UK Government

Power Sector Reforms Programme

Phase II

India - UK Partnering for Accelerated Climate Transitions

March 2025

भारतीय प्रौद्योगिकी संस्थान कानपुर
Indian Institute of Technology Kanpur

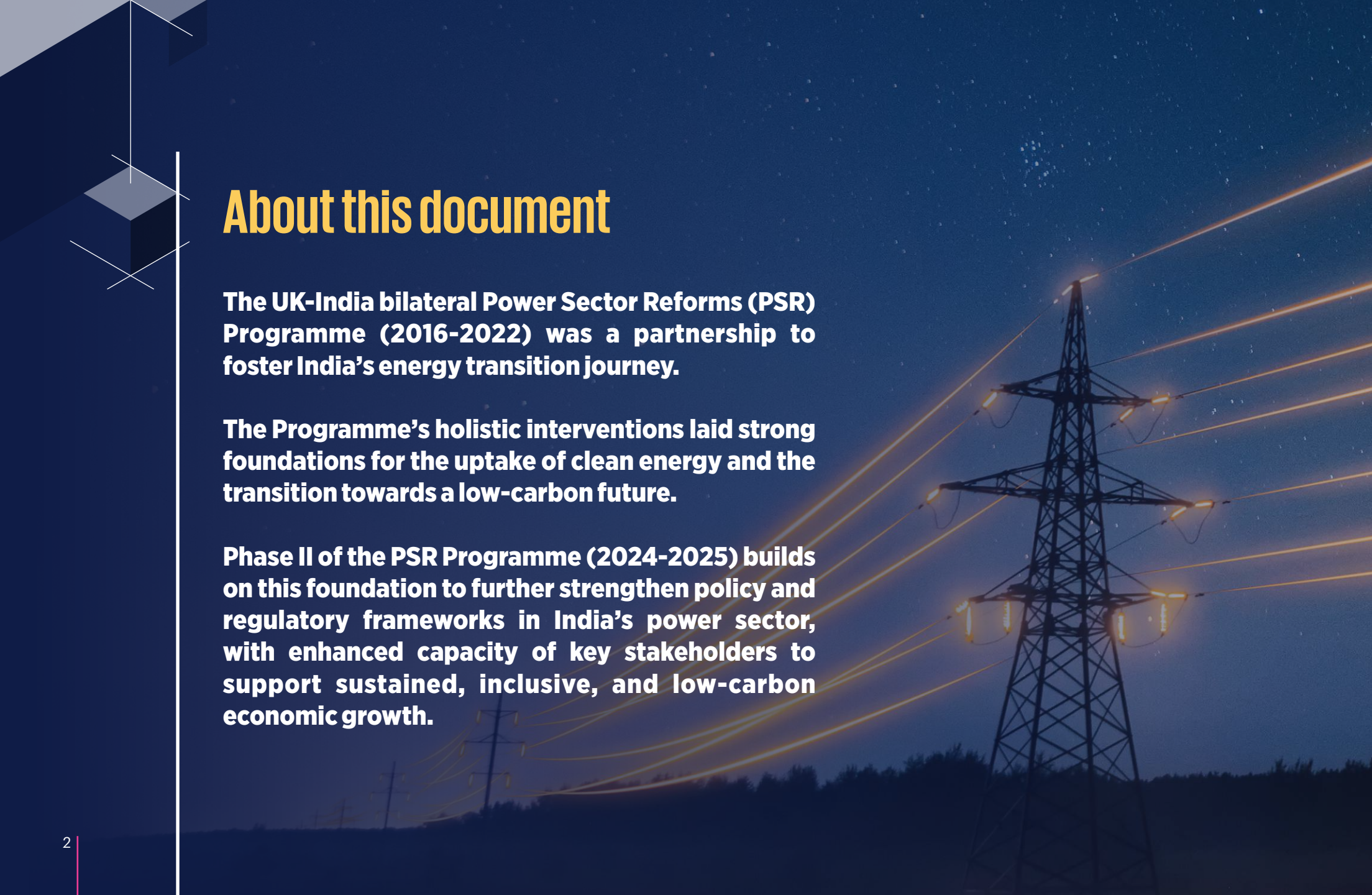
CER
Centre for Energy Regulation

About this document

The UK-India bilateral Power Sector Reforms (PSR) Programme (2016-2022) was a partnership to foster India's energy transition journey.

The Programme's holistic interventions laid strong foundations for the uptake of clean energy and the transition towards a low-carbon future.

Phase II of the PSR Programme (2024-2025) builds on this foundation to further strengthen policy and regulatory frameworks in India's power sector, with enhanced capacity of key stakeholders to support sustained, inclusive, and low-carbon economic growth.



This document provides key highlights and outcomes of Phase II of the PSR Programme.

PSR Programme was designed to drive fundamental changes in sector operations, focusing on sustainable and inclusive growth, energy security, and carbon emissions reduction

Supported Ministry of Railways to Achieve their Carbon Neutrality Targets by 2030

International Capacity Building

Launch of Reform and Regulatory Knowledge Base for Power Sector

Establishment of Centre for Energy Regulation

India-UK Energy for Growth Dialogue

2,000+ MW
RE projects conceptualised

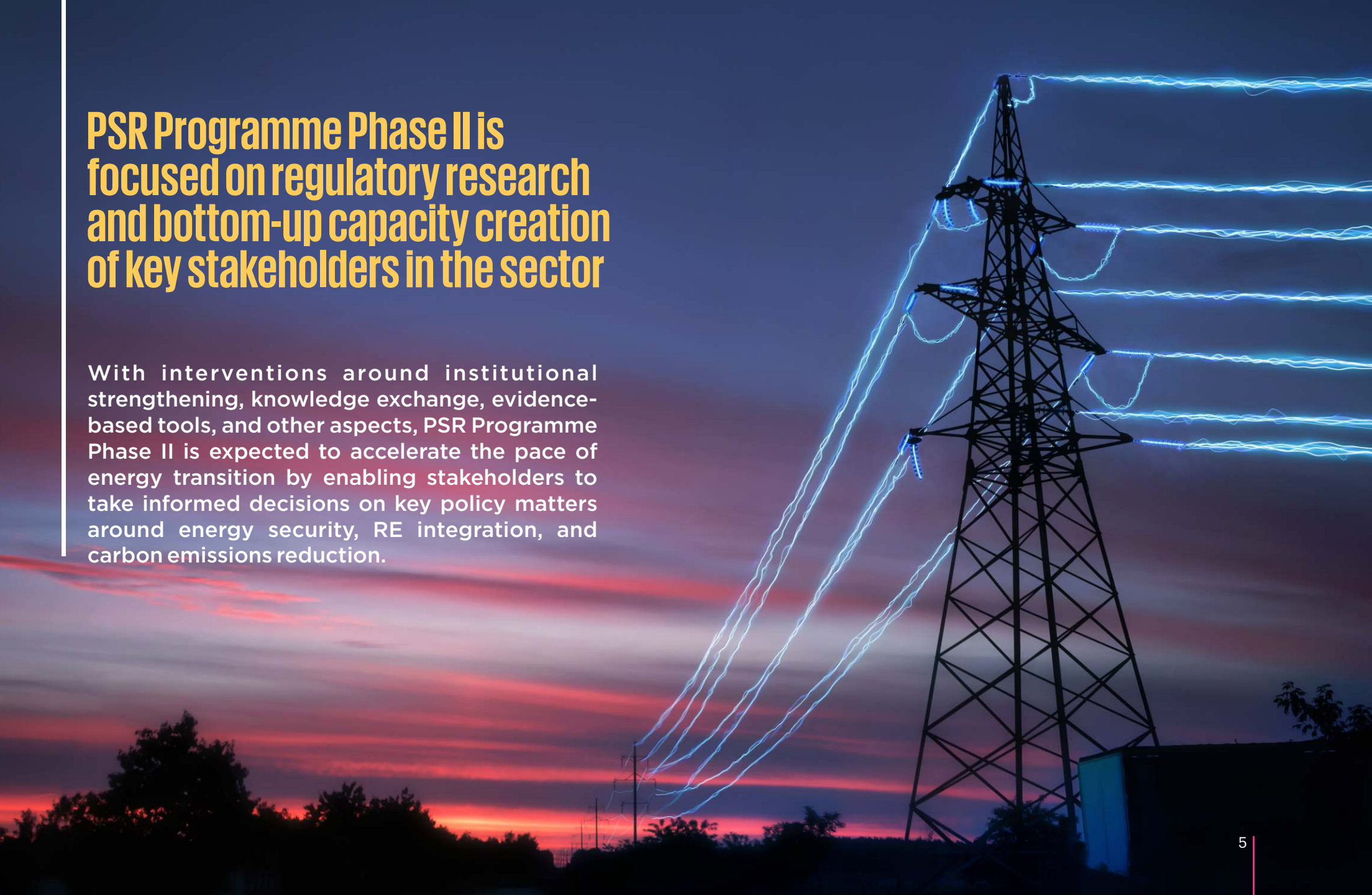
£400+ mn
Investments facilitated

35
Beneficiaries

30+
Technical and policy reports

PSR Programme Phase II is focused on regulatory research and bottom-up capacity creation of key stakeholders in the sector

With interventions around institutional strengthening, knowledge exchange, evidence-based tools, and other aspects, PSR Programme Phase II is expected to accelerate the pace of energy transition by enabling stakeholders to take informed decisions on key policy matters around energy security, RE integration, and carbon emissions reduction.



Programme Architecture

PSR II has been structured into three distinct thematic workstreams

Regulatory Research

- Regulatory Impact Assessment
- Gender Equality and Social Inclusion
- Storage in RE Integration
- Flexibility and RE Integration
- Risk Management in Power Market
- Market Monitoring Framework for the Indian Power Sector

Knowledge-base

- Market Monitoring Dashboard
- Regulatory Database
- Regulatory Insights
- Power Chronicle
- State Level Load Forecasting Tool
- Digital Library

Capacity Building

- Institutional Capacity Building
- Regulatory Conclave
- Young Policy Professional Programme
- Capacity Building on Load Forecasting

Key Outcomes

- More efficient policy and regulatory framework
- Improved accessibility for knowledge exchange
- Enhanced stakeholder participation
- Improved gender sensitisation

Key Stakeholders

The Programme is driven by strong engagement across ministries, state governments, central agencies, regulatory bodies, and international agencies.

1 MINISTRY

- Ministry of Power

6 CENTRAL AGENCIES

- Central Electricity Authority
- Central Electricity Regulatory Commission
- Energy Efficiency Services Limited
- GRID India
- NTPC
- POWERGRID

12 STATES

- Delhi
- Haryana
- Kerala
- Madhya Pradesh
- Maharashtra
- Odisha
- Punjab
- Rajasthan
- Tamil Nadu
- Telangana
- Uttar Pradesh
- Uttarakhand

7 INTERNATIONAL AGENCIES

- Council of European Energy Regulators
- Imperial College London
- National Energy System Operator
- Ofgem
- UK Power Networks
- University College London
- University of Cambridge

REGULATORY

RESEARCH

Regulatory Impact Assessment

Developing a framework for informed and accountable regulation

A robust Regulatory Impact Assessment (RIA) framework is essential to ensure effective regulation, protect consumer interests, and foster market efficiency. Implementing RIA in India's power sector would strengthen regulatory processes by systematically evaluating the potential impacts of new regulations, thereby promoting accountability and transparency as seen globally.

Interventions

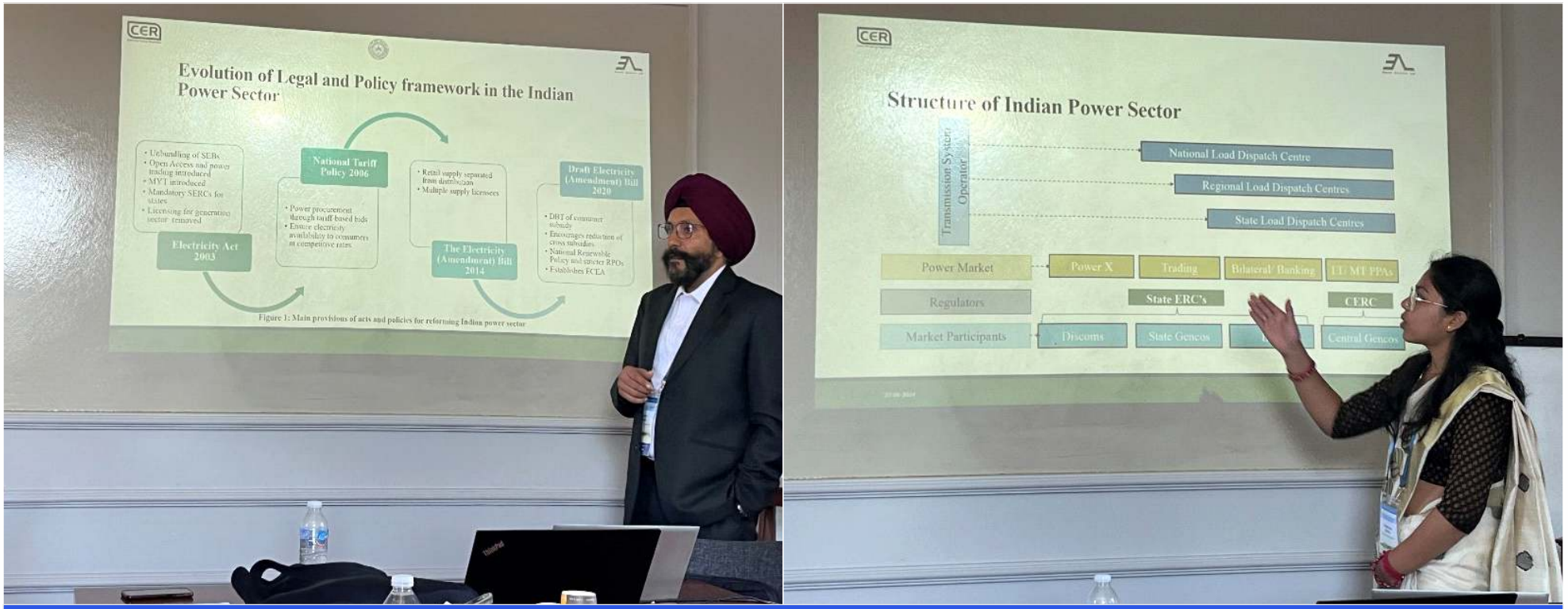
The PSR Programme undertook a comprehensive study to analyse the economic rationale and global practices of RIA, exploring the evolution and implementation of regulatory frameworks internationally. The study further examined the changing tariff determination practices across different regulatory periods in India, identifying key impacts and justifying the need for a structured RIA approach in the Indian electricity sector.

Outcomes

RIA Framework:
Developed a structured methodology to systematically evaluate impacts of regulatory changes prior to implementation.

Implementation Guidance:
Provided actionable steps for central and state regulators to integrate RIA into regulatory processes.

Enhanced Stakeholder Accountability:
Promoted equitable regulatory processes by ensuring consumer interests are clearly considered.



Research findings being disseminated at the 45th International Association for Energy Economics (IAEE) Conference

The structured RIA framework will enable regulators to assess impacts comprehensively and transparently, making regulatory processes more inclusive and responsive to stakeholders.

Gender Equality and Inclusion in Governance

Supporting greater gender representation in power regulations

Women remain underrepresented in the regulatory governance framework of the power sector due to systemic challenges such as cultural norms, workplace barriers, management biases, and limited access to training opportunities. Addressing this imbalance is crucial for fostering diversity in decision-making and ensuring more inclusive regulatory processes.

Interventions

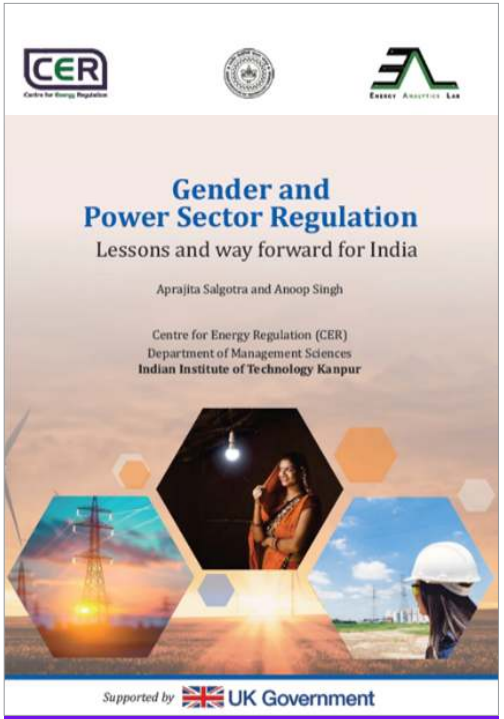
The PSR Programme conducted a comprehensive gender gap assessment in India's power sector regulation, involving an online survey across 9 countries and 30 state / joint electricity regulatory commissions. This study mapped existing barriers to women's participation, analysed global best practices, and identified strategies to enhance gender representation, particularly in leadership roles.

Outcomes

Policy Recommendations: Developed actionable strategies, including reservation policies, training programs, and online learning access to improve gender inclusivity.

Stakeholder Engagement: Key findings were presented and discussed at the Regulatory Conclave on 07th September 2024 to drive awareness and institutional change.

Knowledge Publication: Insights from the study have been compiled into the book "Gender and Power Sector Regulation: Lessons and Way Forward for India" (ISBN: 9789-3341-42310).



Report highlighting the research findings (ISBN 9789-3341-42310)

Study findings were discussed during the Regulatory Conclave on "Role of Women in Power Sector Regulation" in September 2024

The research work lays the foundation for transforming gender inclusion in power sector regulation – paving the way for more women in leadership roles.

Role of Storage in RE Integration

Optimising grid stability through battery storage solutions

As India accelerates its RE expansion, managing intermittency and ensuring grid stability has become critical. To address the variability inherent in sources like solar and wind, India is increasingly investing in battery energy storage systems (BESS) and other storage solutions, backed by supportive policies and regulatory frameworks.

Interventions

The PSR Programme developed an advanced optimisation model leveraging mixed-integer linear programming. This model strategically optimises power generation by integrating conventional generators, RE sources, and battery storage systems in real-time. Piloted successfully in Chhattisgarh, the model leverages state-specific data, making it readily adaptable for other states and regions, facilitating nationwide deployment.

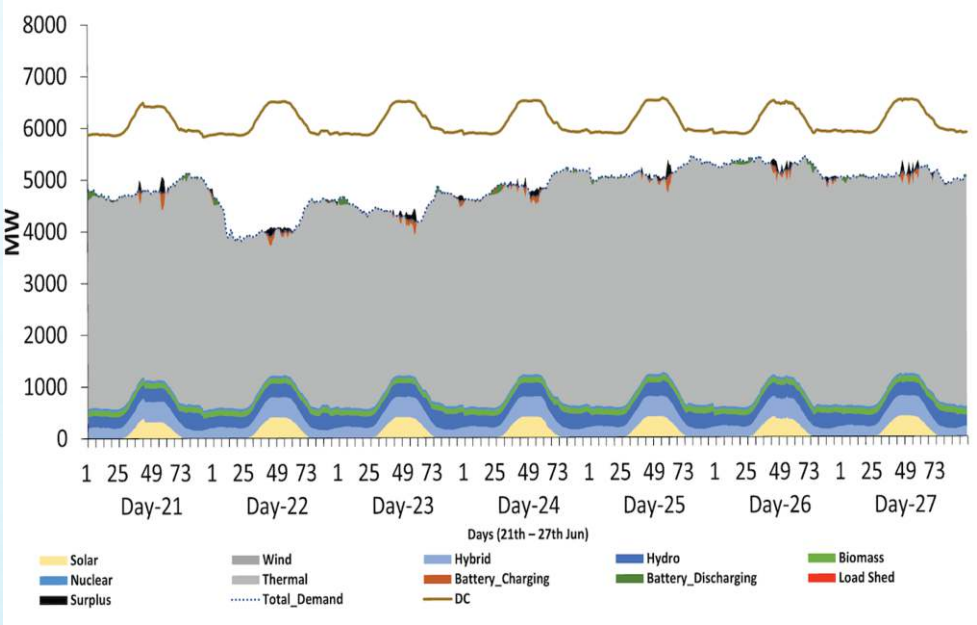
Outcomes

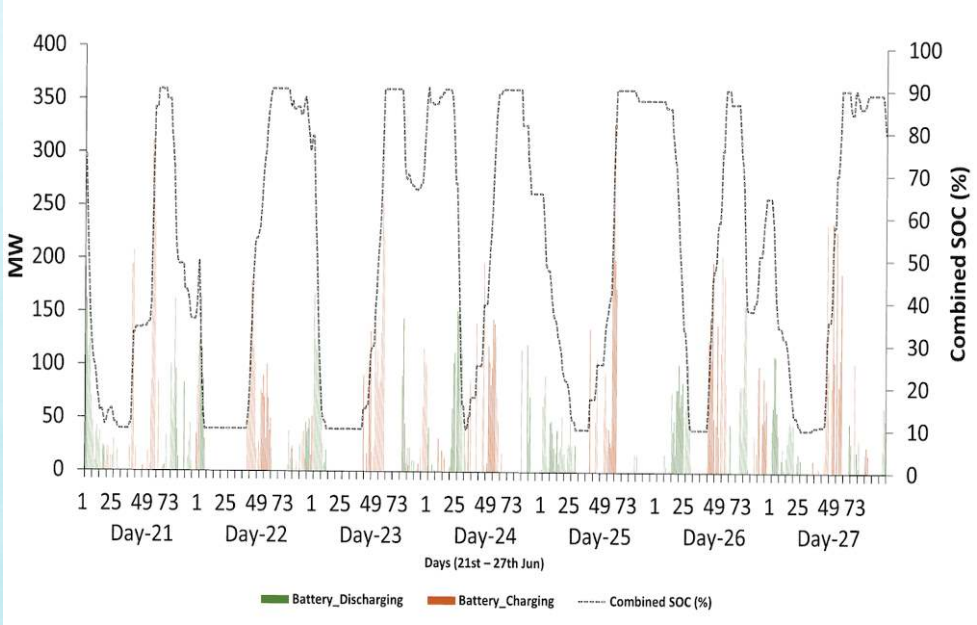
Advanced Optimisation Model: Delivers accurate projections for integrating grid-scale battery storage.

Economic Feasibility Analysis: Provides critical insights into investment viability for large-scale BESS deployment.

Adaptability and Scalability: Model is designed for easy replication, enabling other states to adopt customised strategies.

Snapshot of Chhattisgarh state study on projected demand of FY26





The PSR Programme introduced a sophisticated optimisation model, enhancing decision-making capability for BESS integration, improving grid stability, and investment clarity.

Flexibility and RE Integration

Strategy for flexibilisation of thermal generation under increasing RE integration

Traditionally, coal-fired plants were optimised for base and mid-load provisions. However, today the plants need to have higher operational flexibility to accommodate the increasing mix of RE sources which are variable and uncertain in nature.

Interventions

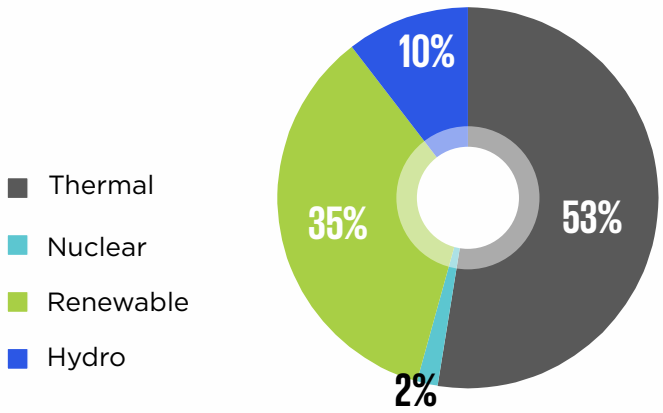
The study by the PSR Programme highlights the challenges posed by variable RE and the consequent need for greater power system flexibility. It specifically examines the role of flexibilisation of coal-fired power plants in mitigating the impacts of RE intermittency and delves into the existing regulatory frameworks and policies designed to promote thermal plant flexibility. The methodology comprised literature review and econometric analysis using data from 2021 to 2024.

Outcomes

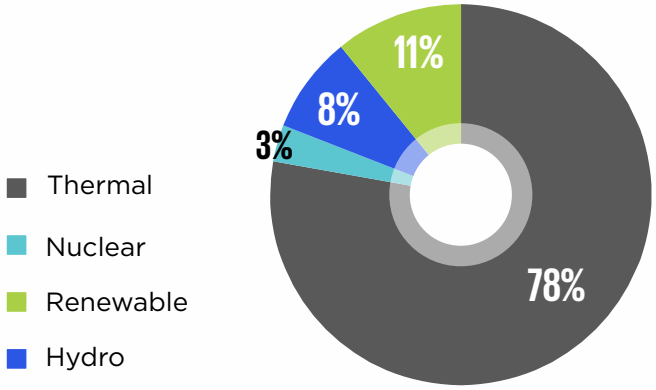
Identification of Priority Thermal Plants:
Plants with higher variable cost are more suited for flexibilisation as they operate below full capacity or function as system marginal plants.

Dissemination:
Findings presented at the 45th IAEE International Conference at Istanbul in June 2024.

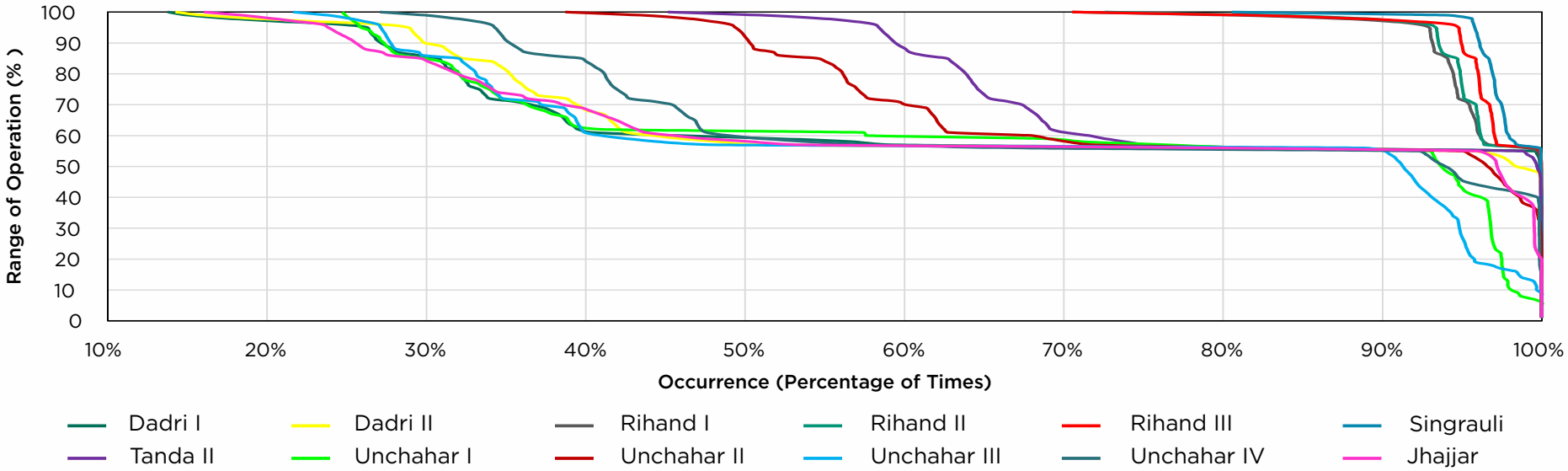
All India Installed Capacity (457 GW) - Till 2024



All India Power Generation – 2024 (1751 BU)



Flexibilisation Potential of Thermal Power Plants



The study provides policy and regulatory recommendations for the promotion of flexible operations of thermal power plants.

Market Monitoring Framework for the Indian Power Sector

Strengthening market oversight for competitive and transparent power markets

A robust market monitoring framework is essential to ensure fair competition, prevent market manipulation, and enhance transparency in the Indian power sector. While market surveillance mechanisms exist, the level of data sophistication and analytical rigour required for effective monitoring needs further refinement.

Interventions

The PSR Programme developed an enhanced market monitoring framework by identifying key market competitiveness indices such as Maximum Market Share, Concentration Ratios (4-CR and 5-CR), Herfindahl Hirschman Index (HHI), Residual Supplier Index (RSI), Pivotal Supplier Indicator (PSI), and Lerner's Index. The framework also incorporated methods for assessing bidding behavior and drew insights from global market monitoring frameworks in the USA and Europe. Additionally, it evaluated different approaches to market monitoring – self-monitoring, independent monitoring, and regulation-driven monitoring – tailoring recommendations for the Indian context.

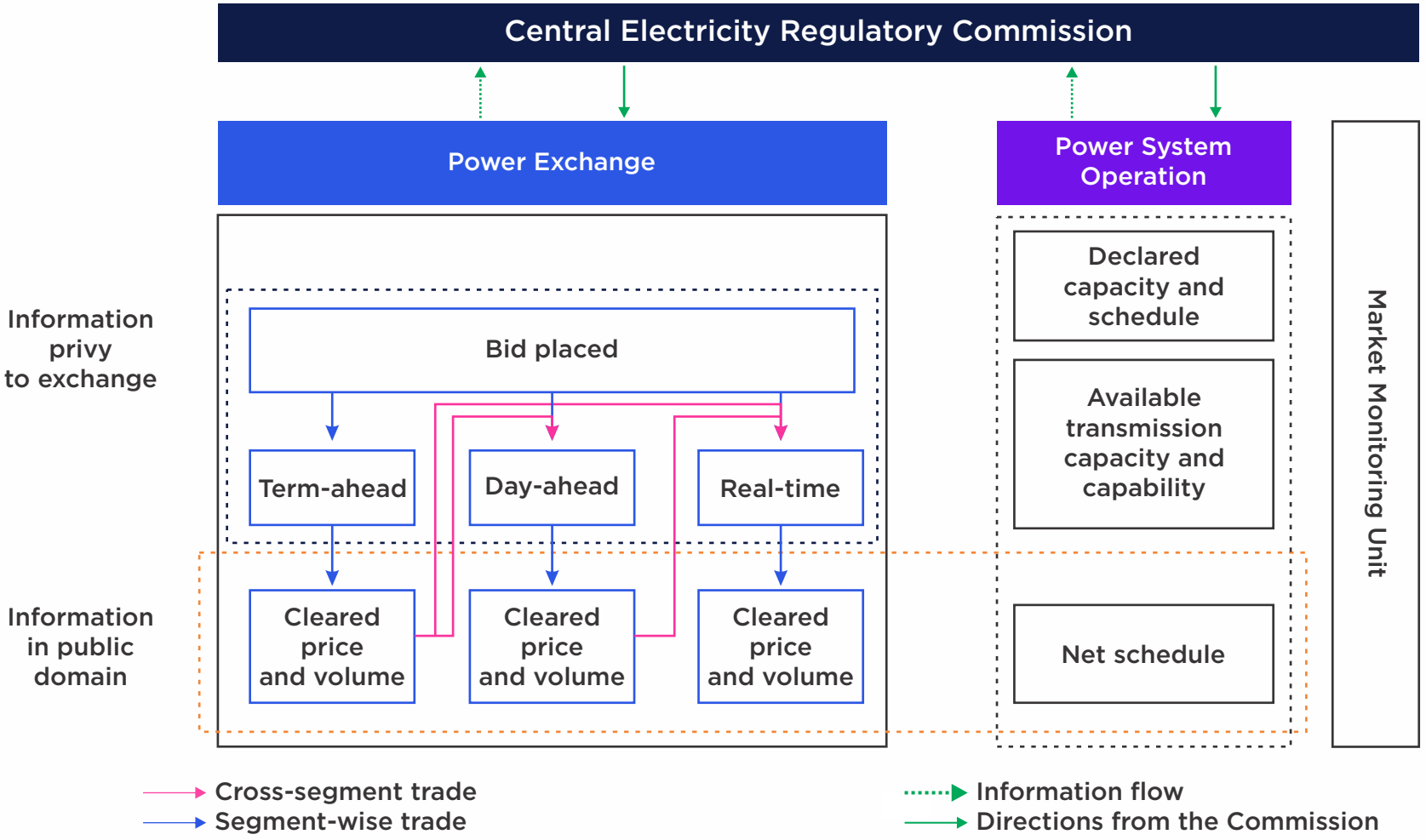
Outcomes

Comprehensive Market Competitiveness Framework: Defines a structured methodology for assessing market concentration and bidding behavior.

Granular Market Analysis: Introduces monitoring at the time-block level to improve oversight of market dynamics.

Guidance for Unified Monitoring Approach: Recommends an integrated framework for market monitoring in India, balancing regulatory and independent oversight.

Framework for Effective Market Monitoring



The new framework provides a structured and data-driven approach, equipping regulators with the tools necessary for effective surveillance and ensuring a competitive and transparent power market.

Dissemination at the 45th International Association for Energy Economics Conference

The International Association for Energy Economics (IAEE) organised the 45th IAEE International Conference in June 2024, bringing together energy professionals from the private sector, government, and academia from around the world.

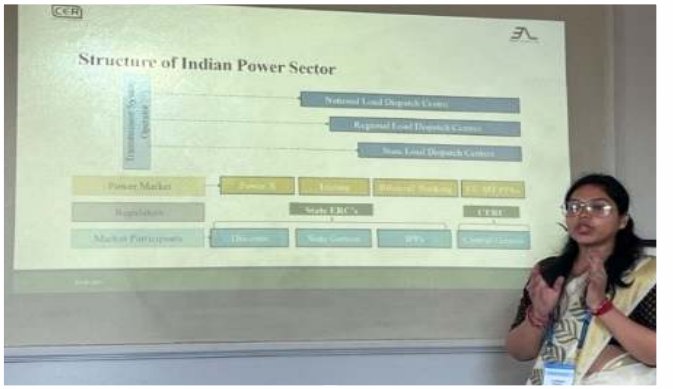
The conference, titled "Energy Sustainability, Security, Efficiency, and Accessibility in a Time of Transition," addressed issues such as oil and gas security, climate change and limiting greenhouse gas emissions, uncertainties in energy prices, and the challenges of meeting future energy needs and long-term technology options.

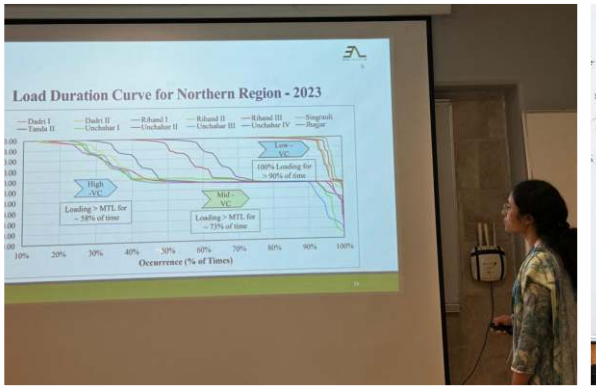
Outcomes

The following research work, conducted under the PSR Programme Phase II, was presented at this forum:

- **An Incentive-based Regulatory Framework for Regulated Tariff Determination of Electricity Generating Plants**
- **A Strategy for Flexibilisation of Thermal Generation under Increasing RE Integration**
- **Market-linked Futures Contract: A Stackelberg Game Theoretic Approach**


Power Sector Reform in India


Structure of Indian Power Sector
National Load Dispatch Centre
Regional Load Dispatch Centres
State Load Dispatch Centres
Power Market
Regulators
Market Participants
State ERCs
CERC


Load Duration Curve for Northern Region - 2023
Dadri I
Tanda II
Dadri II
Unchahar I
Rihand I
Unchahar II
Rihand II
Unchahar III
Rihand III
Unchahar IV
Singrauli
Jhajjar
Low - VC
100% Loading for > 90% of time
High - VC
Loading > MTL for ~ 58% of time
Mid - VC
Loading > MTL for ~ 75% of time
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Occurrence (% of Times)

KNOWLEDGE-BASE

Power Sector Regulatory Oversight and Market Performance Tracking (PROMPT) Dashboard

Enhancing power market oversight and performance monitoring

Effective regulatory oversight and market monitoring are essential to ensure competitive electricity markets, prevent market manipulation, and promote transparency. Traditional methods of tracking power market performance often lacked analytical insights, making it challenging to assess competitiveness and participant bidding behavior dynamically.

Interventions

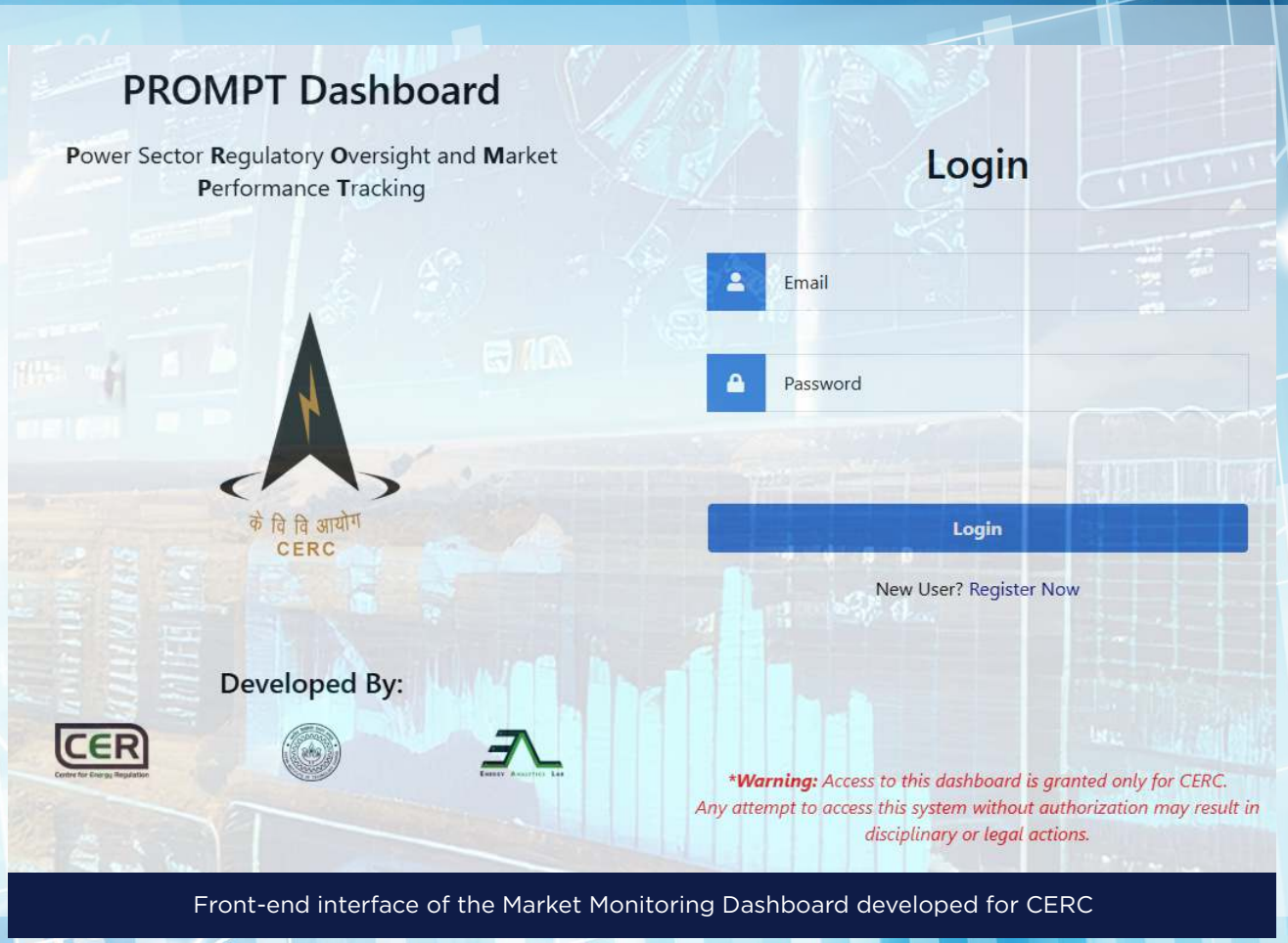
The PSR Programme supported the development of a dynamic PROMPT Dashboard to enhance regulatory monitoring for the CERC. This interactive dashboard integrates key market performance indicators such as Maximum Market Share, Concentration Ratios (4-CR and 5-CR), Herfindahl Hirschman Index (HHI), and Residual Supplier Index (RSI) to assess market competitiveness. Additionally, it enables the analysis of bidding behavior and participant-wise bid patterns for buyers and sellers across different market segments. The platform also features automated daily, weekly, and monthly report generation and ensures data security through two-factor authentication.

Outcomes

Advanced Market Monitoring Tool: Provides real-time visual analytics on market competitiveness and bidding trends.

Automated Reporting System: Generates periodic reports to enhance regulatory efficiency and reduce manual workload.

Secure and Scalable Platform: Ensures data integrity with two-factor authentication while allowing seamless comparison across market segments.



Front-end interface of the Market Monitoring Dashboard developed for CERC

The PROMPT Dashboard introduced automated analytics, enabling CERC to strengthen market monitoring and improve decision-making.

Regulatory Database

Bringing key regulatory information on a single platform

Ensuring transparency and accountability in regulatory decisions is critical for an efficient power sector. As state electricity regulatory commissions (SERCs) continue to evolve, the need for accurate, reliable, and accessible regulatory data remains essential to support informed policymaking and sectoral improvements.

Interventions

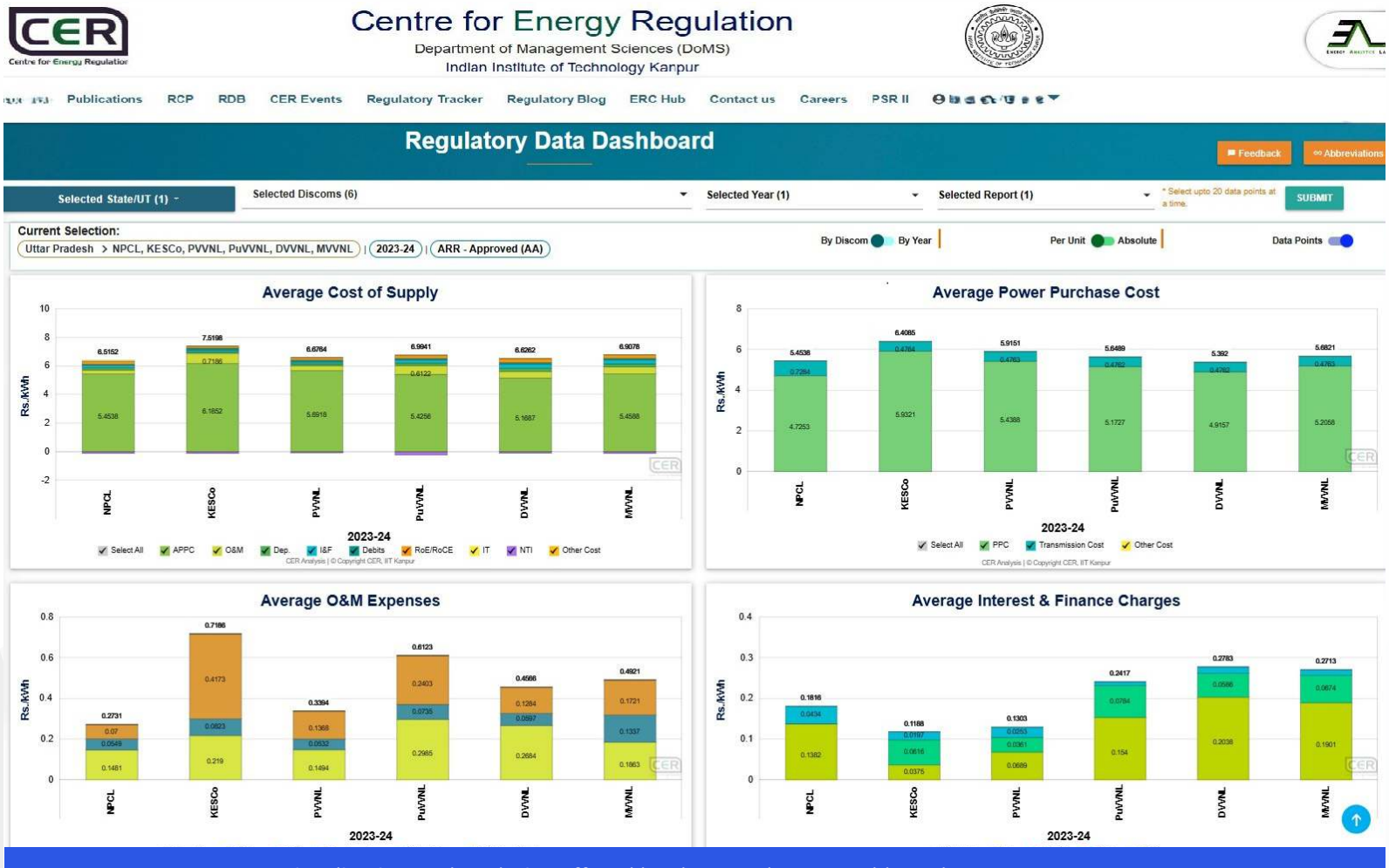
The PSR Programme supported the development of the Regulatory Database, a centralised web portal designed to provide a comparative analysis of DISCOM performance based on the latest retail tariff filings. This database integrates interactive data visualisation and advanced analytical tools, enabling users to track trends, conduct data-driven evaluations, and support regulatory decision-making. The platform strengthens evidence-based policymaking and contributes to a more transparent, sustainable, and equitable energy distribution system.

Outcomes

Comprehensive Database: Aggregates over 1 million data points from 60+ DISCOMs since FY 2008-09, facilitating historical performance tracking.

Interactive Dashboard: Provides an interactive dashboard for comparative utility performance benchmarking, enhancing regulatory oversight.

User-friendly Interface: Features interactive graphs and comparative analytics, ensuring seamless access to regulatory insights for stakeholders.



Visualisation and analytics offered by the Regulatory Dashboard

PSR introduced a centralised, interactive regulatory database, significantly enhancing data accuracy, utility benchmarking, and regulatory accountability, resulting in more informed regulatory decisions.

Digital Library

Centralised repository for policy documents

Access to policy frameworks, regulations, and technical guidelines is critical for informed decision-making in the power sector. However, these resources are often dispersed across multiple platforms or housed in physical archives, limiting accessibility. A centralised digital repository is essential for seamless knowledge sharing, research, and policy development.

Interventions

The PSR Programme helped CEA develop a web-based digital library that aggregates policy documents, regulatory guidelines, and technical reports. The platform, developed by KPMG*, catalogues 17,000+ books and documents from CEA's library, offering a user-friendly access point for industry professionals, regulators, and researchers. With AI-driven search capabilities and partial generative AI, the tool enhances knowledge discovery and streamlines research efforts.

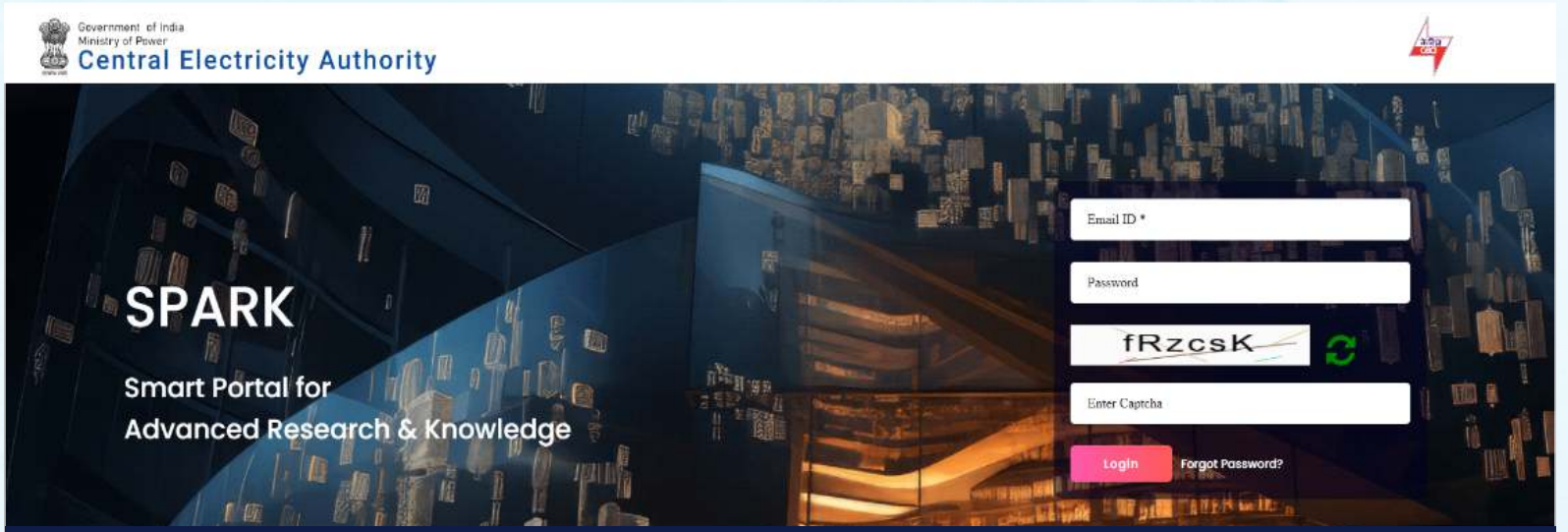
Outcomes

Centralised One-stop Knowledge Platform: Enables evidence-based policy and regulatory decision-making.

Digital Cataloguing and Issuance System: Facilitates efficient management of 17,000+ physical books and documents, improving accessibility.

AI-powered Search and Retrieval: Enhances user experience through intelligent recommendations and document classification.

*This work package was implemented by IIT Kanpur with KPMG as its downstream partner.



Smart Portal for Advanced Research and Knowledge (SPARK) – Front-end interface of the digital library

Sensitisation and capacity building sessions being conducted at CEA

The PSR Programme developed a centralised digital repository, integrating 17,000+ books and documents at CEA with AI-powered search for faster information retrieval.

Automated Tool for Load Surveys

Streamlining and automating data collection from DISCOMs

CEA traditionally relies on manual methods, such as email exchanges, to collect state-level load data from DISCOMs. This process is time-consuming, labour-intensive, and prone to inefficiencies, delaying data analysis and decision-making.

Interventions

The PSR Programme supported CEA in developing an automated tool for conducting load surveys, enabling seamless and standardised data submission from utilities. This centralised platform, developed by KPMG*, allows ~80 DISCOMs to directly submit monthly load data through a single interface, eliminating the need for manual intervention and significantly improving data processing efficiency.

Outcomes

Centralised Digital Platform: Facilitates real-time submission and management of load data across DISCOMs.

Elimination of Manual Processing: Reduces administrative workload, freeing up personnel for analytical tasks.

Improved Efficiency and Accuracy: Enhances data integrity and reporting speed for better decision-making.

*This work package was implemented by IIT Kanpur with KPMG as its downstream partner.

Front-end of the integrated tool for automated load survey and forecasting

Launch of the tool at the Northern Regional Power Committee meeting on 11th March 2025

PSR Programme introduced a fully automated tool for conducting load surveys, significantly reducing reporting time and effort for 80+ DISCOMs.

State-level Load Forecasting Tool

Enhancing accuracy in electricity demand projections

Accurate electricity demand forecasting is critical for effective power sector planning. It enables optimal power procurement to prevent shortages or excess generation, peak demand management for grid stability, renewable energy integration by aligning supply with projected demand, and risk mitigation for utilities, reducing financial and operational uncertainties.

Interventions

The PSR Programme supported CEA in developing a state-level load forecasting tool to enhance long-term electricity demand projections. This model, piloted in Rajasthan, leverages generalised additive models and quantile regression averaging to improve forecasting accuracy. The tool, developed by KPMG*, incorporates multiple scenarios, factoring in socio-economic trends, weather fluctuations, EV adoption, and industrial growth patterns.

Outcomes

Advanced Forecasting Model: Provides accurate electricity demand projections over a 5-10-year timeframe to support strategic planning.

Scalable and Replicable Tool: Designed for easy adaptation by other states, ensuring broader implementation across India.

Institutionalisation at CEA: Embedded within CEA's operations, ensuring sustained use and capacity building for stakeholders.

*This work package was implemented by IIT Kanpur with KPMG as its downstream partner.

Launch of the tool at the Northern Regional Power Committee Meeting on 11th March 2025

The PSR Programme introduced an advanced forecasting tool, thereby improving long-term demand estimation for better resource planning.

Periodicals

Delivering regular insights for informed decision-making

Timely access to comprehensive regulatory updates and market analyses is essential for informed decision-making among stakeholders. Before PSR's intervention, stakeholders in India's power sector faced fragmented and delayed dissemination of regulatory insights and market intelligence, limiting their preparedness and responsiveness to emerging challenges.

Interventions

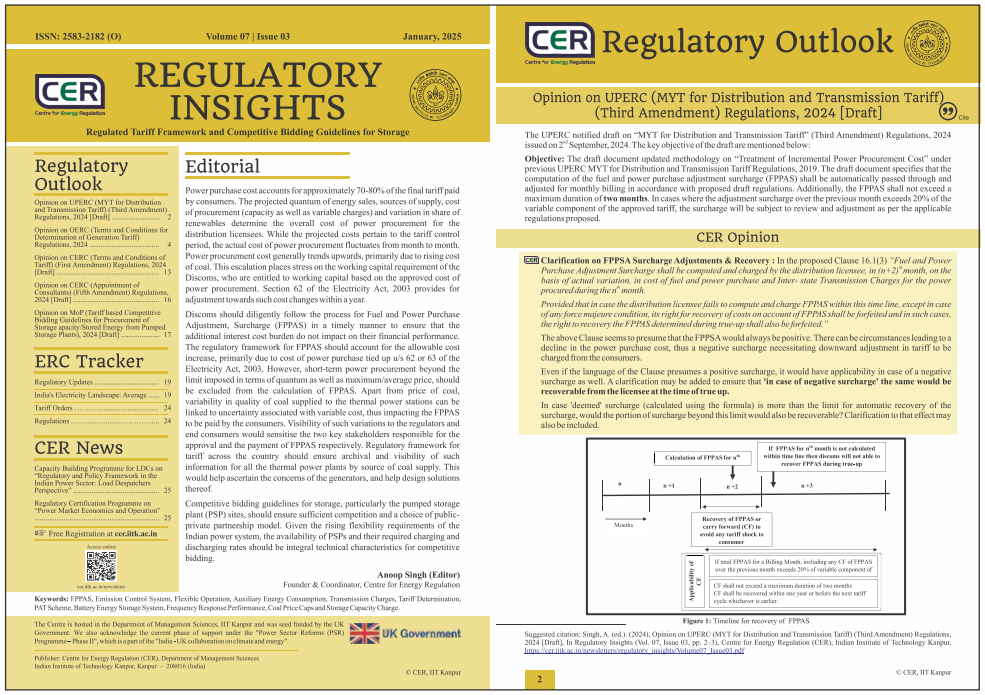
The PSR Programme, through the Centre for Energy Regulation (CER) and Energy Analytics Lab (EAL), publishes two quarterly periodicals: *Regulatory Insights* – ISSN: 2583-2182 (O) and *Power Chronicle* – ISSN: 2583-2182 (O). These publications provide detailed analyses of regulatory developments, tariff regulations, RE integration, and power market dynamics. Sections include Regulatory Outlook, ERC Tracker, Power System and Market Analysis, and Editorial Insights, ensuring stakeholders remain informed on crucial sectoral trends.

Outcomes

Sectoral Insights: Regular updates on tariff regulations, open access policies, RE trends, and detailed analyses of power market indicators.

Interactive Benchmarking Tools: ERC Tracker and market analytics enable stakeholders to compare and assess regulatory practices and market performance effectively across states.

Extensive Stakeholder Outreach: Quarterly dissemination reaches a broad spectrum of stakeholders across India's power sector.



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REGULATORY INSIGHTS

Regulated Tariff Framework and Competitive Bidding Guidelines for Storage

Regulatory Outlook

ERC Tracker

CER News

Free Registration at **cer.iitk.ac.in**

Access online: cer.iitk.ac.in/newsletters

Editorial

Power purchase cost accounts for approximately 70-80% of the final tariff paid by consumers. The projected quantum of energy sales, sources of supply, cost of procurement (capacity as well as variable charges) and variation in share of renewables determine the overall cost of power procurement for the distribution licensees. While the projected costs pertain to the tariff control period, the actual cost of power procurement fluctuates from month to month. Power procurement cost generally trends upwards, primarily due to rising cost of coal. This escalation places stress on the working capital requirement of the Discoms, who are entitled to working capital based on the approved cost of power procurement. Section 62 of the Electricity Act, 2003 provides for adjustment towards such cost changes within a year.

Discoms should diligently follow the process for Fuel and Power Purchase Adjustment, Surcharge (FPPAS) in a timely manner to ensure that the additional interest cost burden do not impact on their financial performance. The regulatory framework for FPPAS should account for the allowable cost increase, primarily due to cost of power purchase tied up u/s 62 or 63 of the Electricity Act, 2003. However, short-term power procurement beyond the limit imposed in terms of quantum as well as maximum/average price, should be excluded from the calculation of FPPAS. Apart from price of coal, variability in quality of coal supplied to the thermal power stations can be linked to uncertainty associated with variable cost, thus impacting the FPPAS to be paid by the consumers. Visibility of such variations to the regulators and end consumers would sensitise the two key stakeholders responsible for the approval and the payment of FPPAS respectively. Regulatory framework for tariff across the country should ensure archival and visibility of such information for all the thermal power plants by source of coal supply. This would help ascertain the concerns of the generators, and help design solutions thereof.

Competitive bidding guidelines for storage, particularly the pumped storage plant (PSP) sites, should ensure sufficient competition and a choice of public-private partnership model. Given the rising flexibility requirements of the Indian power system, the availability of PSPs and their required charging and discharging rates should be integral technical characteristics for competitive bidding.

Anoop Singh (Editor)
Founder & Coordinator, Centre for Energy Regulation

Keywords: FPPAS, Emission Control System, Flexible Operation, Auxiliary Energy Consumption, Transmission Charges, Tariff Determination, PAT Scheme, Battery Energy Storage System, Frequency Response Performance, Coal Price Caps and Storage Capacity Charge.

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UK Government

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CER Centre for Energy Regulation

Regulatory Outlook

Opinion on UPERC (MYT for Distribution and Transmission Tariff) (Third Amendment) Regulations, 2024 [Draft]

The UPERC notified draft on "MYT for Distribution and Transmission Tariff" (Third Amendment) Regulations, 2024 issued on 2nd September, 2024. The key objective of the draft are mentioned below:

Objective: The draft document updated methodology on "Treatment of Incremental Power Procurement Cost" under previous UPERC MYT for Distribution and Transmission Tariff Regulations, 2019. The draft document specifies that the computation of the fuel and power purchase adjustment surcharge (FPPAS) shall be automatically passed through and adjusted for monthly billing in accordance with proposed draft regulations. Additionally, the FPPAS shall not exceed a maximum duration of **two months**. In cases where the adjustment surcharge over the previous month exceeds 20% of the variable component of the approved tariff, the surcharge will be subject to review and adjustment as per the applicable regulations proposed.

CER Opinion

Clarification on FPPSA Surcharge Adjustments & Recovery : In the proposed Clause 16.1(3) *"Fuel and Power Purchase Adjustment Surcharge shall be computed and charged by the distribution licensee, in (n+2)th month, on the basis of actual variation, in cost of fuel and power purchase and Inter- state Transmission Charges for the power procured during the nth month.*

Provided that in case the distribution licensee fails to compute and charge FPPAS within this time line, except in case of any force majeure condition, its right for recovery of costs on account of FPPAS shall be forfeited and in such cases, the right to recovery the FPPAS determined during true-up shall also be forfeited."

The above Clause seems to presume that the FPPSA would always be positive. There can be circumstances leading to a decline in the power purchase cost, thus a negative surcharge necessitating downward adjustment in tariff to be charged from the consumers.

Even if the language of the Clause presumes a positive surcharge, it would have applicability in case of a negative surcharge as well. A clarification may be added to ensure that **'in case of negative surcharge' the same would be recoverable from the licensee at the time of true up.**

In case 'deemed' surcharge (calculated using the formula) is more than the limit for automatic recovery of the surcharge, would the portion of surcharge beyond this limit would also be recoverable? Clarification to that effect may also be included.

Figure 1: Timeline for recovery of FPPAS

Suggested citation: Singh, A. (ed.). (2024), Opinion on UPERC (MYT for Distribution and Transmission Tariff) (Third Amendment) Regulations, 2024 [Draft], In Regulatory Insights (Vol. 07, Issue 03, pp. 2 -3), Centre for Energy Regulation (CER), Indian Institute of Technology Kanpur. https://cer.iitk.ac.in/newsletters/regulatory_insights/Volume07_Issue03.pdf

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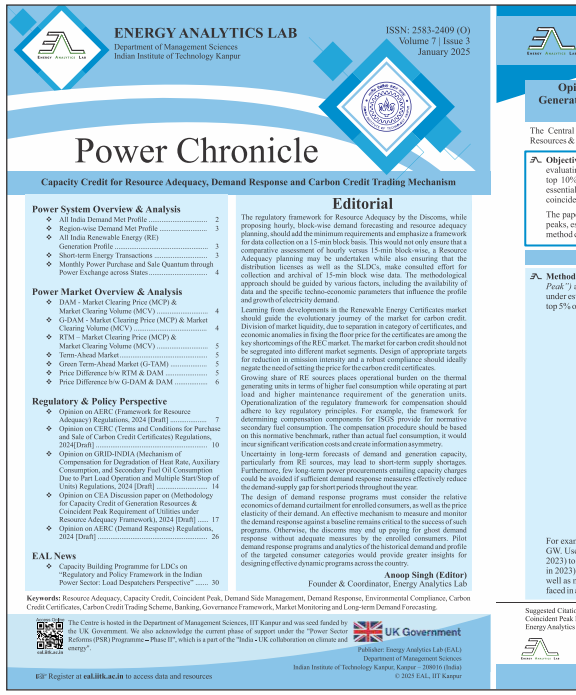

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Power Chronicle

Capacity Credit for Resource Adequacy, Demand Response and Carbon Credit Trading Mechanism

Editorial

The regulatory framework for Resource Adequacy by the Discoms, while proposing hourly, block-wise demand forecasting and resource adequacy planning, should add the minimum requirements and emphasize a framework for data collection on a 15-min block basis. This would not only ensure that a comparative assessment of hourly versus 15-min block-wise, a Resource Adequacy planning may be undertaken while also ensuring that the distribution licenses as well as the SLDCs, make consulted effort for collection and archival of 15-min block wise data. The methodological approach should be guided by various factors, including the availability of data and the specific techno-economic parameters that influence the profile and growth of electricity demand.

Learning from developments in the Renewable Energy Certificates market should guide the evolutionary journey of the market for carbon credit. Division of market liquidity, due to separation in category of certificates, and economic anomalies in fixing the floor price for the certificates are among the key shortcomings of the REC market. The market for carbon credit should not be segregated into different market segments. Design of appropriate targets for reduction in emission intensity and a robust compliance should ideally negate the need of setting the price for the carbon credit certificates.

Growing share of RE sources places operational burden on the thermal generating units in terms of higher fuel consumption while operating at part load and higher maintenance requirement of the generation units. Operationalization of the regulatory framework for compensation should adhere to key regulatory principles. For example, the framework for determining compensation components for ISGS provide for normative secondary fuel consumption. The compensation procedure should be based on this normative benchmark, rather than actual fuel consumption, it would incur significant verification costs and create information asymmetry.

Uncertainty in long-term forecasts of demand and generation capacity, particularly from RE sources, may lead to short-term supply shortages. Furthermore, few long-term power procurements entailing capacity charges could be avoided if sufficient demand response measures effectively reduce the demand-supply gap for short periods throughout the year.

The design of demand response programs must consider the relative economics of demand curtailment for enrolled consumers, as well as the price elasticity of their demand. An effective mechanism to measure and monitor the demand response against a baseline remains critical to the success of such programs. Otherwise, the discoms may end up paying for ghost demand response without adequate measures by the enrolled consumers. Pilot demand response programms and analytics of the historical demand and profile of the targeted consumer categories would provide greater insights for designing effective dynamic programs across the country.

Anoop Singh (Editor)
Founder & Coordinator, Energy Analytics Lab

Keywords: Resource Adequacy, Capacity Credit, Coincident Peak, Demand Side Management, Demand Response, Environmental Compliance, Carbon Credit Certificates, Carbon Credit Trading Scheme, Banking, Governance Framework, Market Monitoring and Long-term Demand Forecasting.

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UK Government

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Indian Institute of Technology Kanpur, Kanpur – 208016 (India)

Register at **eal.iitk.ac.in** to access data and resources

Power Chronicle

Opinion on CEA Discussion paper on (Methodology for Capacity Credit of Generation Resources & Coincident Peak Requirement of Utilities under Resource Adequacy Framework), 2024 [Draft]

The Central Electricity Authority issued discussion paper on, Methodology for Capacity Credit of Generation Resources & Coincident Peak Requirement of Utilities under Resource Adequacy Framework on 06th December 2024.

Objective: The Central Electricity Authority has issued a discussion paper exploring various methodologies for evaluating the capacity credit of solar, wind, and other renewable energy sources, these methodologies include the top 10% demand hours, solar vs. non-solar, and critical day methods. Accurate capacity credit estimation is essential for state and distribution utilities to determine the capacity required from various resources to meet their coincident peak demand obligations, particularly during the national peak demand.

The paper suggests that the solar vs. non-solar methodology may be a better approach for estimating coincident peaks, especially considering factors such as agricultural load shifting and the focus on adding solar capacity. This method could be more relevant than the traditional top 5% demand hour methodology.

EAL Opinion

Methods for Coincidental Peak Calculation: This discussion papers illustrates *(Refer section 3.0 "Coincident Peak")* alternate methods to calculate the coincidental peaks. Average of top 5% peak demand presents a risk of under estimation of the expected peak. We can note from the load duration curve of all India electricity demand that top 5% of the time blocks. Represent peak demand that has a significant range (Figure 5).

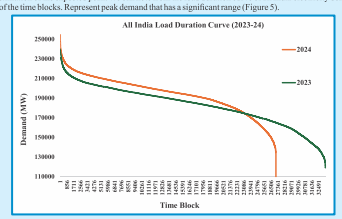

Figure 5: All India Load Duration Curve (2023 and 2024)
Note: Data up to 18th Dec 2024

For example, for part of the 2024 data, this ranges from 219 to 254 GW Power demand with an average of 236.5 GW. Use of the average of top 5% of the demand leaves with an underestimation of about 17.5 GW (14.4 GW in 2023) to the highest peak demand observed. Similar difference across the top 2% hours comes to 14.5 GW (11 GW in 2023). Similar differences are observed across the maximum and the median demand as well. Thus, average as well as median of top 5% or even 2% of the peak demand hours would not adequately represent the peak demand faced in a year.

Suggested Citation: Singh, A. (ed.). (2024), Opinion on CEA Discussion paper on (Methodology for Capacity Credit of Generation Resources & Coincident Peak Requirement of Utilities under Resource Adequacy Framework), 2024 [Draft], In Power Chronicle (Vol. 07, Issue 03, pp. 17-25), Energy Analytics Lab (EAL), Indian Institute of Technology Kanpur. https://eal.iitk.ac.in/assets/docs/power_chronicle_vol_7_issue_3.pdf

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PSR institutionalised regular dissemination through these periodicals, significantly enhancing transparency, stakeholder knowledge, and informed participation in regulatory processes.

CAPACITY BUILDING

Institutional Capacity Building

Fostering global collaboration for regulatory excellence

International collaborations help to enrich the research agenda, foster global partnerships, and address cross-border challenges in energy governance. It also helps build capacity for adoption of new skills and knowledge as well as for accelerated uptake of key interventions.

Interventions

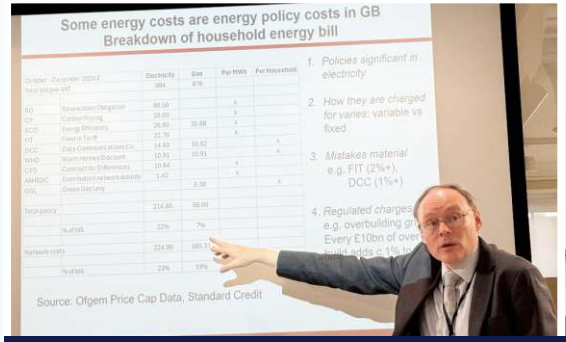
The PSR Programme organised a comprehensive 5-day Institutional Capacity Building (ICB) Programme in October 2024, conducted in London and Brussels. The initiative facilitated knowledge exchange on advanced regulatory frameworks in tariff design, electricity market structures, retail competition, and low-carbon generation policies. Experts from prominent institutions including Ofgem, University of Cambridge, National ESO, UCL, and CEER conducted 16 interactive sessions and site visits, offering firsthand insights into European regulatory best practices.

Outcomes

Knowledge Exchange: Facilitated transfer of international regulatory best practices in the power sector.

Capacity Enhancement: Strengthened institutional knowledge and regulatory capabilities of delegates.

Stakeholder Participation: 18 delegates from Indian institutions engaged directly with over 15 international experts.



Glimpses from the knowledge exchange visit to the UK in October 2024

PSR established structured global engagements, significantly enhancing India's regulatory capacity and enabling the integration of global best practices into India's energy transition pathways.

Regulatory Conclave

Institutionalising a mechanism for knowledge exchange

Regulatory instruments significantly influence various stakeholders, necessitating structured platforms for dialogue and knowledge exchange. The Regulatory Conclave serves as a dedicated online platform for policymakers, regulators, industry representatives, and other stakeholders to share insights, discuss best practices, and address critical regulatory challenges.

Interventions

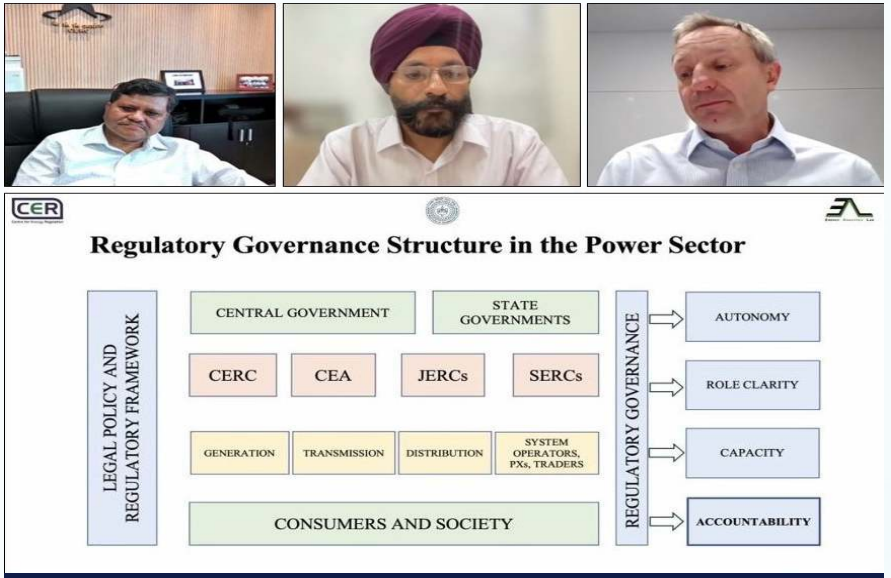
The PSR Programme has institutionalised the Regulatory Conclave to enable structured and periodic engagement on contemporary regulatory and policy issues. This initiative has established an engaging platform for communication and collaboration among key power sector stakeholders, fostering an inclusive and informed regulatory ecosystem.

Outcomes

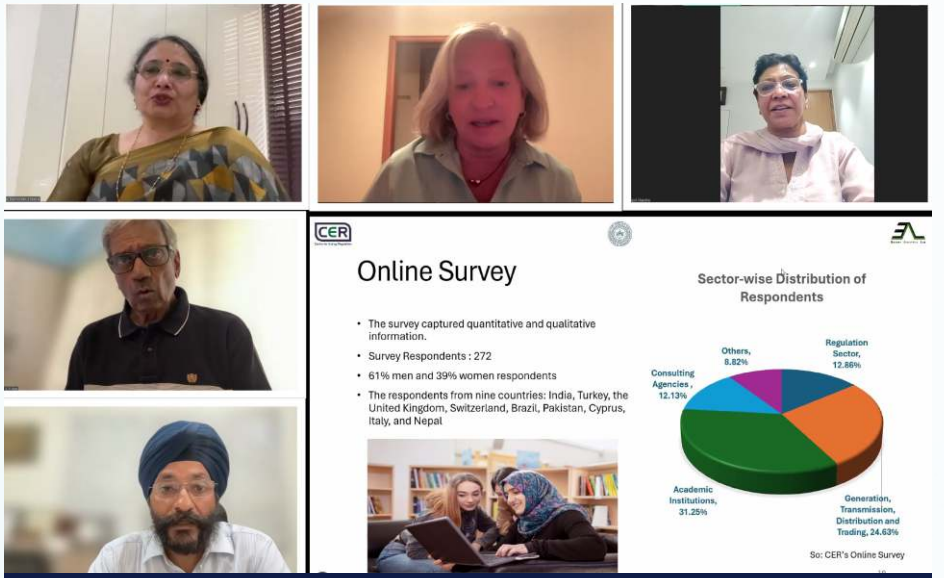
Thematic Regulatory Conclaves: Conducted 4 conclaves focused on –

- Regulatory Governance in the Indian Power Sector Regulatory Governance in the Indian Power Sector: Reporting and Accounting Framework for ERCs
- Role of Women in Power Sector Regulation
- Resource Adequacy Framework for Distribution Utilities: Methodological and Implementation Issues
- Energy Transition and Framework for Renewable Purchase Obligation (RPO)

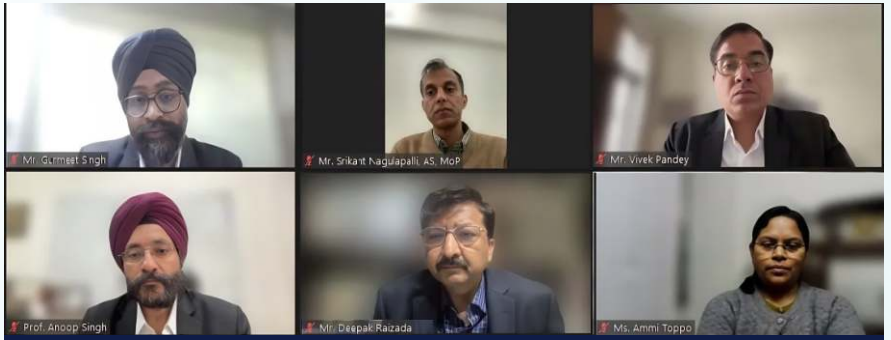
Institutionalised Stakeholder Collaboration: Established a formal and recurring platform to enhance consensus-building and shape progressive regulatory frameworks.



3rd Regulatory Conclave on
Regulatory Governance in the Indian Power Sector



4th Regulatory Conclave on
Role of Women in Power Sector Regulation



5th Regulatory Conclave on
Resource Adequacy Framework for Distribution Utilities

6th Regulatory Conclave on
Energy Transition and Framework for Renewable Purchase Obligation

The Regulatory Conclaves significantly enhanced stakeholder engagement, knowledge-sharing, and collective problem-solving, resulting in stronger and more inclusive regulatory frameworks.

Young Policy Professional Programme

Bridging academia and policy through research fellowships

Young researchers in engineering, economics, law, and social sciences need exposure to the practical aspects of regulation and policymaking in the energy and infrastructure sector to expand their research horizons. The Young Policy Professional Program (YPPP) is designed to address this gap by offering a mentored research fellowship to senior PhD scholars working on regulatory and policy issues relevant to the Indian power sector.

Interventions

The PSR Programme, through YPPP initiative, provided young scholars with opportunities to collaborate through research exchange programmes at IIT Kanpur. This activity focused on building research capacity, fostering global engagement, and enhancing regulatory knowledge in India's energy sector.

Outcomes

Successful completion of research programs by two young scholars on the following topics:

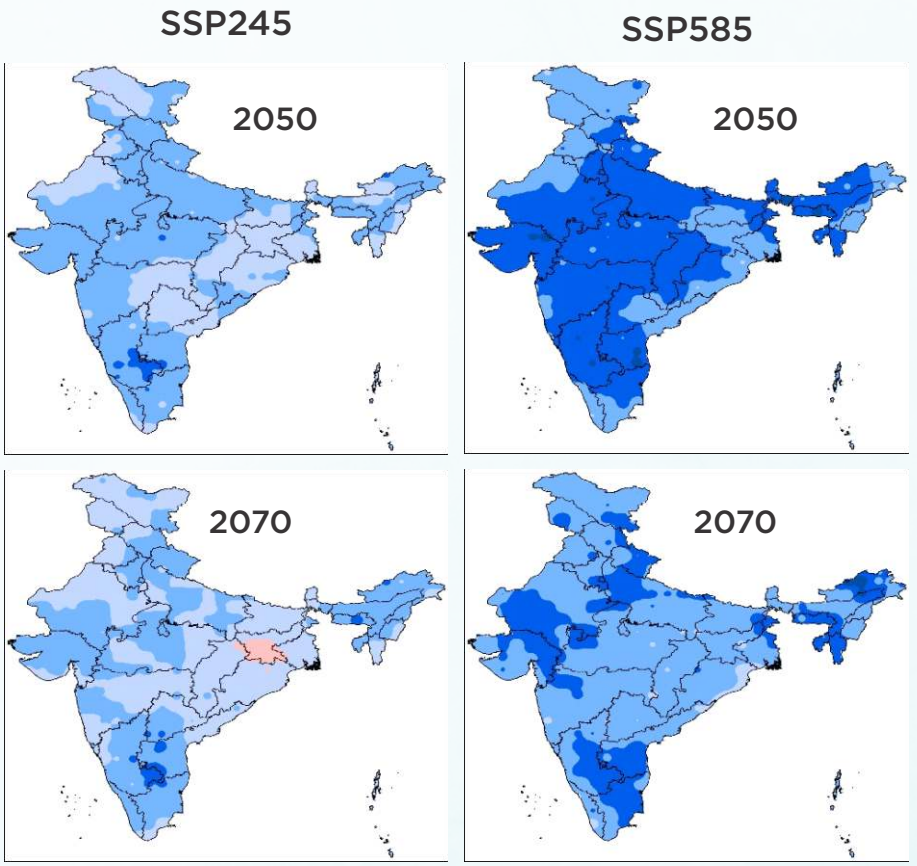
Analysis of Power Generation Potential of Major Operational and Planned Solar PV and Wind Energy Plants in India

Aravinda De Chinnu
Department of Energy Sciences and Engineering,
IIT Bombay

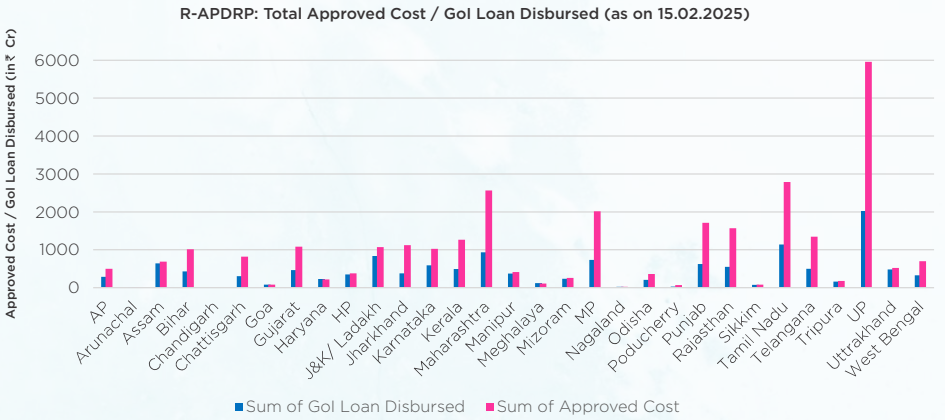
Impact of Central Government-funded Schemes on the Performance of State-owned Power Distribution Companies

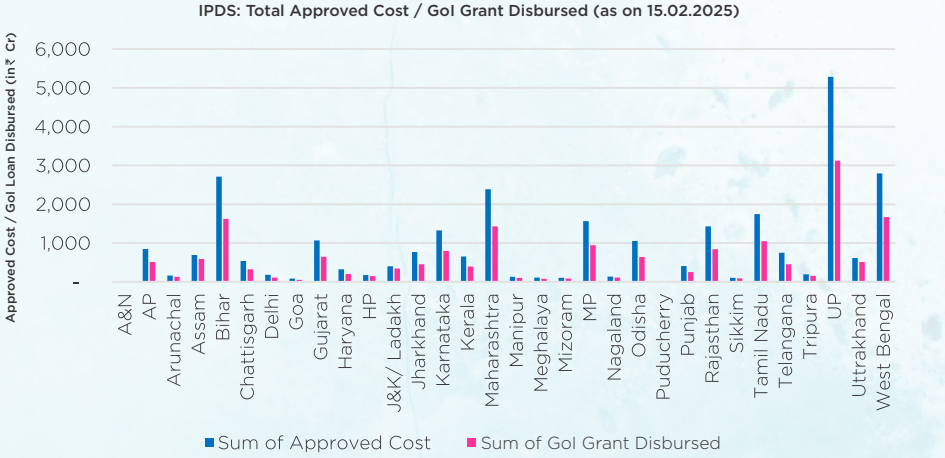
Munawwara Zubair
Gulati Institute of Finance and Taxation, Kerala
(Affiliated to CUSAT)

Snapshot from the analysis of power generation potential of major operational and planned solar PV plants in India



Comparison of approved cost and loan / grant disbursed under the R-APDRP and IPDS Schemes





The PSR Programme has empowered future energy leaders by bridging academic research with real-world policymaking, driving impactful regulatory research relevant to the Indian power sector.

ABOUT CER

Centre for Energy Regulation

The first-of-its-kind regulatory-academia-industry platform

The Centre for Energy Regulation (CER) was established in 2018 at the Department of Management Sciences, IIT Kanpur, with support from the UK Government's PSR Programme as an autonomous research institution.

Since inception, CER has played a crucial role in strengthening India's regulatory ecosystem through a range of initiatives:

Regulatory Research

Demand-driven research shaping policy and regulations through global collaborations

Knowledge-base

Monitoring framework and database for Indian power market, focusing on collection, preservation, and analysis of data to generate actionable insights

Regulatory Certification Programme (RCP)

Certification programme covering the operational, economic, legal and regulatory aspects of the power sector

Institutional Capacity Building

International study tours, regulatory research camps, regulatory conclaves, and capacity-building programmes for government representatives in the UK, Australia, and France

Technical Reports and Periodicals

Technical reports and quarterly periodicals on key sectoral developments


CER's 6th Regulatory Research Camp
on
Regulatory Framework for
Distribution ARR and Tariff Determination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I'm interested!
I'm interested!
I'm interested!
Power Sector Regulation: Theory and Practice
Power Market Economics and Operation
Renewable Energy: Economics, Policy and Regulation
Fundamentals of Power Sector Regulation
Economics and Operation of Power Market
Fundamentals of Renewable Energy: Economics, Policy and Regulation
Advance Topics on Power Sector Regulation
Power Procurement Planning and Strategy
Advance Topics on Renewable Energy: Economics, Policy and Regulation


The National Energy System Operator
NET ZERO
Our Primary Duties
Our Secondary Duties


Ghanshyam Prasad,IS MOP
Anoop Singh, ITK
Kiran
Kalekuri Anantha Ratnakar
Gautam Kumar
Gaurav Sabharwal
Suha
Gaurav Lohani, UERC
Aprajita Salgotra
Sanchit Saran Agarwal
Devendrasinh Chauhan
D Vishnuvardhan reddy SCCL
Shivam Puri
Bijoy Kumar Sahoo
Shambhavi mishra
Harsha Meenawat
Harsha Meenawat

About UK PACT

UK PACT (Partnering for Accelerated Climate Transitions) is a flagship programme under the UK's International Climate Finance (ICF) portfolio. The programme is jointly governed and funded by the Foreign, Commonwealth and Development Office (FCDO) and the Department for Energy Security and Net Zero (DESNZ). The UK is committed to tackling climate change and is investing £11.6bn via ICF over the five years to March 2026.

UK PACT delivers impact through a combination of funding longer-term capacity-building projects and the rapid mobilisation of expertise. UK PACT funds projects which support partner countries to implement and increase their ambitions for carbon emissions reductions in line with their Nationally Determined Contributions (NDCs).

All UK PACT projects work to accelerate partner countries' transition to low carbon development. UK PACT delivers capacity-building activities through strategically managed Funds. Our delivery model creates opportunities for synergies, knowledge sharing and learning between projects.

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