

Report on Short-Term Power Market in India: 2022-23



Economics Division
Central Electricity Regulatory Commission

Report on Short-Term Power Market in India 2022-23



CENTRAL ELECTRICITY REGULATORY COMMISSION

**3rd & 4th Floor, Chanderlok Building
36, Janpath, New Delhi-110001**

Phone: +91-11-23353503, Fax: +91-11-23753923

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, Open 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 and directly by the Distribution Licensees, on Power Exchanges, and Deviation Settlement Mechanism. The short-term power market, 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 2022-23, the short-term market constituted about 12% 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, tariff of long-term sources of power 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, 2022-23 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
BESS	Battery Energy Storage Systems
Block	15 Minutes Time Block
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
DISCOMs	Distribution Companies
DNHDDPDCL	Dadra and Nagar Haveli and Daman and Diu Power



Abbreviation	Expanded Version
	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
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
J&K PDD	Jammu & Kashmir Power Development Department
JKPCL	Jammu Kashmir Power Corporation Ltd.
JVVNL	Jaipur Vidyut Vitaran Nigam Ltd.

Abbreviation	Expanded Version
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
NEEPCO	North Eastern Electric Power Corporation Limited
NER	North Eastern Region
NHDC	National Hydro Development Corporation Limited
NHPC	NHPC Limited
NLC	NLC India Limited
NLDC	National Load Dispatch Centre
NR	Northern Region
NRSS	Northern Region Strengthening Scheme
NSGM	National Smart Grid Mission
NTPC	NTPC Limited
NTPL	NLC Tamil Nadu Power Limited
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

Abbreviation	Expanded Version
PFC	Power Finance Corporation
PGCIL/POWERGRID	Power Grid Corporation of India Limited
POSOCO	Power System Operation Corporation Limited
PPA	Power Purchase Agreement
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
RGGVY	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
SJVNL	Satluj Jal Vidyut Nigam Limited
SRAS	System Restart Ancillary Services
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
THDC	Tehri Hydro Development Corporation Limited



Abbreviation	Expanded Version
TNEB	Tamil Nadu Electricity Board
TPP	Thermal Power Plant
TPS	Thermal Power Station
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: 2022-23’ 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 five sections, viz., an overview of the power sector, trends in the short-term power market in India, cross-border trade of electricity, long-term sources of power, 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 57% of the total installed generation capacity in 2022-23, followed by Renewable Energy Source (RES) (30.1%), Hydro (11.3%), and Nuclear (1.6%).
2. The Compound Annual Growth Rate (CAGR) of total installed generation capacity was 7.7% during the period from 2008-09 to 2022-23. The CAGR in RES was 17.4%, whereas it was 5.7% in all other sources during the period.
3. During the period from 2008-09 to 2022-23, the share of the State sector in the total installed generation capacity declined from 54% to 25%, and the share of the central sector declined from 31% to 24%, while the share of the private sector increased from 15% to 51%.
4. Gross electricity generation in India increased from 747.07 BU in 2008-09 to 1624.47 BU in 2022-23, and it increased at a CAGR of 5.71%.

5. The CAGR in gross electricity generation from 2008-09 to 2022-23 was low (5.71%) when compared with the annual installed electricity generation capacity (7.7%).
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 0.5% in 2022-23, whereas the peak deficit decreased from 11.9% to 4.0%.
7. From 2008-09 to 2022-23, the bulk transmission grew at a CAGR of 5.6%, while the growth in the transmission capacity of substations was at the rate of 10.6%.
8. The annual transmission charges increased at a CAGR of 16.48% during the period from 2011-12 to 2022-23.
9. The total electricity consumption increased from 611.29 BU in 2008-09 to 1403.40 BU in 2022-23 (estimated), registering a CAGR of 6.1%. During the period, per-capita consumption of electricity also increased from 734 kWh to 1327 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 ₹6.29/kWh and ₹4.98/kWh, respectively, in 2021-22. During the last 5 years, the revenue as percentage of cost was varying between 76% and 81%, indicating that the weighted average tariff for all categories of consumers was about 21% lower than the weighted average cost of supply.

‘Short-term transactions of electricity’ refers to contracts of less than one-year period for electricity transacted under bilateral transactions through Inter-State Trading Licensees (only inter-state part) and directly by the Distribution Licensees (also referred to as Distribution Companies or DISCOMs), Power Exchanges {Indian Energy Exchange Ltd. (IEX), Power Exchange India Ltd. (PXIL) and Hindustan Power Exchange (HPX)}, and Deviation Settlement Mechanism (DSM). The analysis of the short-term power market includes (i) yearly/monthly/daily trends in short-term



transactions of electricity; (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. Salient features of the short-term power market during 2022-23 are as under:

1. Of the total electricity procured in India in 2022-23, the short-term power market comprised about 12%. The balance 88% of generation was procured mainly by distribution companies through long-term contracts and short-term intra-state transactions.
2. From 2009-10 to 2022-23, the volume of short-term transactions of electricity increased at a higher rate (CAGR of 8.7%) when compared with the gross electricity generation (CAGR of 5.9%).
3. In terms of volume, the size of the short-term market in India increased from 186.75 BU in the year 2021-22 to 194.35 BU in 2022-23, registering an annual growth of about 4%.
4. Excluding DSM and direct bilateral sale between the DISCOMs, the volume of electricity transacted was 136.76 BU in 2022-23. In monetary terms, the size of this segment of the short-term market was ₹84152 crore in the year 2022-23¹, which was about 35% more than in the year 2021-22. The increase in the size of the market was mainly due to increased volumes transacted through power exchanges and traders.
5. The volume of electricity transacted through power exchanges increased at a CAGR of 29%, and the volume of electricity transacted through traders increased at a CAGR of 3.1% from 2008-09 to 2022-23.

¹excluding banking transactions



6. The volume of DSM transactions increased by 4% in 2022-23 over the year 2021-22. The share of DSM as a percentage of the total volume of short-term transactions of electricity continued a downward trend in past years, and it declined from 39.2% in 2009-10 to 13.5% in 2022-23.
7. In terms of volume, the direct bilateral transactions between DISCOMs witnessed an increase of about 52% in 2022-23 as compared to 2021-22. The share of direct bilateral transactions between DISCOMs as a percentage of total short-term transaction volume increased from 9.4% in 2009-10 to 16.1% in 2022-23.
8. The weighted average price of electricity transacted through power exchanges was ₹6.25/kWh and through trading licensees it was ₹5.85/kWh in 2022-23. The corresponding values for the year 2021-22 were ₹4.69/kWh and ₹3.72/kWh, respectively. The weighted average prices of electricity transacted through Day Ahead Market, Green Day Ahead Market, Real-Time Market, Term Ahead Market and Green Term Ahead Market sub-segment of the power exchanges in 2022-23 were ₹6.03/kWh, ₹5.64/kWh, ₹5.67/kWh and ₹7.55/kWh and ₹6.51/kWh respectively.
9. The price of DSM increased from ₹3.73/kWh in 2021-22 to ₹5.39/kWh in 2022-23.
10. During 2022-23, 47% of the volume of electricity transacted through traders was at a price less than ₹5/kWh and 95% of the volume was transacted through traders at less than ₹10/kWh.
11. In Day Ahead Market, during 2022-23, 83% of the volume of electricity was transacted at a price less than ₹10/kWh, while about 50% of the volume was transacted at a price less than ₹5/kWh at IEX. In case of PXIL, 84% of the volume of electricity was transacted at a price less than ₹10/kWh and 47% of the volume was transacted at less than ₹5/kWh. In case of HPX, about 79% of the volume was transacted at less than ₹10/kWh and 60% of the volume of electricity in DAM was transacted at less than ₹5/kWh.

12. In Green Day Ahead market, during 2022-23, about 87% of the volume of electricity was transacted at a price less than ₹10/kWh, while about 57% of the volume was transacted at a price less than ₹5/kWh, at IEX. In the case of GDAM, 100% of the volume was transacted at less than ₹6/kWh. There was no trade in GDAM segment on HPX.
13. In Real-Time Market (RTM), during 2022-23, 93% of the volume of electricity was transacted at a price less than ₹10/kWh while about 78% of the volume was transacted at a price less than ₹5/kWh at IEX. In case of PXIL, only 4% of the volume was transacted at less than ₹5/kWh, and 6% of the volume was transacted at a price less than ₹10/kWh. There was no trade in RTM on HPX.
14. During 2022-23, of the total electricity bought under bilateral transactions from traders, 85.8% was on round the clock (RTC) basis, followed by 14.1% in periods other than RTC and peak (OTP), and 0.1% was during peak hours. The per unit price of electricity procured during the Peak period was high (₹7.92/kWh) when compared with the price during RTC (₹6.03/kWh) and OTP (₹4.79/kWh).
15. It is observed from the block-wise and region-wise prices of electricity transacted through power exchanges in 2022-23 that the price of electricity in all the regions was almost similar at IEX, which is indicative of very few instances of congestion. Though no consistent trend has been observed in price in different regions in case of PXIL, the price of electricity in the southern region was relatively high when compared with the prices in other regions.
16. From 2008-09 to 2022-23, the number of traders who were undertaking trading increased from 15 to 38. 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 0.1874 in 2022-23. The concentration of market power, in terms of the volume of electricity transacted through traders/trading licensees, was moderate in 2022-23.

17. The weighted average trading margin charged by the trading licensees in 2022-23 was ₹0.027/kWh, which is in line with the CERC Trading License Regulations, 2020.
18. In the power exchanges, Open Access industrial consumers bought 7.6 BU of electricity, which formed 9.6% of the total day ahead, green day ahead, and real-time market volume transacted in the power exchanges during 2022-23.
19. The weighted average price of electricity bought by open access consumers at IEX was ₹3.92/kWh, which was lower as compared to the weighted average price of the total electricity transacted through IEX (₹5.90/kWh), i.e., through day-ahead, green day-ahead & real-time market. The weighted average price of electricity bought by open access consumers through PXIL (₹4.06/kWh), was lower compared to weighted average price of the total electricity transacted through PXIL (₹6.49/kWh) in 2022-23. In case of HPX, the weighted average price of electricity bought by open access consumers (₹5.30/kWh), was lower compared to weighted average price of the total electricity transacted through HPX (₹6.51/kWh) in 2022-23.
20. The year witnessed very few constraints on the volume of electricity transacted through power exchanges due to transmission congestion. During 2022-23, the actual transacted volume was about 0.02% 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 ₹16.58 crore.
21. The energy scheduled under Regulation UP of RRAS increased from 2212.28 MU in 2016-17 to 4153.26 MU in 2022-23. The energy scheduled under Regulation DOWN of RRAS increased from 286.00 MU in 2016-17 to 4532.77 MU in 2022-23.

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 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.
2. During 2022-23, a total of 82.50 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 also allowed transactions of RECs through the trading licensees.

