidelines by developing community-led templates for managing urban floods.

Key stakeholders in urban flood management, including vulnerable communities, disaster management authorities, local governments, NGOs, and community representatives, were identified. The project focused on two cities: Jodhpur in Rajasthan and Ahmedabad in Gujarat. Two structured questionnaires were prepared and pilot-tested for residents of selected flood-prone areas and the municipalities governing these areas.

Interviews were conducted with vulnerable communities in six flood-prone locations in Ahmedabad and Jodhpur. Key informant interviews with government representatives from various departments were also carried out in both cities.

An in-depth review of existing literature and guidelines for flood management was conducted to identify strategies for effective urban flood disaster management. The project provided policy recommendations to address gaps in the current urban flood management guidelines.

A framework for preparedness, response, recovery, and mitigation was developed for pre-, during, and post-floods in the project cities. The community-led, inclusive urban flooding framework and templates were designed to help address the specific needs, vulnerabilities, and strengths of the

communities and build resilience to future flooding events. The templates developed through this project align with India’s national disaster management guidelines and are tailored to the specific needs and capacities of the communities.

Framework for Vulnerable Community focused Urban Flooding Action Plans			
PREPAREDNESS	RESPONSE	RECOVERY	MITIGATION
<ul style="list-style-type: none"> • Mapping flooding hotspots • Vulnerability Mapping • Notification of vulnerable wards • Ward wise Flooding modelling • Flood Severity Classification– yellow, orange & red • Rescue routes notification • Prioritise DPRs for construction, repair and maintenance • Prioritise DPRs for construction, repair and maintenance • Capacity Building – Mock drills for rescue and action • Sensitisation plan for vulnerable community: awareness & training • Constitute Ward level committees • Cleaning of drains and nullah • Seasonal Monsoon forecasts • Harmonised structures to clearly assign roles of ULBs 	<ul style="list-style-type: none"> • Provision of relief material– food, water, medicines • Vulnerable groups specific campaigns focused on women • Information provision on response and entitlement • Installation and provision of dewatering pumps • setting up relief camps, shelters for affected, helplines 	<ul style="list-style-type: none"> • Restoration of power, water supply. • Insurance and claim settlements • Inclusion of vulnerable groups in the committees for compensations • Deaths should be compensated • Public Health campaigns by Medical Centres • Documentation of flooding impacts, loss and damages 	<ul style="list-style-type: none"> • Clearance of damage assessment reports made by tehsildar • Investments in infrastructure • Inclusive flood management plans • Strengthening Early warning systems • Budget provisions for vulnerable wards • Detailed project reports for the areas. • Mapping of wetlands and systematic efforts to preserve and maintain them

Figure: Framework for Vulnerable Community-Focused Urban Flooding Action Plans

Supported by: Adaptation Research Alliance (ARA), UKAID

Duration: September 2023 to February 2024

Workshops

4.2.1 Stakeholders' Consultation on Strengthening Vulnerable Community-Focused Policy Guidelines & Action Framework for Urban Flooding in India (12th December 2023)

IRADe and Mahila Housing Trust (MHT), with support from The Adaptation Research Alliance and UK Aid, co-organised a stakeholders' consultation on urban flood resilience. The consultation featured expert-led discussions on effective strategies for resilient cities, inclusive policy perspectives, and proactive community engagement in policy shaping. It highlighted the tangible impacts of flood resilience on daily life, health, and income, particularly for vulnerable groups. Experts provided insights into policy formulation addressing the needs of these communities, emphasising collaborative approaches and innovation. The proceedings document with policy recommendations was also prepared, emphasising defining urban flooding comprehensively, incorporating nature-based solutions, and promoting collaboration among stakeholders, including vulnerable groups like women. Nature-based solutions like rooftop rainwater harvesting, green roofs, and permeable roads were emphasised for sustainable urban planning.

4.2.2 National Workshop on Integrating Vulnerable Community Inputs for Inclusive Policy Design and Action for Urban Flooding (28th February 2024)

IRADe and MHT co-organised a national workshop highlighting policy gaps in



urban flooding guidelines and advocating for inclusive urban flooding frameworks incorporating community perspectives and resilience-building initiatives to tackle urban flooding challenges effectively. It advocated for inclusive urban flooding frameworks, community-led templates for flood management, and decentralisation with community participation in policy-making. Emphasis was placed on preserving natural catchments, ecological balance, and integrating disaster management into city planning. Proactive disaster response, sustainable development practices, and inclusive infrastructure design were highlighted. The discussion also underscored the necessity of comprehensive urban flood guidelines, capacity-building, and disaster management integration into urban development planning.

4.3 Integrating Heat Action Plans in Climate Policy and Guidelines for Evolving Gender-sensitive Heat Adaptation Plans in Cities in South Asia

IRADe developed climate-adaptive and gender-integrated heat action plans collaborating with municipal corporations in Colombo (Sri Lanka), Rajshahi (Bangladesh) and Surat (India). The project engaged with key decision-makers and stakeholders to evolve and disseminate knowledge, build

stakeholder capacity, and support cities in developing administrative capacity and increasing awareness among policymakers.

The Gender-Sensitive Heat Action Plan (HAP) for the project cities address heat stress through a gender-inclusive lens. The plan emphasises gender disaggregated data collection, stakeholder consultations, and the development of targeted strategies and implementation protocols, prioritising gender-specific considerations at every stage. Monitoring and evaluation phases establish protocols for gender-specific tracking and regular reviews, ensuring continuous improvement and responsiveness to stakeholder feedback for an effective and evolving Gender-Sensitive HAP.

The project established gender-specific impacts of heat stress, developed technical and institutional capacities for gender-sensitive heat adaptation plans, and implemented climate adaptive frameworks in South Asia, fostering preparedness of the municipalities for heat mitigation and adaptation.

Supported by: Asia-Pacific Network for Global Change Research

Duration: October 2021 - September 2023

Workshops:

4.3.1 Training for Trainers Workshop on Gender-Sensitive Heat Action Plans for Colombo, Sri Lanka (27th September 2023)

SLYCAN Trust and IRADe organised a hybrid workshop focusing on incorporating adaptive resilience into climate-resilient smart cities



across Sri Lanka, India, and Bangladesh, with an emphasis on gender-sensitive heat adaptation plans. Mr. Rohit Magotra, Deputy Director of IRADe, presented the Gender-Sensitive Heat Action Plan, highlighting early warning systems, public awareness, and adaptive measures. Participants underscored knowledge gaps among Colombo residents regarding climate change and heat stress risks, emphasising the need for targeted educational efforts. SLYCAN Trust presented a vulnerability assessment for the Colombo Municipal Council area. The workshop also discussed a detailed framework for gender-integrated heat action plans and launched a step-wise training module in local languages for stakeholders' capacity building.

5 POVERTY ALLEVIATION & GENDER

5.1 Role of Decentralised Renewable Energy (DRE) Technology in Promoting Quality School Education

Role of DRE Technology in Promoting Quality School Education in Bihar

PR Number: IRADe-PR-103(2023)

IRADe conducted a comprehensive survey across 90 government-run schools (Primary, Upper Primary, and Higher Secondary Schools) in Bihar and Jharkhand (45 per state spread across 15 blocks from 3 districts in each state) to assess school infrastructure, electricity access, and the impact of Distributed Renewable Energy (DRE) on educational quality.

Through structured questionnaires administered to the teaching staff, as well as

semi-structured group discussions and other observations, the following observations emerged:

- In Bihar and Jharkhand, 62% and 84% of schools report sufficient water supply, 93% and 64% have separate toilets for girls.
- Power disruptions occurred for 8-9 hours and 10-12 hours per week in Bihar and Jharkhand, respectively, with voltage fluctuations by 46%-60% and 60%-80% of the schools.
- Diesel generator (DG) sets as backup power were available in only 20% and 60% of higher secondary schools in Bihar and Jharkhand.
- Daylight illumination in classrooms and

Role of DRE Technology in Promoting Quality School Education in Jharkhand

PR Number: IRADe-PR-102(2023)



other rooms was assessed using a "LUX" meter, revealing that all facilities had illumination levels below the minimum prescribed. Primary schools mainly used inefficient incandescent tube lights and older fans, while upper primary and higher secondary schools had better facilities but still showed significant potential for energy efficiency improvements in both states.

- For mid-day meals, 67% of upper primary schools and 20% of primary schools use

only LPG for cooking in Bihar, while 53% of primary schools use a mix of LPG and wood, and 27% rely solely on wood. In Jharkhand, over 87% of primary schools and 73% of upper primary schools use LPG.

Operational support, regular maintenance to prevent system failures, clear installation standards, comprehensive training for school staff, procurement standards, and energy-efficient appliances are recommended.

Supported by: New Venture Fund, USA

Duration: December 2021 to May 2023

IRADe 20th Anniversary Celebration: An Evening Celebrating Two Decades of Impact; 30th October 2023



IRADe celebrated its 20th Anniversary with a memorable reception dinner at the India International Centre (IIC) on 30th October 2023. This special occasion provided an opportunity to reflect on our achievements and share our journey with a gathering of members, collaborators, and decision-makers pivotal to our success.

The event began with a heartfelt welcome by Prof Kirit Parikh, Chairman of IRADe, who highlighted the institute's significant milestones and future aspirations, including the necessity of differentiating policy at the local level through various action plans.

Shri Tarun Kapoor, Adviser to the Prime Minister, delivered a keynote address, stating that in the last decade, energy growth



has been around 10%. He emphasised that while 24% of the grid currently comprises renewable energy, this must increase to 50% within the next ten years. He highlighted IRADe's crucial role in shaping sustainable policies and practices, pivotal for achieving these goals and advancing green technology adoption in energy sector.

Prof Jyoti Parikh, Executive Director of IRADe, presented a comprehensive progress report and emphasised the significant impact of IRADe's studies on climate change, which

have helped the government set targets in the Paris Agreement. She noted IRADe's role in promoting energy trade among South Asian countries such as Bangladesh, Bhutan, Nepal, and India.

Our Council Member, Prof Deepak Nayyar, Emeritus Professor of Economics at Jawaharlal Nehru University, shared a special address and reflected on the institute's contributions to economic research and sustainable development goals. The esteemed Chief Guest, Shri Suman Bery, Vice Chairperson of NITI Aayog, provided valuable perspectives and insights for the path forward, highlighting the importance of continued innovation and collaboration in the fields of climate change, sustainable development, and energy transition.

Mr Suresh Prabhu, Council Member, IRADe, and former Union Minister, Government of India, also graced the occasion. The celebration was a harmonious blend of reflection, gratitude, and anticipation for the institute's future journey at the intersection of climate change, sustainable development, and energy transition.

IRADe 20-Year Journey: A Cinematic Celebration of Impact and Innovation



20 YEARS JOURNEY OF ACTION & RESEARCH

IRADe unveiled a film that encapsulates our remarkable 20-year journey. This release coincides with our joyous celebration of the 20th anniversary, highlighting our journey through two decades of impact and innovation. The film beautifully captures pivotal moments, significant achievements, and the inspiring individuals who have played pivotal roles in shaping our mission dedicated to sustainability and positive change.

T20/G20 workshop on Challenges and Opportunities of Sustainable Energy Transition, New Delhi (04th July 2023)



IRADe hosted a hybrid T20/G20 workshop under Task Force 4 on “Refuelling Growth: Clean Energy and Green Transition.” The event attracted over 300 participants from 32 countries, including representatives from national governments of G20 countries, think tanks, research institutes, development agencies, and civil society.

The panel comprised senior representatives from the Prime Minister's Office, Government

of India, Bureau of Energy Efficiency (BEE), International Renewable Energy Agency (IRENA), World Bank, UNESCAP, Economic Research Institute for ASEAN and East Asia (ERIA), TERI, International Energy Agency (IEA), Imperial College London, Columbia University, and other Indian government officials. They provided policy-level insights on strategies for sustainable energy transition.

The workshop facilitated robust discussions on the key challenges and opportunities of sustainable energy transition, and the necessary strategies and policies for an accelerated transition. Key issues faced by both developed and developing countries for Just Transition were discussed. Significant insights included the necessity for each country to have a unique path to energy transition. The energy transition working group highlighted five key sectors and pillars for energy efficiency: Buildings, Industry, Transport, Appliances, and Behavioural Change technologies. These should be developed jointly or considered as global public goods to ensure accessibility. The discussions emphasised that attention should not only be on large, financially supported countries but also on others. A lifecycle analysis of the Energy Transition is crucial, considering the social implications of the whole process.

Key Recommendations for Sustainable Energy Transition from the T20/G20 Workshop:

- **Tailored Energy Transition:** Develop unique energy transition pathways for each country, ensuring inclusivity, energy security, and fairness, with a focus on clean coal technologies in the medium term.
- **Industrial Decarbonisation:** Prioritise electrification of industrial processes, expand biomass energy solutions, and scale efficient technologies.
- **Regional Energy Sharing:** Promote cross-border electricity grid connections to aid energy transition in smaller nations and reduce storage costs.
- **Renewable Energy Investment:** Increase investments in renewable energy in regions expecting rapid energy demand growth, by lowering capital costs in developing nations.
- **Access to Technology and Finance:** Ensure affordable technology and finance for developing countries, utilising public funds to attract private investments.
- **Local Supply Chain Development:** Enhance local manufacturing of renewable energy equipment to reduce import reliance and protect employment.
- **Institutional Framework for Transition:** Establish national and provincial institutions to guide a just energy transition, adopting a modular approach.
- **Building Consensus:** Achieve consensus among stakeholders and provide federal support for provincial governments to facilitate tailored energy transitions.
- **Energy Efficiency Emphasis:** Focus on energy efficiency measures, particularly in buildings and cooling systems to reduce energy demand.
- **Green Hydrogen Advancement:** Support the development and integration of green hydrogen in transport and industry.
- **Demand-Side Management:** Emphasise demand management strategies to achieve net-zero goals.
- **Financing Diversification:** Mobilise private finance for clean energy through policy reforms, increased concessional finance, new financial instruments, and the strengthening of local financial markets, particularly in emerging economies.

Axes of Sustainable Development and Growth in India Essays in Honour of Professor Jyoti K. Parikh



We are delighted to highlight the launch of the book "Axes of Sustainable Development and Growth in India: Essays in Honour of Professor Jyoti K. Parikh". Edited by Prof. Piyush Tiwari, Professor of Property, Melbourne School of Design, University of Melbourne, Melbourne, Australia, and Prof. Kirit Parikh, Chairman, IRADe, and published by Springer Nature, this remarkable collection of essays celebrates the illustrious career of Prof. Jyoti K. Parikh. The book's release was a significant event during the T20/G20 hybrid workshop on "Challenges and Opportunities of Sustainable Energy Transition." It was officially launched by Shri Tarun Kapoor, Adviser to the Prime Minister of India, Government of India, and Mr. Auguste Tano Kouamé Country Director for India, World Bank.

The book features contributions from her students, colleagues, prominent academics and practitioners, who had the privilege of working directly with her at Indira Gandhi Institute of Development Research, (IGIDR), Mumbai and IRADe Delhi at different stages of their professional careers. These contributors are now spread across institutions such as

the University of Melbourne, the World Bank, the Asian Development Bank (ADB), Indian Institutes of Technology (IITs), Indian Institutes of Management (IIMs), IGIDR, Indian Institute of Science (IISc), and IRADe.

The genesis of these essays lies in the influential work of Prof. Parikh conducted over the past 60 years in the realms of energy access and policy, climate change, and sustainable development nationally and internationally. The analytical rigour and policy orientation have been the hallmark of Professor Parikh's work, which is also defining feature of chapters by her students and colleagues.

The essays in the book are distributed across six parts: briefly energy transition, climate change, energy and women empowerment, efficiency of firms, sustainable urban development, quality of growth and human development. The book concludes with a compilation of her publications, national and international appointments.

Prof. Jyoti K. Parikh is the Executive Director of IRADe. She was a Member of the Prime Minister's Council on Climate Change—India and is a recipient of Nobel Peace Prize awarded to IPCC authors in 2007. She served as the senior professor and Acting Director at IGIDR, Mumbai 1986-03. at the International Institute for Applied Systems Analysis (IIASA), Austria, for eight years (1980-86, 76-78), and as a senior energy consultant at the Planning Commission, New Delhi (1978-1980).

We at IRADe are proud to celebrate Prof. Jyoti Parikh's monumental contributions and look forward to her continued influence on policies and praxis related to sustainable development worldwide.

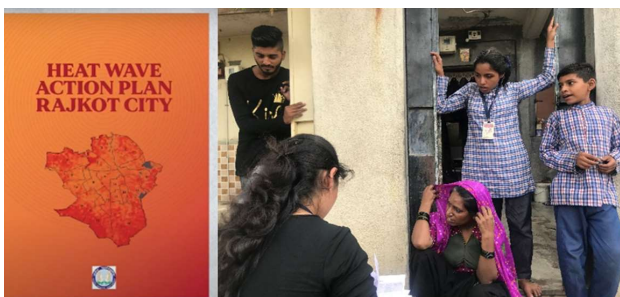
IRADe Joins India Universities and Institutions Network for Disaster Risk Reduction (IUNDRR)

IRADe has been inducted as a member of the India Universities and Institutions Network for Disaster Risk Reduction



(IUNDRR), hosted by the National Institute of Disaster Management (NIDM), India. IUNDRR is a network of esteemed universities and institutions dedicated to knowledge creation, sharing, and capacity building in the field of disaster risk management.

Pioneering Heat Wave Action Plan in Rajkot Published by Global Center on Adaptation



The Heat Wave Action Plan for Rajkot, developed by IRADe in association with

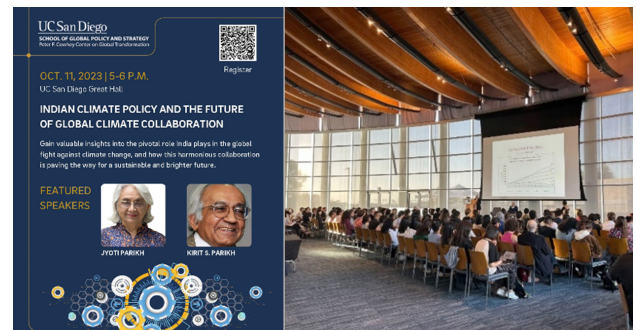
the Indian Institute of Public Health (IIPH), Gandhinagar, and Rajkot Municipal Corporation (RMC), has been identified by the Global Center on Adaptation as a valuable resource for other urban areas seeking to address similar challenges.

A video feature capturing this work has been released by the Global Center on Adaptation at COP 28.

WATCH: “Heat Stress: The Silent Killer in Indian Cities”

Pacific Leadership Fellows, UC San Diego

Prof Jyoti Parikh and Prof Kirit Parikh were selected as the Pacific Leadership Fellows



at UC San Diego from 9th to 13th October 2023. In a thought-provoking public lecture titled "Indian Climate Policy and the Future of Global Climate Collaboration," held on 11th October 2023, they delivered profound insights into India’s crucial role in the global fight against climate change. Their expertise shed light on the harmonious collaboration shaping a path toward a sustainable and brighter future. Throughout their stay, they engaged in dynamic dialogues, groundbreaking research, and inspiring teaching sessions, fostering a meaningful exchange of ideas and knowledge within the San Diego community.

7

PUBLICATIONS & MEDIA COVERAGE

S.No.	Project Report No. and Year	Title of Project	Funding Agency
01	IRADe-PR-102 (2023)	Role of DRE Technology in Promoting Quality School Education - Jharkhand	New Venture Fund
02	IRADe-PR-103 (2023)	Role of DRE Technology in Promoting Quality School Education - Bihar	New Venture Fund
03	IRADe-PR-104 (2023)	Challenges and Opportunities of Sustainable Energy Transition	IRADe
04	IRADe-PR-105 (2023)	South Asia Subregional Economic Cooperation Regional Energy Cooperation - Detailed technical transmission interconnection study - Cross Border Power Trading Specialist (52070-001)	Asian Development Bank (ADB)
05	IRADe-PR-106 (2023)	South Asia Subregional Economic Cooperation Regional Energy Cooperation - Energy Sector Policy and Regulatory Specialist (Gas and Clean Energy)	Asian Development Bank (ADB)
06	IRADe-PR-107 (2023)	South Asia Subregional Economic Cooperation Regional Energy Cooperation - Study on Economic Analysis derived for regional cooperation in electricity in SASEC region	Asian Development Bank (ADB)

Articles:

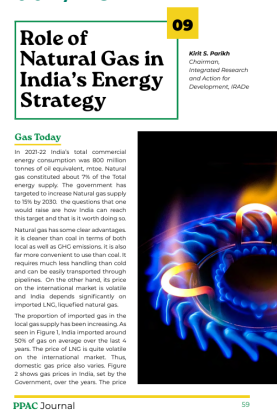
- Prof. Jyoti Parikh- Better access to clean, affordable cooking options: A promise on a Women's Day | *ETEnergyWorld*; 8th Mar 2024.
- Prof. Jyoti Parikh and Dr. Navpreet Saini- Partnerships and Power trade with neighbours through Energy Diplomacy.
- Pankaj Batra- Ensuring Energy Security: Global Trends and Opportunities in Energy Consumption.
- Prof. Jyoti Parikh and Dr. Gaurav Bhatiani- Climate-focused policies are key to building resilient infrastructure.
- Prof. Jyoti Parikh and Prof. Kirit Parikh- A Blueprint for Climate Finance at COP28.

Publications:

Challenges and Opportunities of Sustainable Energy Transition

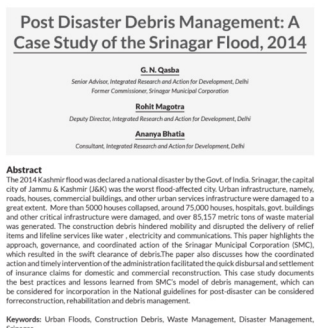
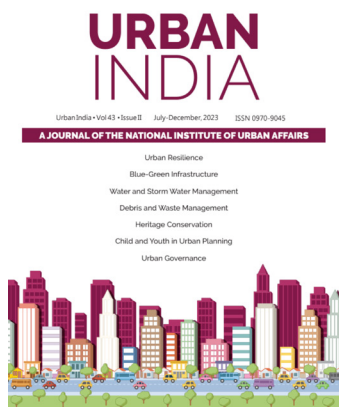


Role of Natural Gas in India's Energy Strategy: Publication in PPAC Journal Volume: 2023-24 | Edition1 | February 2024



"Post-Disaster Debris Management: Handling Construction Debris after Disasters - A Case Study of the Srinagar Flood, 2014": Publication in Urban India

Workshop Proceedings: National Workshop on "Integrating Vulnerable Community Inputs for Inclusive Policy Design and Action for Urban Flooding"; 28th February 2024



Workshop Proceedings: National workshop on "Strengthening Vulnerable Community Focused Policy Guidelines & Action Framework for Urban Flooding in India"; 12th December 2023



8

PROFESSIONAL ACTIVITIES

Prof. Jyoti Parikh, Executive Director, IRADe

2nd May 2023: Nominated for ETN: India 50 - Influence Women Leader and participated in the IESA-IGEF Women in Energy Roundtable and Networking Dinner on Energy Storage, Electric Mobility, and Green Hydrogen as part of India Energy Storage Week (IESW) 2023, New Delhi.

4th May 2023: Speaker at the Talk series on Transitioning to Modern Energy in Cooking: Star Labelling for the Induction Cook stoves organised by Finovista.

13th-16th June 2023: Speaker at the Asia Clean Energy Forum (ACEF) organised by the Asian Development Bank (ADB) in Manila, Philippines.

3rd Nov 2023: Speaker at the Modern Energy Cooking Forum-India on 'Role of Policy in promoting e-cooking by consumers' organised by Finovista.

1st Dec 2023: Speaker at International Solar Alliance (ISA)'s thematic event on "One Sun One World One Grid" during COP 28.

10th Jan 2024: Participated in the Strategic Roundtable on Milestones for India's Energy and Food Systems Transition in 2024, organised by Shakti Sustainable Energy Foundation.

12th Jan 2024: Speaker at the IHD Global

Conclave organised by the Institute for Human Development (IHD).

29th Jan 2024: Speaker at the Knowledge Partners Strategy Session organised by Air Quality Asia.

31st Jan 2024: Panelist for the plenary session titled "Emphasising ESG practices in Critical Raw Materials Mining" at the workshop on 'Critical Raw Materials for Low Carbon Technologies' organised by Indian Council for Research on International Economic Relations (ICRIER).

26th Feb 2024: Speaker at the launch of WRI India's Report: Climate Resilient Cities - Assessing Differential Vulnerability to Climate Hazards in Urban India organised by WRI Ross Center for Sustainable Cities.

8th March 2024: Speaker at Women in Renewable Energy: Inspiring Gender Inclusion through Skill Development and Targeted Policies for Green Jobs organised by the Ministry of New and Renewable Energy (MNRE), Government of India.

13th Mar 2024: Speaker at 13th EU - India Smart Energy Workshop in the session on Regional Energy Connectivity at India Smart Utility Week (ISUW 2024) organised by India Smart Grid Forum.

Mr. Pankaj Batra, Senior Advisor, IRADe

13th March 2024: Panelist in the 13th EU-India Smart Energy Workshop (in



Prof. Jyoti Parikh in the panel on “Women Leaders in Renewable Energy: Learnings & Recommendations” organised by MNRE, Government of India



Mr Pankaj Batra at the 13th EU-India Smart Energy Workshop at India Smart Utility Week (ISUW 2024).

collaboration with the European Union) at India Smart Utility Week (ISUW 2024).

7th March 2024: Delivered opening address at the 2nd National Power-Gen Water Summit & Awards 2024.

7th-9th February 2024: Participated in the Green Grids Initiative (GGI): ASEAN 2024 Workshop in Bangkok and led the session on interconnection priorities and challenges within South Asia.

18th January 2024: Panelist in the session “Solar + Storage - Way forward for Round the Clock (RTC) RE-Power Supply,” held during the 9th Smart Cities India Expo in New Delhi.

5th January 2024: Chaired a virtual meeting of ETD 11 of the Bureau of Indian Standards (BIS), focusing on Secondary Cells.

30th November 2023: Speaker at the Inaugural Session of the 3rd Heat Rate Efficiency in Thermal Power Plants organised by the Council of Environmental Excellence in New Delhi.

24th November 2023: Delivered a Leadership talk on “Revolutionising Energy: RE + Storage Policies and the Path Forward” at the RE

+ Storage Show 2023 organised by Solar Quarter Magazine in New Delhi.

16th-17th November 2023: Led the Indian delegation for the International Electrotechnical Commission (IEC) plenary session of the TC 120 Committee on System Aspects of Electrical Energy Storage in London.

9th November 2023: Panelist in the roundtable session on “Repurposing Closed/ Reclaimed Coal-Mined Lands for Renewable Energy Development to Enable a Just Transition in India” organised by the Nature Conservancy India Solutions Private Limited in New Delhi.

26th October 2023: Keynote speaker at the conference on "Digital Transformation for Reliable & Resilient Grids" organised by Power Line Magazine and AVEVA at The Leela Ambience, Gurugram.

8th & 13th September 2023: Jury Member for the 11th edition of the ICC (Indian Chambers of Commerce) Innovation with Impact Awards for Discoms 2023.

4th-6th July 2023: Participated in the workshop on "Promoting Energy Cooperation in South

Asia Subregional Economic Cooperation (SASEC) Region” in Colombo, Sri Lanka, organised by the Asian Development Bank (ADB).

13th-16th June 2023: Moderated a session where the representatives of South Asian countries presented their country perspectives on regional grid cooperation in the Asia Clean Energy Forum (ACEF) organised annually by the Asian Development Bank (ADB).

Mr. Rohit Magotra, Deputy Director, IRADe

15th March 2024: .Pathways - Carbon Neutral and Resilient Delhi” organised by C40 Cities and the Government of National Capital Territory Delhi (GNCTD).

14th February 2024: Delivered a presentation on SOPs for Developing Climate-Adaptive and Ward-Level Heat Action Plans during the National Workshop on “Management Interventions and Mitigation Strategies for Heat Waves” organised by the National Disaster Management Authority (NDMA).

30th January 2024: Discussant in the Annual Work-planning Workshop on 'Pathways to Sustainable Cooling in India' hosted by the Industry, Buildings and Cooling team of Shakti Sustainable Energy Foundation.

9th January 2024: with Panelist in the brainstorming workshop on 'Developing Framework for Heatwave Mitigation' organised by the National Disaster Management Authority (NDMA), India.

1st December 2023: Speaker in the webinar

on “Planning for Adaptation to Climate Change: Challenges and Possibilities” organised by NICMAR University, Pune.

27th October 2023: Lecture on Climate Adaptive Heat Action Plans for Dr Bhanuben Nanavati College of Architecture (BNCA)'s master's students.

16th August 2023: Panelist for “Inclusive Climate Action at City Level” during the virtual Changemaker20 summit, organised by Kubernein Initiative in collaboration with Connecting Dreams Foundation (CDF).

26th July 2023: Commentator at high-level policy roundtable discussion on evolving Indian environment and climate change priorities with the Honourable Steven Guilbeault, Canada’s Minister of Environment and Climate Change.

8th June 2023: Speaker in the consultative workshop on "Informing decision-making about informed Indoor heat risks to human health” organised by Red Cross Climate Centre.

29th April 2023: Panelist for the session on User Forum for Health Sector in the



Mr. Rohit Magotra with the Honourable Steven Guilbeault, Canada's Minister of Environment and Climate Change.

25th Session of the South Asian Climate Outlook Forum (SASCOF-25) organised by The Regional Climate Center (RCC), India Meteorological Department (IMD), Regional Integrated Multihazard Early-warning System for Asia and Africa (RIMES) and World Meteorological Organization (WMO).

27th April 2023: Speaker in the webinar on ‘Rising Vulnerability to Heat Stress: Actions and Strategies for South Asian Cities’ organised by ICLEI – Local Governments for Sustainability.

Dr. Probal Ghosh, Associate Director, IRADe

29th February-1st March 2024: Participated in the 5th Annual Flagship Convening of the Electric Mobility Initiative (EMI) Workshop, organised by the Shakti Sustainable Energy Foundation.

25th January 2024: Participated in the Annual Work-planning workshop titled ‘Modelling Long-Term Low Carbon Pathways’ organised by the Climate Policy team of Shakti Sustainable Energy Foundation.



Mr. Probal Ghosh at the Mission NetZero India Summit 2023.

14th December 2023: Participated in the Workshop-Seminar on “Energy and Well-being in India” organised by IIT Delhi.

7th December 2023: Panelist in conference track on “Empowering India’s Energy Sector to achieve Net Zero” in the Mission NetZero India Summit 2023.

23rd August 2023: Speaker at the launch of IDEEA – Indian Zero Carbon Energy Pathways at GNEC-IIT Roorkee.

4th-6th July 2023: Participated in the workshop on "Promoting Energy Cooperation in South Asia Sub regional Economic Cooperation (SASEC) Region" in Colombo, Sri Lanka, organised by the Asian Development Bank (ADB)

Dr. Anjana Das, Senior Advisor, IRADe

30th May-3rd June, 2023: Participated as an expert in the Technical Meeting to Review the IAEA’s Methodologies and Analytical Tools for Sustainable Energy Development, at the International Atomic Energy Agency, Vienna, Austria

4th-6th July 2023: Participated in the workshop on "Promoting Energy Cooperation in South Asia Subregional Economic Cooperation (SASEC) Region" in Colombo, Sri Lanka, organised by the Asian Development Bank (ADB).

S.No.	Title	Funding Agency	Starting Date	End Date	Status
Energy and Power Systems					
1.	Pathways for Adoption of Zero Emission Vehicle in India	International Sustainable Energy Foundation (ISEF)	November 2022	October 2024	Ongoing
2.	Pathways for Green Hydrogen Development in India	International Sustainable Energy Foundation (ISEF)	March 2023	March 2024	Completed
3.	Development of Economy Wide Low-carbon Pathway for India	International Sustainable Energy Foundation (ISEF)	March 2023	December 2023	Completed
Asia Centre for Sustainable Development					
4.	Study on Economic Benefits of Regional Cooperation in Electricity in the SASEC Region	Asian Development Bank	March 2022	September 2023	Completed
5.	Prospects of Inter-Regional Power Trade among the SASEC and the SEA Region	Asian Development Bank	March 2022	September 2023	Completed
6.	Scenarios and Roadmap to Promote Renewables to Meet Energy Needs and Accelerate Reduction in Dependence on Gas in SASEC Countries	Asian Development Bank	March 2022	September 2023	Completed

7.	Electricity Grid Interconnection Masterplan for the BIMSTEC Region	Asian Development Bank	November 2022	July 2024	Completed
Climate Change and Environment					
8.	Assessing Fiscal Policies to Support Adoption of Technologies for a Net Zero Transition in Power Sector using an Integrated Economy-Energy Model	European Union Climate Dialogues (EUCDs)	May 2023	July 2024	Completed
9.	Long-term Decarbonisation Strategies for the Indian Steel Sector with Hydrogen as One Option	Department of Science and Technology (DST), Government of India	April 2022	September 2024	Ongoing
Sustainable Urban Development					
10.	Policy Intervention for Enhancing Effectiveness of the Heat Early Warning Systems in India	International Sustainable Energy Foundation (ISEF)	February 2024	July 2025	Ongoing
11.	Supporting India's National Disaster Management Guidelines by Developing Community-led Templates for Managing Urban Floods	Adaptation Research Alliance (ARA), UKAID	September 2023	February 2024	Completed
12.	Integrating Heat Action Plans in Climate Policy and Guidelines for Evolving Gender-sensitive Heat Adaptation Plans in Cities in South Asia	Asia-Pacific Network for Global Change Research	October 2021	September 2023	Completed
Poverty Alleviation and Gender					
13.	Role of Decentralised Renewable Energy (DRE) Technology in Promoting Quality School Education	New Venture Fund, USA	December 2021	May 2023	Completed

Sponsors (Past and Present)



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