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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 2024-25, the short-term market constituted about 13.03% 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, 2024-25 useful.

***

Abbreviations

Abbreviation	Expanded Version
AC	Alternating Current
ACP	Area Clearing Price
ACS	Average Cost of Supply
ADSS	Any Day Single Sided Contract
AMNSIL	Arcelor Mittal Nippon Steel India Ltd
APCPDCL	Andhra Pradesh Central Power Distribution Company Limited
APDCL	Assam Power Distribution Company Ltd
APL	Above Poverty Line
APTEL	Appellate Tribunal for Electricity
ARR	Average Revenue Realized
AT&C	Aggregate Technical and Commercial
BESS	Battery Energy Storage Systems
BEST	Brihanmumbai Electricity Supply and Transport
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
CCPP	Combined Cycle Power Plant
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CGS	Central Generating Station
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
DAC	Day Ahead Contingency
DAM	Day Ahead Market
DDUGJY	Deendayal Upadhyaya Gram Jyoti Yojana
DISCOMs	Distribution Companies
DSM	Deviation Settlement Mechanism
DVC	Damodar Valley Corporation
ER	Eastern Region
FCAS	Frequency Control Ancillary Services
FRAS	Fast Response Ancillary Services

Abbreviation	Expanded Version
G-DAC	Green Day Ahead Contract
G-DAM	Green Day Ahead Market
GNA	General Network Access
GPP	Gas Power Plant
GPS	Gas Power Station
GRIDCO	GRIDCO Limited
G-TAM	Green Term Ahead Market
GUVNL	Gujarat Urja Vikas Nigam Limited
GW	Giga Watts
HHI	Herfindahl-Hirschman Index
HP-DAM	High Price Day Ahead Market
HP-TAM	High Price Term Ahead Market
HPO	Hydro Purchase Obligation
HPP	Hydroelectric Power Plant
HPPC	Haryana Power Purchase Centre
HPS	Hydro Power Station
HPX	Hindustan Power Exchange Ltd.
HVDC	High-Voltage Direct Current
ID	Intra Day
IDAM	Integrated Day Ahead Market
IEA	International Energy Agency
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
IT	Information Technology
JBVNL	Jharkhand Bijli Vitran Nigam Limited
JKPCL	Jammu Kashmir Power Corporation Ltd.
KSEB	Kerala State Electricity Board
KSEBL	Kerala State Electricity Board Ltd
kV	Kilovolt
kWh	Kilo Watt Hour
LTA	Long Term Access
Ltd.	Limited
MCP	Market Clearing Price
MMC	Market Monitoring Cell
MNRE	Ministry of New and Renewable Energy

Abbreviation	Expanded Version
MOP	Ministry of Power
MP	Miscellaneous Petition
MPDCL	Meghalaya Power Distribution Corporation Limited
MPP	Merchant Power Plant
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
N1	Northern Region 1
N2	Northern Region 2
N3	Northern Region 3
NCAS	Network Control Ancillary Services
NER	North Eastern Region
NEW Grid	North East West Grid
NLDC	National Load Dispatch Centre
NR	Northern Region
NRSS	Northern Region Strengthening Scheme
NSGM	National Smart Grid Mission
NTPC	National Thermal Power Corporation
NTSD	Non Transferable Specific Delivery
OA	Open Access
OAC	Open Access Consumer
OTP	Other than RTC and Peak period
PCKL	Power Company of Karnataka Limited
PDCL	Power Distribution Corporation 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
RC	Regulatory Compliance
RE	Renewable Energy
REC	Renewable Energy Certificate

Abbreviation	Expanded Version
RES	Renewable Energy Sources
RGGVY	Rajiv Gandhi Grameen Vidyutikaran Yojana
RLDC	Regional Load Despatch Centre
RLNG	Regasified Liquefied Natural Gas
RPO	Renewable Purchase Obligation
RRAS	Reserves Regulation Ancillary Services
RTC	Round the Clock
RTM	Real-Time Market
RUVNL	Rajasthan Urja Vikas Nigam Limited
RUVSL	Rajasthan Urja Vikas and IT Services Limited
S1	Southern Region 1
S2	Southern Region 2
S3	Southern Region 3
SR	Southern Region
SAARC	South Asian Association for Regional Cooperation
SBPDCL	South Bihar Power Distribution Company Ltd
SEB	State Electricity Board
SEBI	Securities & Exchange Board of India
SHP	Small Hydro Power
SM	Suo-Motu
SPCL	State power Corporation Limited
SRAS	Secondary Reserve 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
T-GNA	Temporary General Network Access
TPP	Thermal Power Plant
TPS	Thermal Power Station
TRAS	Tertiary Reserve Ancillary Services
TSSPDCL	Telangana Southern Power Distribution Company Limited
UDAY	Ujwal DISCOM Assurance Yojana
UPPCL	Uttar Pradesh Power Corporation Limited
UPCL	Uttarakhand Power Corporation Limited
URS	Un-requisitioned Surplus
W1	Western Region 1
W2	Western Region 2

Abbreviation	Expanded Version
W3	Western Region 3
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: 2024-25' 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 52.0% of the total installed generation capacity in 2024-25, followed by Renewable Energy Source (RES) (36.3%), Hydro (10.0%), and Nuclear (1.7%).

2. The Compound Annual Growth Rate (CAGR) of total installed generation capacity was 7.6% during the period from 2008-09 to 2024-25. The CAGR of RES was 17.4%, whereas it was 5.2% for all other sources combined during the period.

3. During the period from 2008-09 to 2024-25, the share of the State sector in the total installed generation capacity declined from 53.6% to 23.5%, and the share of the central sector declined from 30.9% to 22.4%, while the share of the private sector increased from 15.5% to 54.1%.

4. Gross electricity generation in India increased from 747.07 BU in 2008-09 to 1829.69 BU in 2024-25, and it increased at a CAGR of 5.8%.

5. The CAGR of gross electricity generation from 2008-09 to 2024-25 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 shortage of electricity (both energy and peak shortage/deficit). The energy deficit decreased from 11.1% in 2008-09 to about 0.09% in 2024-25, whereas the peak deficit decreased from 11.9% to 0.001% during this period.

7. From 2008-09 to 2024-25, the transmission lines (AC&HVDC) grew at a CAGR of 5.2%, whereas the transformation capacity of substations (220 kV and above) grew at the rate of 10.1%.

8. The annual transmission charges increased at a CAGR of 13.67% during the period from 2011-12 to 2024-25.

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 ₹7.09/kWh and ₹5.54/kWh, respectively, in 2023-24. 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 20-23% 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 2024-25 are as under:

1. Of the total electricity generated in India in 2024-25, the short-term power market comprised about 13.03%. The balance 86.97% of generation was procured mainly by distribution companies through long-term contracts and short-term intra-state transactions.

2. During the period from 2009-10 to 2024-25, the volume of short-term transactions of electricity & DSM increased at a higher rate (CAGR of 8.9%) when compared with the gross electricity generation (CAGR of 5.8%).

3. In terms of volume, the size of the short-term market & DSM increased from 218.22 BU in 2023-24 to 238.35 BU in 2024-25, registering an annual growth of about 9.2%.

4. The volume of electricity transacted through short-term (i.e. excluding the volume of electricity transacted through DSM and direct bilateral transactions between the entities) was 170.0 BU in 2024-25. In monetary terms, the size of this short-term market was about ₹89681 crore in the year 2024-25[1].

5. The volume of electricity transacted through power exchanges increased at a CAGR of 22.1%, whereas the volume of electricity transacted through traders declined at a CAGR of -0.1% from 2009-10 to 2024-25.

6. The DSM volume as a percentage of the total volume of short-term transactions of electricity & DSM declined from 39.2% in 2009-10 to 13.49% in 2024-25.

[1] *excluding banking transactions*

7. The volume of electricity transacted through direct bilateral as a percentage of the total volume of short-term transactions of electricity & DSM increased from 9.4% in 2009-10 to 15.19% in 2024-25.

8. The weighted average price of electricity transacted through power exchanges was ₹4.93/kWh and through trading licensees it was ₹7.17/kWh in 2024-25. The corresponding values for the year 2023-24 were ₹5.82/kWh and ₹7.33/kWh, respectively.

9. DSM charge declined from ₹5.73/kWh in 2023-24 to ₹5.00/kWh in 2024-25.

10. During 2024-25, 4% of the volume of electricity transacted through traders was at a price less than ₹5/kWh and 94% of the volume was transacted through traders at less than ₹9/kWh.

11. In Day Ahead Market at IEX, during 2024-25, 79% of the volume of electricity was transacted at a price less than ₹5/kWh, while 88% of the volume was transacted at a price less than ₹9/kWh. In case of PXIL, 1% of the volume of electricity was transacted at a price less than ₹5/kWh and 5% of the volume was transacted at less than ₹9/kWh. In case of HPX, 4% of the volume of electricity was transacted at a price less than both ₹5/kWh and ₹9/kWh.

12. In Green Day Ahead Market at IEX, during 2024-25, 82% of the volume of electricity was transacted at a price less than ₹5/kWh, while about 92% of the volume was transacted at a price less than ₹9/kWh. At PXIL, 100% volume was transacted in G-DAM at a price less than ₹5/kWh. There was no trading of electricity in G-DAM at HPX.

13. In Real-Time Market at IEX, during 2024-25, 82% of the volume of electricity was transacted at a price less than ₹5/kWh while about 90% of the volume was transacted at a price less than ₹9/kWh. At PXIL and HPX, there was no volume transacted at price less than ₹5/kWh, however, about 3% and 1% of the volume was transacted at a price less than ₹9/kWh.

14. In High Price- Day Ahead Market at IEX, during 2024-25, 3% of the volume of electricity was transacted at a price less than ₹10/kWh, while about 82% of the volume was transacted at a price less than ₹15/kWh. In case of PXIL and HPX, there was no trade in HP-DAM segment.

15. During 2024-25, of the total electricity bought under bilateral transactions from traders, 86.4% was on round-the-clock (RTC) basis, followed by 11.7% in periods other than RTC and peak (OTP), and 1.9% was during peak hours. The per unit price of electricity procured during the Peak period was high (₹9.35/kWh) when compared with the price during RTC (₹7.01/kWh) and OTP (₹6.61/kWh).

16. It is observed from the block-wise and region-wise prices of electricity transacted through power exchanges in 2024-25, that the price of electricity in all the regions was almost similar in DAM, G-DAM and RTM at IEX, which is indicative of very few instances of congestion. There was no consistent trend in the price in different regions in DAM and RTM at PXIL and the same was mainly due to low liquidity.

17. From 2008-09 to 2024-25, the number of traders who were undertaking trading increased from 15 to 44. 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 0.1760 in 2024-25. The concentration of market power, in terms of the volume of electricity transacted through traders/trading licensees, was moderate in 2024-25.

18. The weighted average trading margin charged by the trading licensees in 2024-25 was ₹0.019/kWh, in line with the CERC Trading License Regulations, 2020.

19. In the power exchanges, Open Access industrial consumers bought 14.30 BU of electricity in collective transactions, which formed 13.2% of the total day ahead, green day ahead, high-price day ahead and real-time market volume transacted in the power exchanges during 2024-25.

20. During 2024-25, the weighted average price of electricity bought by open access consumers at IEX was (₹3.31/kWh and ₹3.17/kWh in DAM and RTM), which was lower as compared to the weighted average price of the total electricity transacted through IEX (₹4.26/kWh and ₹4.05/kWh in DAM and RTM). No open access consumers bought electricity though DAM and RTM at PXIL and HPX during 2024-25.

21. The year witnessed very few constraints on the volume of electricity transacted through power exchanges due to transmission congestion. During 2024-25, the actual transacted volume was about 0.48% 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 ₹155.51 crore.

22. During 2024-25, the energy scheduled under TRAS-Up through markets was 4.58 MU (including DAM-AS and RTM-AS), whereas energy scheduled under TRAS-Down through Markets was 20.37 MU (including DAM-AS and RTM-AS). Energy scheduled under TRAS-UP in shortfall/emergency was 5130.80 MU, while energy scheduled under TRAS-Down in shortfall/emergency was 10453.70 MU.

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. The 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. The Cross Border Trade in Real-Time Market of IEX commenced from October 2023.

2. During 2024-25, a total of 343.10 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 CERC (Terms and Conditions for Renewable

Energy Certificates for Renewable Energy Generation) Regulations 2022, w.e.f. 05.12.2022. These Regulations provides for the transactions of RECs through the trading licensees in addition to the transactions through power exchanges. A new contract, namely "REC", has been made available for trading of RECs by the power exchanges w.e.f. December 2022.

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