



Report on Short-term Power Market in India: 2023-24

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Economics Division
Central Electricity Regulatory Commission

Report on Short-Term Power Market in India 2023-24



CENTRAL ELECTRICITY REGULATORY COMMISSION

6th, 7th & 8th Floor, Tower B, World Trade Centre,
Nauroji Nagar, New Delhi- 110029
Phone: +91-11-26189709, Fax: +91-11-20904365

www.cercind.gov.in

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Preface

The Electricity Act 2003 consolidates the laws relating to the generation, transmission, distribution, trading, and use of electricity and generally for taking measures conducive to the development of electricity industry, promoting competition therein, protecting the interest of consumers and supply of electricity to all areas, rationalization of electricity tariff, ensuring transparent policies, etc. This is further strengthened by the regulatory initiatives of the Electricity Regulatory Commissions through various regulations and orders required to enable a framework for a robust and healthy power market in the country.

The Central Electricity Regulatory Commission sets the regulatory process in motion through Trading License Regulations, General Network Access Regulations, Power Market Regulations, REC Regulations, Deviation Settlement Mechanism Regulations, Ancillary Services Regulations, and Cross Border Trade of Electricity Regulations. Under these regulations, the short-term power market covers contracts of less than a year for electricity transacted through Inter-State Trading Licensees, directly between entities, and through Power Exchanges. The short-term power market and Deviation Settlement Mechanism, as an integral part of the power sector, has been beneficial for meeting the short-term needs of consumers, suppliers, and the sector as a whole. In 2023-24, the short-term market constituted about 12.5% per cent of the total electricity generation in India.

The annual report on the short-term power market in India provides a snapshot of short-term transactions of electricity through different instruments used by various market participants. The Central Electricity Regulatory Commission brings out this report with the objective of keeping market participants and other stakeholders aware and updated on the state of the power market in the country. The dissemination of information through the report is one of the key elements to ensure efficiency and competition in the sector and for stakeholders and consumers to maintain faith in the system. This report covers an overview of the power sector, trends in short-term



transactions of electricity on annual, monthly, and daily basis, time of the day variation in volume and price of electricity, trading margin for bilateral transactions, analysis of transactions carried out by various types of participants with emphasis on open access consumers on power exchanges, effect of congestion on volume of electricity traded on power exchanges, and ancillary services operations. The report also covers cross border trade of electricity between India and its neighbouring countries and analysis on transactions of Renewable Energy Certificates.

In order to ensure ease of access, this report is also made available on the CERC website www.cercind.gov.in. We are hopeful that market participants and stakeholders will find the Report on Short-term Power Market in India, 2023-24 useful.



Abbreviations

| Abbreviation | Expanded Version |
|--------------|--|
| AC | Alternating Current |
| ACE | Area Control Error |
| ACS | Average Cost of Supply |
| ADSS | Any Day Single Sided Contract |
| AGC | Automatic Generation Control |
| APCPDCL | Andhra Pradesh Central Power Distribution Company Limited |
| APDCL | Assam Power Distribution Company Ltd |
| APL | Above Poverty Line |
| APPCC | Andhra Pradesh Power Coordination Committee |
| APSPDCL | Andhra Pradesh Southern Power Distribution Company Limited |
| APTEL | Appellate Tribunal for Electricity |
| ARR | Average Revenue Realized |
| AT&C | Aggregate Technical and Commercial |
| BALCO | Bharat Aluminium Company Limited |
| BESS | Battery Energy Storage Systems |
| Block | 15 Minutes Time Block |
| BRPL | BSES Rajdhani Power Limited |
| BSPHCL | Bihar State Power Holding Company Limited |
| BU | Billion Units (Billion kWh) |
| CAGR | Compound Annual Growth Rate |
| CBTE | Cross Border Trade of Electricity |
| CCGT | Combined Cycle Gas Turbine |
| CEA | Central Electricity Authority |
| CERC | Central Electricity Regulatory Commission |
| CESC | Calcutta Electric Supply Corporation |
| CGS | Central Generating Station |
| CGSEB | Chhattisgarh State Electricity Board |
| Ckm | Circuit km |
| COD | Commercial Operation Date |
| COP | Conference of the Parties |
| CPP | Captive Power Producer/Plant |
| CSPDCL | Chhattisgarh State Power Distribution Company Limited |
| CTU | Central Transmission Utility |
| DAM | Day Ahead Market |
| DBFOO | Design, Build, Finance, Own and Operate |
| DBFOT | Design, Build, Finance, Operate and Transfer |
| DDUGJY | Deendayal Upadhyaya Gram Jyoti Yojana |



| Abbreviation | Expanded Version |
|--------------|---|
| DISCOMs | Distribution Companies |
| DNHDDPDCL | Dadra and Nagar Haveli and Daman and Diu Power Distribution Corporation Limited |
| DSM | Deviation Settlement Mechanism |
| DVC | Damodar Valley Corporation |
| EDCL | Energy development Company Limited |
| EGoM | Empowered Group of Ministers |
| ER | Eastern Region |
| ERSS | Eastern Region Strengthening Scheme |
| FCAS | Frequency Control Ancillary Services |
| FGUTPS | Firoz Gandhi Unchahar Thermal Power Station |
| FRAS | Fast Response Ancillary Services |
| G-DAC | Green Day Ahead Contract |
| G-DAM | Green Day Ahead Market |
| GNA | General Network Access |
| GOHP/GoHP | Government of Himachal Pradesh |
| GPS | Gas Power Station |
| GRIDCO | GRIDCO Limited |
| G-TAM | Green Term Ahead Market |
| GUVNL | Gujarat Urja Vikas Nigam Limited |
| GW | Giga Watts |
| HEP | Hydro Electric Project |
| HHI | Herfindahl-Hirschman Index |
| HP | Himachal Pradesh |
| HPDAM | High Price Day Ahead Market |
| HPO | Hydro Purchase Obligation |
| HPP | Hydroelectric Power Plant |
| HPPC | Haryana Power Purchase Centre |
| HPSEB | Himachal Pradesh State Electricity Board |
| HPX | Hindustan Power Exchange Ltd. |
| HVDC | High-Voltage Direct Current |
| IDAM | Integrated Day Ahead Market |
| IEGC | Indian Electricity Grid Code |
| IEX | Indian Energy Exchange |
| IPDS | Integrated Power Development Scheme |
| IPP | Independent Power Producers |
| ISGS | Inter State Generating Station |
| ISTS | Inter State Transmission System |
| JBVNL | Jharkhand Bijli Vitran Nigam Limited |

| Abbreviation | Expanded Version |
|--------------|---|
| JITPL | Jindal India Thermal Power Limited |
| J&K PDD | Jammu & Kashmir Power Development Department |
| JKPCL | Jammu Kashmir Power Corporation Ltd. |
| JVVNL | Jaipur Vidyut Vitaran Nigam Ltd. |
| KSEB | Kerala State Electricity Board |
| KV | Kilovolt |
| kWh | Kilo Watt Hour |
| LHP | Large hydro Power Plants |
| LDC | Longer Duration Contracts |
| LDP | Low Dam Project |
| LTA | Long Term Access |
| Ltd. | Limited |
| MBD | Model Bidding Document |
| MCP | Market Clearing Price |
| MNRE | Ministry of New and Renewable Energy |
| MOP | Ministry of Power |
| MPDCL | Meghalaya Power Distribution Corporation Limited |
| MPP | Merchant Power Plant |
| MPPGCL | Madhya Pradesh Power Generating Company Limited |
| MPPMCL | MP Power Management Company Limited |
| MSEDCL | Maharashtra State Electricity Distribution Co. Ltd. |
| MU | Million Units |
| MVA | Mega Volt Ampere |
| MW | Mega Watts |
| MWh | Mega Watt Hour |
| NCAS | Network Control Ancillary Services |
| NCTP | National Capital Thermal Power Plant |
| NDMC | New Delhi Municipal Corporation |
| NEEPCO | North Eastern Electric Power Corporation Limited |
| NER | North Eastern Region |
| NHDC | National Hydro Development Corporation Limited |
| NLC | NLC India Limited |
| NLDC | National Load Dispatch Centre |
| NPCL | Noida Power Company Limited |
| NR | Northern Region |
| NRSS | Northern Region Strengthening Scheme |
| NSGM | National Smart Grid Mission |
| NTPC | National Thermal Power Corporation |
| NTPL | NLC- Tamil Nadu Power Limited |



| Abbreviation | Expanded Version |
|-----------------|--|
| OA | Open Access |
| OAC | Open Access Consumer |
| OTP | Other than RTC and Peak period |
| OTPC | ONGC Tripura Power Company |
| PCKL | Power Company of Karnataka Limited |
| PFC | Power Finance Corporation |
| PGCIL/POWERGRID | Power Grid Corporation of India Limited |
| POSOCO | Power System Operation Corporation Limited |
| PPA | Power Purchase Agreement |
| PRAS | Primary Reserve Ancillary Services |
| PSPCL | Punjab State Power Corporation Limited |
| PX | Power Exchange |
| PXIL | Power Exchange India Limited |
| RDSS | Revamped Distribution Sector Scheme |
| RE | Renewable Energy |
| REC | Renewable Energy Certificate |
| RES | Renewable Energy Sources |
| RFP | Request for Proposal |
| RFQ | Request for Qualification |
| RGVY | Rajiv Gandhi Grameen Vidyutikaran Yojana |
| RGPS | Ratnagiri Gas Power Station |
| RLDC | Regional Load Despatch Centre |
| ROR | Run of River |
| RPC | Regional Power Committee |
| RPO | Renewable Purchase Obligation |
| RRAS | Reserves Regulation Ancillary Services |
| RTC | Round the Clock |
| RTM | Real-Time Market |
| RUVNL | Rajasthan Urja Vikas Nigam Limited |
| S1 | Southern Region 1 |
| S2 | Southern Region 2 |
| S3 | Southern Region 3 |
| SAARC | South Asian Association for Regional Cooperation |
| SBD | Standard Bidding Document |
| SEB | State Electricity Board |
| SEBI | Securities & Exchange Board of India |
| SHP | Small Hydro Power |
| SJVNL | Satluj Jal Vidyut Nigam Limited |
| SRAS | Secondary Reserve Ancillary Services |

| Abbreviation | Expanded Version |
|--------------|--|
| SR Grid | Southern Region Grid |
| St | Stage |
| STPP | Super Thermal Power Plant |
| STPS | Super Thermal Power Station |
| TAM | Term Ahead Market |
| TANGEDCO | Tamil Nadu Generation and Distribution Corporation |
| T-GNA | Temporary General Network Access |
| THDC | Tehri Hydro Development Corporation Limited |
| TNEB | Tamil Nadu Electricity Board |
| TPCL | Tata Power Company Limited |
| TPP | Thermal Power Plant |
| TPS | Thermal Power Station |
| TRAS | Tertiary Reserve Ancillary Services |
| TSSPDCL | Telangana Southern Power Distribution Company Limited |
| TSPCC | Telangana State Power Coordination Committee |
| UDAY | Ujwal DISCOM Assurance Yojana |
| UMPP | Ultra-Mega Power Projects |
| UPPCL | Uttar Pradesh Power Corporation Limited |
| UPCL | Uttarakhand Power Corporation Limited |
| VAE | Virtual Ancillary Entity |
| W1 | Western Region 1 |
| W2 | Western Region 2 |
| WBSEDCL | West Bengal State Electricity Distribution Company Ltd |
| WR | Western Region |
| WRSS | Western Region Strengthening Scheme |

Executive Summary

The 'Report on Short-term Power Market in India: 2023-24' provides a snapshot of the developments in the power sector, with a focus on short-term power transactions through different mechanisms by various market participants. The report broadly comprises four sections, viz., an overview of the power sector, trends in the short-term power market in India, cross-border trade of electricity and trading of renewable energy certificates.

The chapter on the Overview of the power sector discusses the year-wise trend in electricity generation, transmission and distribution, including the revenue gap of state electricity distribution companies (DISCOMs)/SEBs and the measures/reforms undertaken by the Ministry of Power in recent years. The salient features of the power sector, as discussed in the report, are as under:

1. Thermal energy (mainly from Coal) is an important source of electricity generation in India, contributing about 55% of the total installed generation capacity in 2023-24, followed by Renewable Energy Source (RES) (32.5%), Hydro (10.6%), and Nuclear (1.9%).
2. The Compound Annual Growth Rate (CAGR) of total installed generation capacity was 7.6% during the period from 2008-09 to 2023-24. The CAGR of RES was 17.2%, whereas it was 5.4% for all other sources combined during the period.
3. During the period from 2008-09 to 2023-24, the share of the State sector in the total installed generation capacity declined from 54% to 24%, and the share of the central sector declined from 31% to 24%, while the share of the private sector increased from 15% to 52%.
4. Gross electricity generation in India increased from 747.07 BU in 2008-09 to 1739.09 BU in 2023-24, and it increased at a CAGR of 5.8%.
5. The CAGR of gross electricity generation from 2008-09 to 2023-24 was low (5.8%) as compared to the CAGR of annual installed electricity generation capacity (7.6%).



6. An increase in the installed capacity resulted in a decrease in the demand shortage (both energy and peak shortage). The energy shortage decreased from 11.1% in 2008-09 to about 0.3% in 2023-24, whereas the peak deficit decreased from 11.9% to 1.4% during this period.
7. From 2008-09 to 2023-24, the bulk transmission grew at a CAGR of 5.4%, while the growth in the transmission capacity of substations (220 KV and above) was at the rate of 10.3%.
8. The annual transmission charges increased at a CAGR of 14.88% during the period from 2011-12 to 2023-24.
9. The total electricity consumption increased from 611.29 BU in 2008-09 to 1543.0 BU in 2023-24 (estimated), registering a CAGR of 6.4%. During the period, per-capita consumption of electricity also increased from 734 kWh to 1395 kWh.
10. All India average cost of supply and average revenue (without subsidy) of state power utilities increased from ₹3.40/kWh and ₹2.63/kWh, respectively, in 2008-09 to ₹7.11/kWh and ₹5.53/kWh, respectively, in 2022-23. During the last five years, the revenue as a percentage of cost was varying between 77% and 80%, indicating that the weighted average tariff for all categories of consumers was about 22% lower than the weighted average cost of supply.

‘Short-term transactions of electricity and DSM Volume’ refers to contracts of less than one-year period for electricity transacted bilaterally through Inter-State Trading Licensees (only inter-state part) and directly between entities; through Power Exchanges {Indian Energy Exchange Ltd. (IEX), Power Exchange India Ltd. (PXIL) and Hindustan Power Exchange (HPX)}; and the volume under Deviation Settlement Mechanism (DSM). The analysis of the short-term power market & DSM volume includes (i) yearly/monthly/daily trends in short-term transactions of electricity and DSM; (ii) time of the day variation in volume and price of electricity transacted through traders and power exchanges; (iii) trading margin charged by trading licensees for bilateral transactions; (iv) analysis of open access consumers on power exchanges; (v)



major sellers and buyers of electricity in the short term market; (vi) effect of congestion on volume of electricity transacted through power exchanges; and (vii) ancillary services operations. Major highlights of the short-term power market during 2023-24 are as under:

1. Of the total electricity generated in India in 2023-24, the short-term power market comprised about 12.5%. The balance 87.5% of generation was procured mainly by distribution companies through long-term contracts and short-term intra-state transactions.
2. From 2009-10 to 2023-24, the volume of short-term transactions of electricity & DSM volume increased at a higher rate (CAGR of 8.9%) when compared with the gross electricity generation (CAGR of 6.0%).
3. In terms of volume, the size of the short-term market & DSM volume in India increased from 194.35 BU in the year 2022-23 to 218.22 BU in 2023-24, registering an annual growth of about 12%.
4. Excluding DSM and direct bilateral transactions between entities, the volume of electricity transacted was 162.51 BU in 2023-24. In monetary terms, the size of this segment of the short-term market was ₹100729 crore in the year 2023-24¹, which was about 19% more than the year 2022-23.
5. The volume of electricity transacted through power exchanges increased at a CAGR of 22.4%, and the volume of electricity transacted through traders increased at a CAGR of 3.1% from 2009-10 to 2023-24.
6. The DSM volume witnessed an increase of 1.86% in 2023-24 over the last year 2022-23. The DSM volume as a percentage of the total volume of short-term transactions of electricity and DSM continued the downward trend. It has come down from 39.2% in 2009-10 to 12.3% in 2023-24.

¹excluding banking transactions



7. In terms of volume, the direct bilateral transactions between entities decreased by about 7.6% in 2023-24 as compared to 2022-23. The share of direct bilateral transactions as a percentage of total short-term transaction & DSM volume increased from 9.4% in 2009-10 to 13.3% in 2023-24.
8. The weighted average price of electricity transacted through power exchanges was ₹5.82/kWh and through trading licensees it was ₹7.33/kWh in 2023-24. The corresponding values for the year 2022-23 were ₹6.25/kWh and ₹5.85/kWh, respectively.
9. DSM charge increased from ₹5.39/kWh in 2022-23 to ₹5.73/kWh in 2023-24.
10. During 2023-24, 4% of the volume of electricity transacted through traders was at a price less than ₹5/kWh and 91% of the volume was transacted through traders at less than ₹9/kWh.
11. In Day Ahead Market at IEX, during 2023-24, 66% of the volume of electricity was transacted at a price less than ₹5/kWh, while 81% of the volume was transacted at a price less than ₹9/kWh. In case of PXIL, 2% of the volume of electricity was transacted at a price less than ₹5/kWh and 6% of the volume was transacted at less than ₹9/kWh. In case of HPX, there was no transactions at less than ₹9/kWh.
12. In Green Day Ahead Market at IEX, during 2023-24, 68% of the volume of electricity was transacted at a price less than ₹5/kWh, while about 86% of the volume was transacted at a price less than ₹9/kWh. There was no trade in G-DAM segment on PXIL and HPX.
13. In Real-Time Market at IEX, during 2023-24, 66% of the volume of electricity was transacted at a price less than ₹5/kWh while about 84% of the volume was transacted at a price less than ₹9/kWh. In case of PXIL and HPX, there was no transactions at less than ₹9/kWh.

14. In High Price- Day Ahead Market at IEX, during 2023-24, 1% of the volume of electricity was transacted at a price less than ₹10/kWh, while about 9% of the volume was transacted at a price less than ₹15/kWh. In case of PXIL, there were no transactions at price less than ₹10/kWh and 100% of the volume was transacted at price less than ₹15/kWh. There was no trade in HP-DAM segment on HPX.
15. During 2023-24, of the total electricity bought under bilateral transactions from traders, 85.8% was on round-the-clock (RTC) basis, followed by 13.9% in periods other than RTC and peak (OTP), and 0.4% was during peak hours. The per unit price of electricity procured during the Peak period was high (₹9.62/kWh) when compared with the price during RTC (₹7.37/kWh) and OTP (₹7.23/kWh).
16. It is observed from the block-wise and region-wise prices of electricity transacted through power exchanges in 2023-24, that the price of electricity in all the regions was almost similar at IEX (in DAM, G-DAM and RTM), which is indicative of very few instances of congestion. No consistent trend was observed in price in different regions in case of PXIL, as there was very low liquidity in DAM.
17. From 2008-09 to 2023-24, the number of traders who were undertaking trading increased from 15 to 39. The Herfindahl-Hirschman Index (HHI), based on the volume of electricity transacted in the short-term through traders, increased from 0.1630 in 2008-09 to 0.1721 in 2023-24. The concentration of market power, in terms of the volume of electricity transacted through traders/trading licensees, was moderate in 2023-24.
18. The weighted average trading margin charged by the trading licensees in 2023-24 was ₹0.029/kWh, in line with the CERC Trading License Regulations, 2020.
19. In the power exchanges, Open Access industrial consumers bought 11.03 BU of electricity in collective transactions, which formed 12.8% of the total day ahead, green day ahead, high-price day ahead and real-time market volume transacted in the power exchanges during 2023-24.

20. The weighted average price of electricity bought by open access consumers at IEX was ₹3.76/kWh, which was lower as compared to the weighted average price of the total electricity transacted through IEX (₹5.10/kWh), i.e., through day-ahead, green day-ahead, high price-day ahead & real-time markets. The weighted average price of electricity bought by open access consumers through PXIL (₹7.39/kWh), was lower compared to weighted average price of the total electricity transacted through PXIL (₹10.23/kWh) in 2023-24. In case of HPX, the weighted average price of electricity bought by open access consumers (₹10.00/kWh), was slightly higher compared to weighted average price of the total electricity transacted through HPX (₹9.98/kWh) in 2022-23.
21. The year witnessed very few constraints on the volume of electricity transacted through power exchanges due to transmission congestion. During 2023-24, the actual transacted volume was about 0.10% less than the unconstrained volume. Due to a few instances of congestion and the splitting of the market, the congestion amount collected during the year was ₹25.20 crore.
22. With coming into effect, the provision relating to TRAS, the RRAS Regulations 2015 ceased to be in operation. The energy scheduled under Regulation UP of RRAS was 522.56 MU and the energy scheduled under Regulation DOWN of RRAS was 2132.41 MU in 2023-24 (Apr-May 2023).
23. Energy Scheduled under TRAS-Up through Market was 47.07 MU (including DAM-AS and RTM-AS), whereas energy scheduled under TRAS-Down through Market was 3.03 MU (including DAM-AS and RTM-AS). Energy scheduled under TRAS-UP was 5132.43 MU in shortfall/emergency, while energy scheduled under TRAS-Down in shortfall/emergency was 8302.36 in 2023-24 (June 2023 onwards).

Salient features of the cross-border trade of electricity and renewable energy certificates transacted through power exchanges are as under:

1. India has been importing electricity from Bhutan and exporting electricity to Bangladesh, Nepal, and Myanmar. India was net importer of electricity from 2013-14 to 2015-16, and has been a net exporter of electricity from 2016-17 onwards.



Cross Border Electricity Trade in the Day Ahead Market of IEX was commenced in 2021-22. The trade with Nepal was commenced on 17.04.2021, whereas the trade with Bhutan was commenced on 01.01.2022. Trade in Real-Time Market of IEX commenced from October 2023.

2. During 2023-24, a total of 138.53 lakh RECs were transacted on the power exchanges and bilaterally through trading licensees. The categorization of RECs between solar and non-solar has been dispensed with, with the introduction of the concept of multiplier under the Central Electricity Regulatory Commission (Terms and Conditions for Renewable Energy Certificates for Renewable Energy Generation) Regulations 2022, w.e.f. 05.12.2022. A new contract, namely “REC”, has been made available for trading by the power exchanges w.e.f. December 2022. REC Regulations 2022 allowed transactions of RECs through the trading licensees.



