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GUIDANCE NOTE FOR BHUTAN TO TRADE IN INDIAN POWER EXCHANGE

AUGUST 2023

Prepared by
South Asia Regional Energy Partnership (SAREP)

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ABBREVIATIONS

ABT	Availability Based Tariff
ACP	Area Clearing Price
ANC	Authority of Neighboring Countries
BEA	Bhutan Electricity Authority
BPC	Bhutan Power Corporation
BPSO	Bhutan Power System Operator
BU	Billion Unit
CAGR	Compounded Annual Growth Rate
CBET	Cross Border Electricity Trade
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
COD	Date of Commercial Operation
CT	Current Transformer
CTU	Central Transmission Utility, India
DA	Designated Authority
DAC	Day Ahead Contingency
DAM	Day Ahead Market
DASP	Deviation and Ancillary Service Pool
DoE	Department of Energy, Ministry of Economic Affairs, Bhutan
DGPC	Druk Green Power Corporation
DSM	Deviation Settlement Mechanism
ESC	Energy Savings Certificate
FY	Financial Year
GoI	Government of India
G-DAM	Green-Day Ahead Market
G-TAM	Green Term-Ahead Market
HEP	Hydro Electric Plants
HVDC	High Voltage Direct Current system
IEGC	Indian Electricity Grid Code

IEX	Indian Energy Exchange
IGA	Inter Government Agreement
IT	Information Technology
ISO	International Organization for Standardization
JOC	Joint Operation Committee
JTT-T	Joint Technical Team – Transmission
kWH	Kilo Watt Hour
LC	Letter of Credit
LoI	Letter of Intent
LTA	Long Term Access
MCP	Market Clearing Price
MCV	Market Clearing Volume
MTOC	Medium Term Open Access
NOC	No Objection Certificate
NLDC	National Load Despatch Center
OA	Open Access
OTC	Over the Counter
MoP	Ministry of Power, India
MoU	Memorandum of Understanding
MU	Million Units of Electricity (one unit is 1 kilo watt hour)
MW	Mega Watt
MW	Mega Watt Hour
NOAR	National Open Access Registry
PMR	Power Market Regulation
PSA	Power Sale Agreement
PPA	Power Purchase Agreement
PRAS	Primary Reserve Ancillary Service
PT	Potential Transformer
PTA	Power Trade Agreement
PTC	PTC India Limited
PXIL	Power Exchange India Limited
REA	Regional Energy Account
REC	Renewable Energy Certificate
RGoB	Royal Government of Bhutan
RLDC	Regional Load Despatch Center
RPC	Regional Power Committee
RTC	Round the Clock

RTM	Real Time Market
SA	South Asia
SAREP	South Asia Regional Energy Partnership
SCADA	Supervisory Control and Data Acquisition
SEBI	Securities and Exchange Board of India
SLDC	State Load Despatch Centers
SRAS	Secondary Reserve Ancillary Service
STOA	Short Term Open Access
STU	State Transmission Utility
TAM	Term Ahead Market
TRAS	Tertiary Reserve Ancillary Service
UI	Unscheduled Interchange
USAID	United States Agency for International Development
UT	Union Territories

MESSAGE BY DGPC

For deepening cross border energy trade and market integration, SAREP provided technical assistance and hand holding suppon to Bhutan in parcicipating in the Indian power exchange. Druk Green Power Corporation (DGPC) import of power from the Indian power exchange staned at the beginning of the year 2022. It was the first time that Bhutan was purchasing power from the Indian Day Ahead Market (DAM) platform of Indian Energy Exchange (IEX) and Bhutan's system came under the India's Deviation Settlement Mechanism (DSM) for this import transaction. With Bhutan's parricipation in India's DAM Power Exchange market segment, many dimensions of operational planning and techno-commercial consideration has come into picture. While a large component of the energy exchanges between Bhutan and India will continue to take place through the long-term legacy Power Purchase Agreements, rhe sale and purchase of power through the Indian Energy Exchange is expected to grow over the years. Besides having to abide by the power market regulations of India, participation in the Indian Power Exchange will require Bhutan to comply to the Deviation Settlement Mechanism (DSM) regulations.

I have no doubt that the agencies in Bhutan involved in power trading, comprising of Bhutan Power System Operator, Druk Green Energy Trading and Bhutan Power Corporation will find the Guidance Note to Trade in Indian Power Exchange very helpful in ensuring smooth and effective trade of electricity to and from the power exchanges. On behalf of the Royal Government of Bhutan, DGPC, and other power sector agencies in Bhutan, Iwould like to express my sincere appreciation for the support beint rendered by the USAID/SAREP for providing the handholding support that the power sector in Bhutan is continuint to avail so as to enhance the capacity of the Bhutanese to efficiently participate in the Indian power market.

We also look forward to our future cooperation with and support from USAID/SAREP.

TASHI DELEK

Chhewang Rinzin
Managing Director, DGPC

ACKNOWLEDGEMENT

The South Asia Regional Energy Partnership (SAREP) is a flagship program of The U.S. Agency for International Development (USAID) to advance objectives of the U.S. government's clean Asia enhancing development and growth through energy (CLEAN EDGE) initiative. SAREP improves access to affordable, secure, reliable, and sustainable energy in six countries – Bangladesh, Bhutan, India, Maldives, Nepal, and Sri Lanka – to strengthen systems and processes, in line with the economic and energy-security priorities of these countries.

USAID's SAREP provided technical assistance and support to Bhutan, facilitating its participation in the Indian power exchange for import of electricity from India. In future both import and export of power through Power exchanges of India are being envisaged in Bhutan. In the above context, the Power exchange market of India will continue to remain as a viable option for Bhutan to access to reliable and competitively priced electricity for satisfying its growing demand. In order to provide overall insight into various aspects of short-term power trading, a comprehensive Guidance Note was felt necessary to be developed for Bhutanese stakeholders' reference to guide their participation in electricity trading through Indian power exchange. Accordingly, this **Guidance Note for Bhutan to trade in Indian Power Exchange** has been developed by USAID's SAREP program.

SAREP extends special thanks to Dasho Chhewang Rinzin MD of DGPC for his leadership role and necessary help in guiding and developing this Guidance Note. We also extend special thanks and acknowledge the strong support and guidance of Monali Zeya Hazra, Regional Energy and Clean Energy Specialist and Mission Environment Officer, Indo Pacific Office of USAID/India, for this Guidance Note.

SAREP team comprising of Rakesh Goyal , Namrata Mukherjee, Yeshi Wangdi, Rajiv Panda, Pramod Kumar, Arneet Gujral and Ajit Kumar contributed their valuable inputs in finalising this guidance note.

CONTEXT

Bhutan procured electricity for the first time through the Indian Power Exchange in January 2022 to meet its power shortage. This exposure to the market-based electricity trading necessitated the concerned power sector agencies in Bhutan to work in a coordinated manner to place the bids and procure power through the Indian Power Exchange. In future as well, because of rising domestic demand outpacing the firm power capacity available in the lean seasons, Bhutan is expected to continue importing electricity through power exchange platform. On the other hand, due to surplus power generation in the monsoon months, Bhutan is also looking forward to sell its available free capacity (the power that is not committed through long term PPAs) in the short term power market of India.

United States Agency for International Development (USAID) through its South Asia Regional Energy Partnership (SAREP) program provided requisite training and handholding support including developing an excel based model "Integrated Model for Dispatch, Scheduling and Billing (IMDSB)" to enable import of power through the power market. This comprehensive document, which can be referred by various Bhutan power sector stakeholders such as Druk Green Power Corporation (DGPC), Bhutan Power Corporation (BPC), Bhutan Power System Operator (BPSO), Bhutan Electricity Authority (BEA)/ Electricity Regulatory Authority (ERA), Department of Energy (DOE) and various hydro power projects, etc. for a deeper understanding of the power exchange-based trading.

This document covers various relevant policies, regulations, process flows, information on Indian Power Exchanges and their products, modes of trading through power exchanges, information on applicable charges, etc. This document provides key information that is needed by professionals and institutions for trading electricity through Indian power exchanges.

INTRODUCTION

A. BACKGROUND

Bhutan is a hydro-rich nation with the highest per-capita energy consumption of 3,164 kWh per year in the South Asia (SA) region, The country has a total hydropower potential of approximately 30,000 MW, of which 26,760 MW is economically feasible. Bhutan is also a major electricity-exporting nation in the SA region with export being higher during the monsoon season i.e. between June and September. While on an annual basis, Bhutan will continue to be a net exporter of energy, however because of a sharp anticipated rise in domestic demand and little capacity addition coming online, the country will have to continue to import power in dry seasons, i.e. in the lean inflow months (January, February and March). This will require Bhutan to buy power from India by participating in the Indian power exchange. In 2022, the country procured 240 million units (MUs) of electricity in the months of January, February and March through the Indian Energy Exchange (IEX). Further, in the current year i.e. 2023, starting from January 1st, the country has started to import electricity from the power exchange and has imported 360 MUs till April 2023. In addition, Bhutan has also got approval for selling power from its Basochhu Hydro Power Plant during the coming summer months through the Indian power exchange. This plant has been developed outside the bilateral arrangement between India and Bhutan and do not have any long term PPA with India.

USAID through the SAREP program provided detailed training to Bhutanese stakeholders in December 2021 and handholding support from January 2022 to enable Bhutan to deal with various issues and challenges of participating in the power exchange. Handholding support was further continued from April 2022 to develop an excel based model to help estimate not only optimal bid volume and price but also to manage the deviations from schedule through real time interventions with respect to change in demand and inflow. In addition to this support, a comprehensive guidance note covering various aspects is now developed for Bhutanese stakeholders' reference to provide overall insight into short-term power trading and guide Bhutan's participation in electricity trading through Indian power exchange.

The Guidance Note provides information on all the key aspects of power trading including policy, regulatory, operational aspects, overview of power exchanges and its products, guidance for trading electricity through power exchanges, details on fees and charges applicable etc. This document will be useful for all power sector stakeholders and will enable them to develop deeper understanding of power exchange related trades.

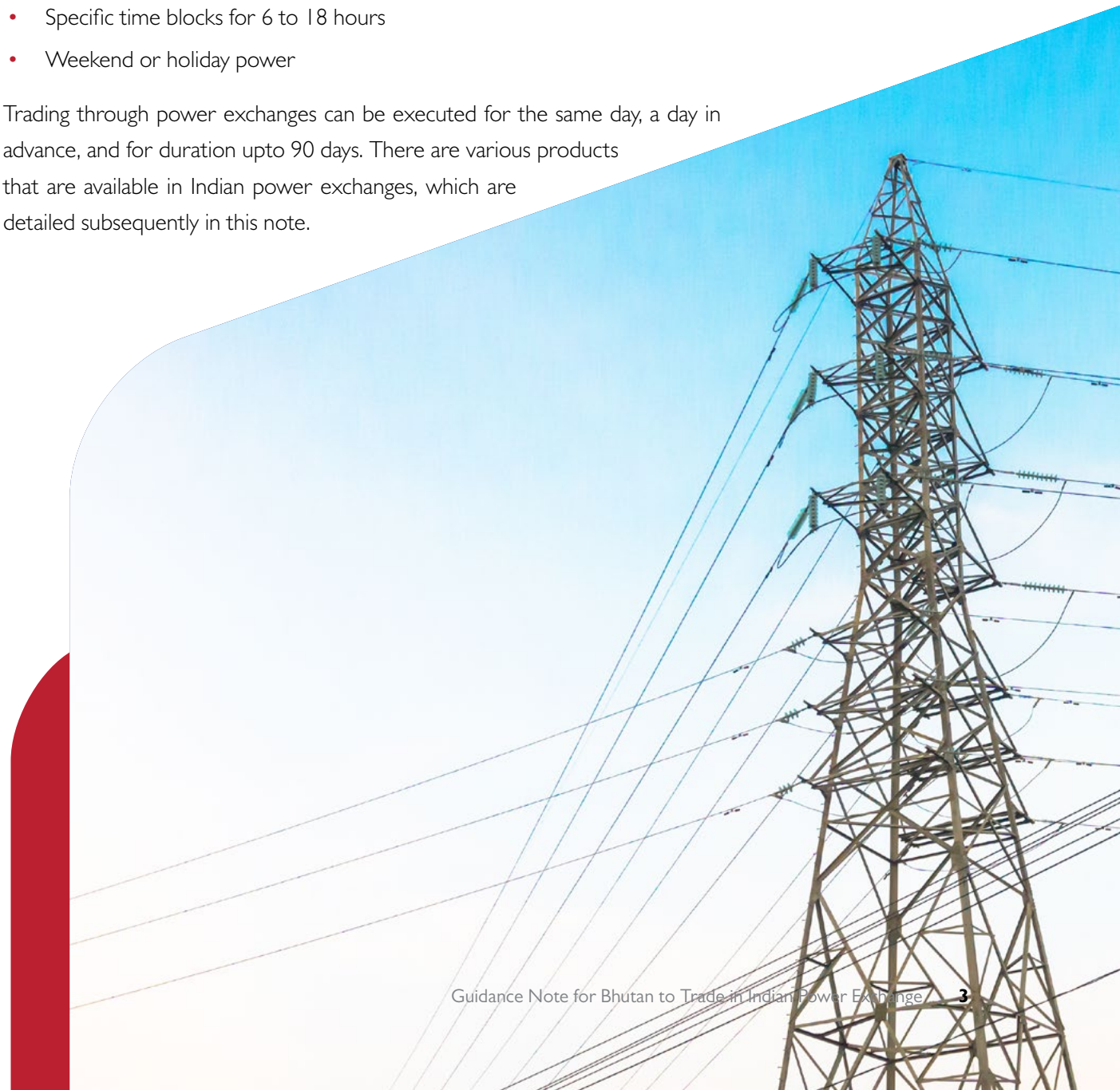
B. SHORT-TERM POWER MARKET OVERVIEW IN SOUTH ASIA

In the South Asian region, the short-term power market has evolved only in India. The Cross-border Import/ Export of Electricity Guidelines issued by Government of India in 2018, opened up participation of neighboring countries in its short-term power market. Further MOP vide its notification dated 26.07.2023 has allowed participation of neighboring countries in Real time Market (RTM) segment in Indian power exchanges and Central Electricity Authority (CEA) has also issued necessary amendment in the procedure for approval and facilitating import/export of electricity by Designated Authority (DA) on 31.07.2023.

Short term power market in India comprises of short term bi-lateral trades and power exchange-based trade and procurement. The contracts under short term are less than one year time frame. Bilateral contracts have been defined for the following periods for both buyer and seller and their contracts:

- Round the Clock Power (RTC)
- Evening or morning peak/ afternoon or night off-peak power
- Specific time blocks for 6 to 18 hours
- Weekend or holiday power

Trading through power exchanges can be executed for the same day, a day in advance, and for duration upto 90 days. There are various products that are available in Indian power exchanges, which are detailed subsequently in this note.



C. BHUTAN POWER SECTOR OVERVIEW

OVERVIEW

Bhutan's electricity sector is dominated by hydro-based electricity. The current capacity of hydropower is 2326 MW out of a total hydro potential of ~30,000 MW. Out of its annual generation from this 2326 MW capacity, around 75% of the electricity is exported to India. The export revenue earned is the key contributor to Gross Domestic Product and driver of socio-economic progress in Bhutan. Electricity exports accounted for 63% of total export earnings in FY20.

The following six hydro power plants constitute the current installed capacity in Bhutan.

Table 1: List of Hydro Plants in Bhutan

Sr. No.	Hydro Electric Plants	Capacity	Remarks
1.	**Chukha**	336 MW	Majority is exported to India through Intergovernmental agreement
2.	**Tala**	1020 MW	Majority is exported to India through Intergovernmental agreement
3.	**Kurichhu**	60 MW	Partly exported to India through Intergovernmental agreement
4.	**Basochhu**	64 MW	Domestic consumption within Bhutan
5.	**Mangdechhu**	720 MW	Majority is exported to India through Intergovernmental agreement
6.	**Dagachhu**	126 MW	Majority is exported to India through Joint Venture and Long term PPA

Source: DGPC's Website (https://www.drukgreen.bt/en/)

After meeting the domestic demand, surplus power from generating plants is exported to India through long terms PPAs as provided in the bilateral agreements between the two countries. The above power plants, with the exception of Basochhu and Dagachhu, have been developed through the bilateral assistance from the Government of India. Basochhu has been developed through third country assistance while Dagachhu was the first project developed under PPP model. Electricity from Dagachhu is exported through Tata Power Trading Co. Electricity from the above plants are transmitted to the Indian grid through various transmission lines (listed in Annexure I).

In addition to the above, the following hydropower projects are under construction in Bhutan:

Table 2: List of upcoming plants in Bhutan by year 2025

Sr. No.	Hydro Electric Plants	Capacity	Remarks
1.	Punatsangchhu I	1200 MW	Surplus electricity to be exported to India through Intergovernmental agreement
2.	Punatsangchhu II	1020 MW	Surplus electricity to be exported to India through Intergovernmental agreement
3.	Nikachhu	118 MW	Surplus electricity to be exported to India through long term PPA with PTC India
4.	Kholongchhu	600 MW	Surplus to be exported to India

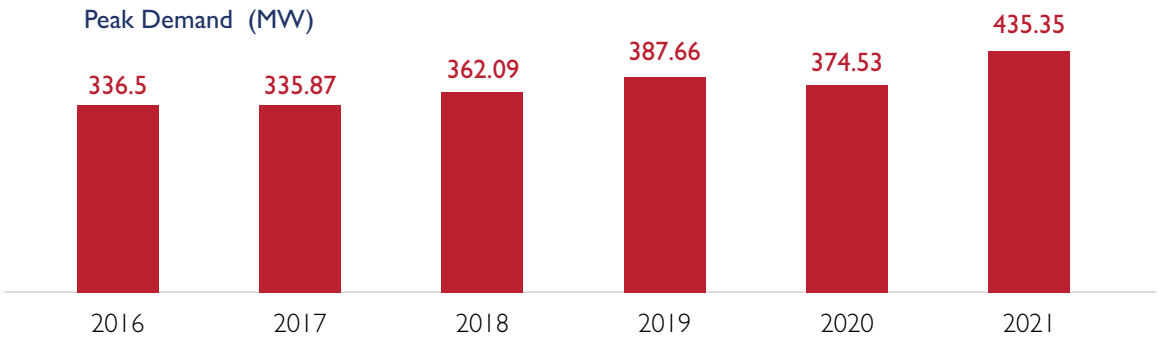
Source: DGPC Annual Reports

The above projects are under various stages of progress – Nikachhu is slated for commissioning in year 2023 and Punatsangchhu-II by 2024. Punatsangchhu-I and Kholongchhu could take time till 2027 for completion.

There are a number of potentially viable projects that are under consideration for implementation. These are 1125 MW Dorjilung, 2585 MW Sunkosh and 404 MW Nyera Amari I and II. The implementation plan of these projects will depend on modalities of construction which are under discussion between GOB and GOI.

The trend of power demand-supply situation in the country has been such that the domestic load growth has recently exceeded the generation capacity in the lean months although Bhutan remains power surplus in the summer months. The peak demand until 2020 had remained under the firm generation capacity of 440 MW, whereas in November 2022, the evening demand has increased upto 621 MW as on 06th Nov 2022.

Figure 1: Year wise Bhutan's Peak Demand



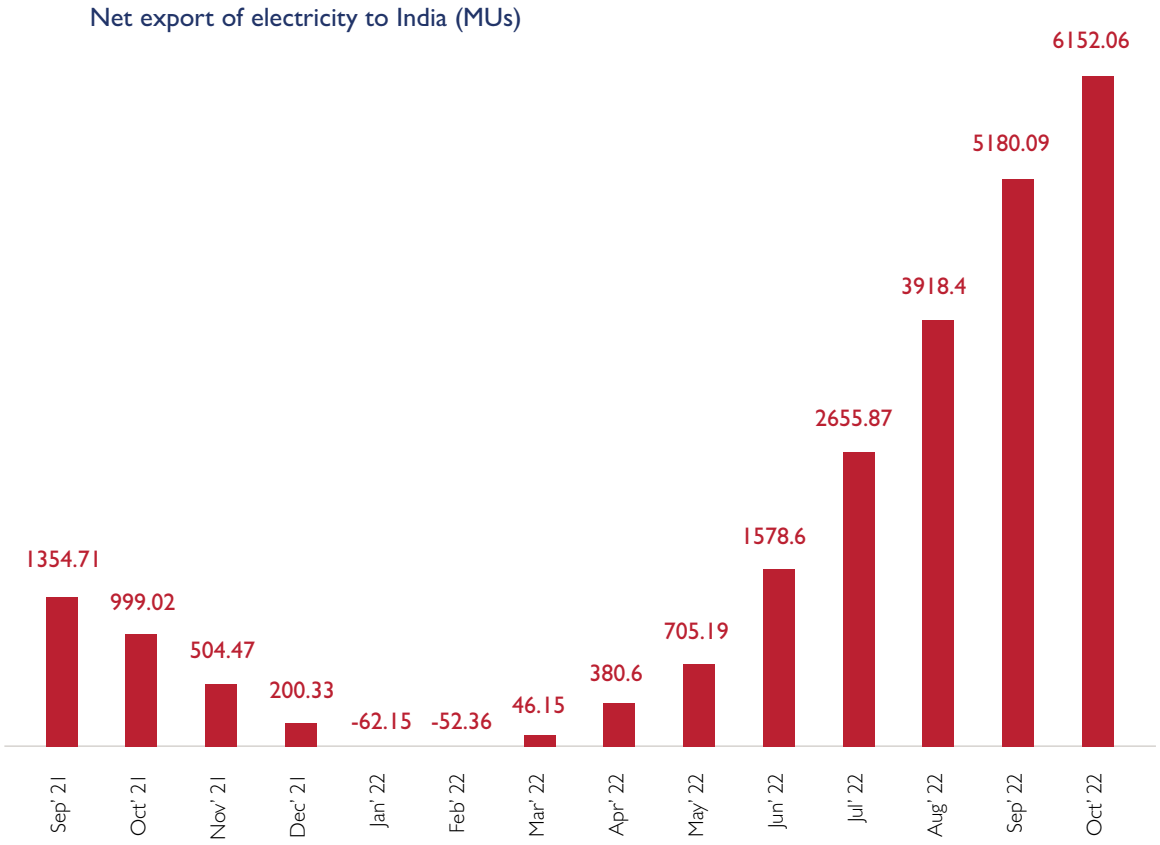
Source: Statistical Yearbook of Bhutan 2021, National Statistics Bureau, (https://www.nsb.gov.bt/)

With capacity addition in the near future being only from run-of-river schemes with no significant storage available and with demand exceeding firm power capacity, Bhutan would have to continue to import power to meet its power shortage in the lean months of the year. To address power shortage that the country is likely to face henceforth, Bhutan is looking into developing reservoir/ pump storage projects and harness other renewables like solar power.

POWER EXPORT AND IMPORT BY BHUTAN

Bhutan has been a net exporter of electricity in the South Asian region since 1986 with the commissioning of its first 336 MW Chukka Hydropower Project. The exports are maximum in the monsoon months of June-September, whereas in the lean seasons (January-March), the export had been decreasing due to growth in domestic demand till the winter season of 2022 when Bhutan had to import electricity from Indian power exchange. The months of April, May, November, and December are moderate months where the generation is low as compared to peak months but sufficient to cater to the domestic demand. Month wise export to electricity to India is presented below:

Figure 2: Bhutan's Net Export of electricity to India



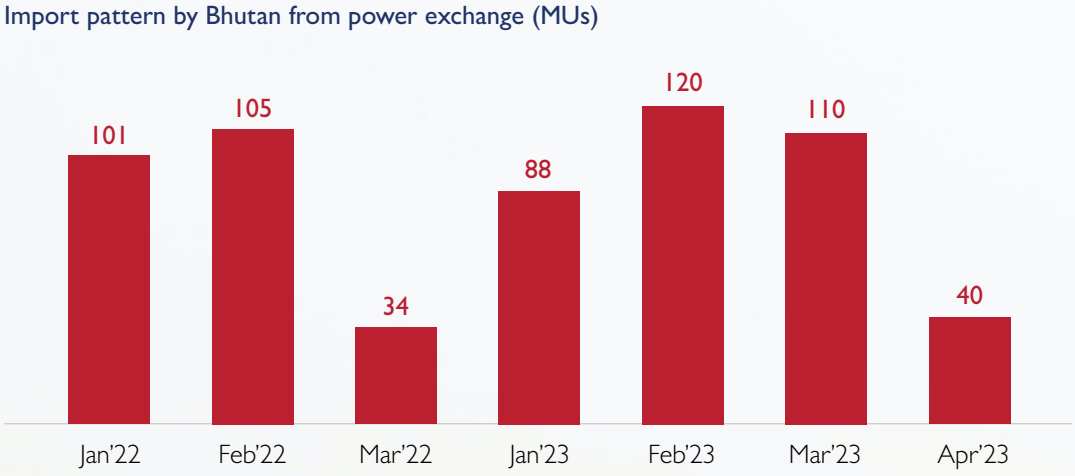
Source: SAREP Analysis of Data compiled from Grid India's monthly reports (https://posoco.in/)

Total quantum (net) of electricity traded between the two countries between September 21-October 22 was 23561 Mus. Most of the cross border electricity tranmission takes place from 400kV AC transmission lines between the two countries.

In the lean season of 2022, due to maintenance of Tala Hydropower Plant, Bhutan had approached India for sourcing of electricity during the winter months through power exchange. India approved Bhutan's request to import electricity from India through Indian power exchange as per extant regulations and approval process for cross border energy trade.

More than 240 Mus of electricity was imported in the months of January, February, and March 2022. Trading of electricity through power exchange was performed by Bhutan through the Indian trader, Power Trading Corporation (PTC) of India, which is also the GOI nominated power trader for Bhutan for PPA based export of power. Majority of the electricity was sourced through 400 kV Binaguri- Malbase and 220 kV Birpara- Malbase transmission lines by Bhutan.

Figure 3: Trade of Electricity by Bhutan through Indian Power Exchange

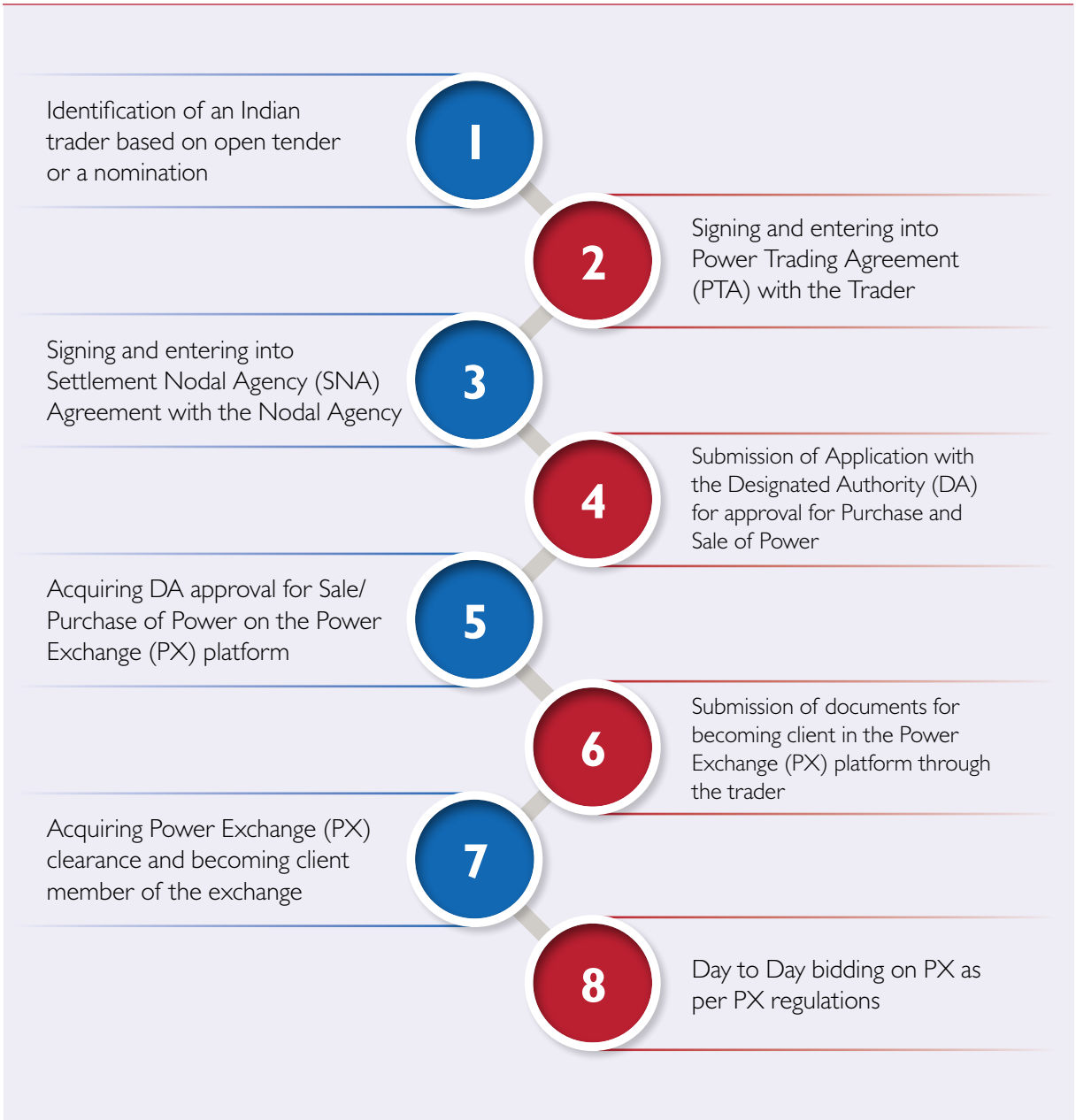


Source: SAREP Analysis of Data compiled from Grid India's monthly reports (https://posoco.in/)

OVERVIEW OF CURRENT PROCESS/ PRACTICE OF PARTICIPATION IN INDIAN POWER EXCHANGE BY BHUTAN

As per the cross border energy trading regulations issued by Central Electricity Regulatory Commission (CERC) and procedure for approval and facilitating import/export (Cross Border) of Electricity by the Designated Authority issued by Central Electricity Authority (CEA) under Ministry of Power, Government of India, cross border entities can take part in the Day Ahead Market (DAM) and Real Time Market (RTM) of power exchange (PX) platforms in India. To participate in this PX platform for cross border electricity trading, following process is required to be followed:

Figure 4: General Process for participation in Indian Power Exchange



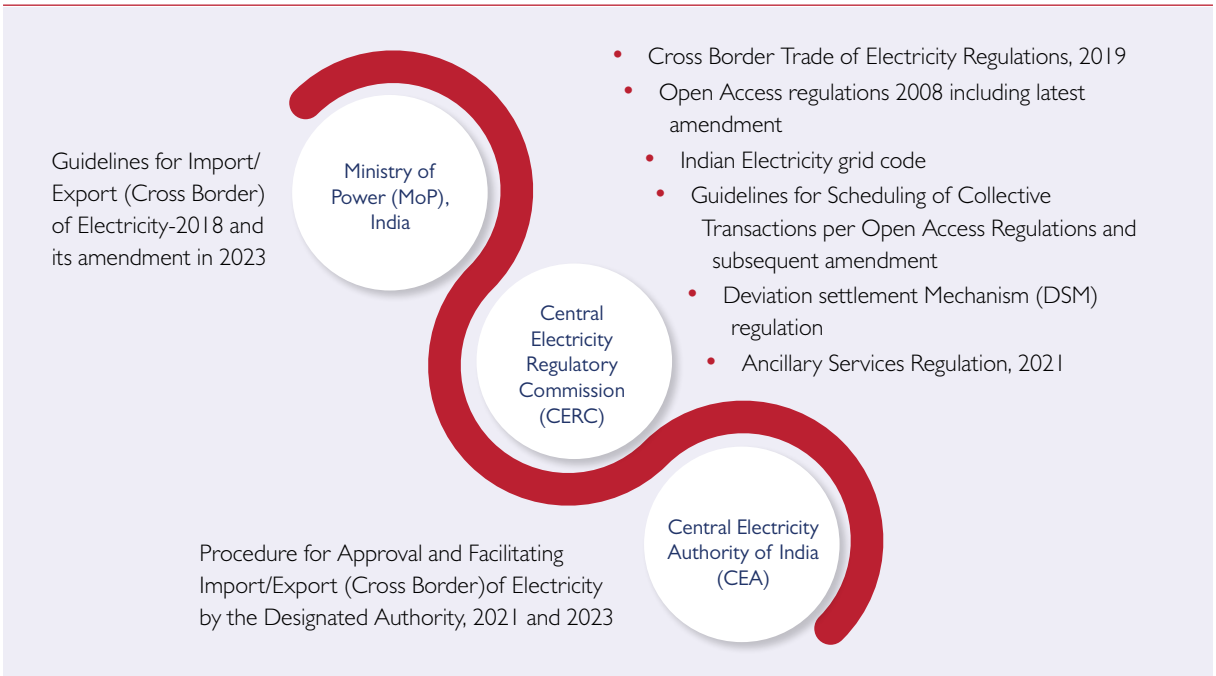
Current Process flow for Day-ahead participation in Indian power exchange by Bhutan is as follows:

- **STEP-1(by 8:00 am IST/ 8:30 am BT):** Plants provide day-ahead Inflow forecast based on their respective assessment, and specify a time-block wise generation plan (provisional) based on the inflow-forecast. In addition, DGPC provides time-block wise DAM Price Forecast for next day to Bhutan Power System Operator (BPSO).
- **STEP-2 (by 8:00 am):** Bhutan Power Company (BPC) provides day-ahead load forecast with time-block resolution to BPSO. In addition, BPC also shares Planned Industrial Outages for outage margin assessment by BPSO.
- **STEP-3 (by 8:30 am):** Based on Inflow, Load and Price Forecasts, BPSO identifies least cost DAM Purchase volume, and at the same time optimizes inflow and generation utilization. Inflow and Load forecasts are re-computed by BPSO and compared with the ones shared by plants and BPC for outliers/ anomalies. Plant-wise dam level moderation based on initial conditions are determined by BPSO, based on coordination with DGPC and Plants.
- **STEP-4 (by 9:00 am):** Optimized Schedules/Generation plans are shared by BPSO with Plants as R-1 (revision-1). In addition, DAM Purchase volume (Import) are also shared by BPSO with DGPC for onward processing and bidding purpose.
- **STEP-5 (by 10:00 am):** DGPC coordinates with BPSO on the finalized generation and Import volume and create a Buy Bid based on Price Forecast and finalized Import Volume. Once Buy Bid is prepared, the same is processed for bidding and coordination with Indian Trader for successful bid placement. The bids are to be submitted by 10:45 am.
- **STEP-6 (01:00 pm to 04:00 pm):** Final volume selection in DAM, and subsequent schedules are shared by DGPC with BPSO. In addition, plants and BPC share updated Inflow and load forecasts for day-ahead.
- **STEP-7 (05:00 pm to 07:00 pm):** BPSO re-runs the process in step-3 to re-assess supply-demand-import conditions for day-ahead considering Import as static variable. Generations are optimized accordingly.
- **STEP-8 (05:00 pm to 07:00 pm):** Based on optimization processing by BPSO, updated Schedules (Revision 2,3) are issued to plants. Multiple revisions can be issued by BPSO based on changing conditions of demand-inflow till the start of next-day. A lead time of 30 minutes can be considered for schedule finalization for next day, so that plants can plan generation accordingly. Final Revision (RF) for day-ahead are issued by BPSO by 11:30 pm IST.

OVER VIEW OF RELEVANT POLICIES AND REGULATIONS RELATING TO CROSS BORDER POWER TRADE THROUGH POWER EXCHANGES IN INDIA

Cross Border Electricity Trade (CBET) in India is primarily governed through the Ministry of Power and other power sector agencies such as Central Electricity Regulatory Commission (CERC), and Central Electricity Authority (CEA). Ministry of Power, India issues the policy level interventions and central regulating and planning agency i.e. Central Electricity Regulatory Commission (CERC) and Central Electricity Authority (CEA) respectively provides regulatory and procedural aspects. Further, power exchange operations and transactions are regulated by CERC through various regulations and power flow on exchange is governed by National Load Dispatch Centre (NLDC) to maintain stability of grid. Following are the key relevant policies and regulations which provide necessary directions and regulations for cross border trade through Indian power exchanges. As Bhutan is continuously engaged in Indian Power Sector, these regulations need to be understood by all Bhutanese stakeholders operating in the power sector for integrated and efficient transactions for import/export of electricity:

Figure 5: Policies and Regulations for Cross Border Electricity Trade



A summary on relevant aspects from each of the above-mentioned policy/regulations are provided below.

A. GUIDELINES FOR IMPORT/EXPORT (CROSS BORDER) OF ELECTRICITY-2018 AND ITS AMENDMENT ISSUED BY MINISTRY OF POWER (MOP), INDIA

Cross Border Trade of Electricity between Indian and the neighboring countries has been taking place under bilateral Memorandum of Understandings (MoUs)/ Bilateral Agreements / Power Trade Agreement (PTAs) for a long time. To facilitate and promote cross border trade of electricity with greater transparency, consistency, and predictability in regulatory approaches across jurisdictions and minimize perception of regulatory risks, the "Guidelines on Cross Border Trade of Electricity- 2016" were issued by Ministry of Power, GOI in December 2016 in consultation with various stakeholders. After receiving inputs from various stakeholders, a revised document "Guidelines for Import/ Export (Cross Border) of Electricity-2018" was issued on December 18, 2018, which provides guiding principles for carrying out Cross Border Electricity Trade with neighboring countries.

The key objectives of the policy are:

- To facilitate import/ export of electricity between India and neighboring countries.
- To evolve a dynamic and robust electricity infrastructure for import/ export of electricity.
- To promote transparency, consistency and predictability in regulatory mechanism pertaining to import/ export of electricity in the country.
- Reliable grid operation and transmission of electricity for import/ export..

KEY FEATURES OF THE GUIDELINES FOR IMPORT/EXPORT OF ELECTRICITY

Agreements for Trade

The import/ export of electricity may be allowed through mutual agreements between Entity(ies) of India and neighboring country(ies) under the overall framework of agreements signed between them consistent with the provisions of the prevailing laws in the respective country(ies), including

- through bilateral agreement between two countries
- through bidding route; or
- through mutual agreements between entities

Provided that in case of tripartite agreements, the cross-border trade of electricity across India shall be allowed under the overall framework of bilateral agreements signed between Government of India and the Government of respective neighboring country(ies) of the participating Entity(ies).

Institutional Framework

- The import/ export of electricity by Indian entities shall be governed by the rules/regulations and policies framed and notified by Government of India/ Central Electricity Authority (CEA)/ Central Electricity Regulatory Commission (CERC), and wherever applicable, the appropriate State Electricity Regulatory Commission(s).
- MoP, Govt. of India shall appoint a Designated Authority (DA) for facilitating the process of approval and laying down the procedure for import/ export of electricity.
- The DA shall coordinate with the respective authority of the neighboring country for all purposes as stated in the Guidelines which, inter alia, include-
    - Planning, monitoring, and commissioning of transmission lines for import/ export of electricity.
    - The grid security, safety and operation.
    - Any other function as assigned by the MoP, Govt. of India.
- Any entity proposing to import/ export electricity may do so only after taking approval of the DA.
- • Approval of the DA will, however, not be necessary where the import/ export is taking place under the Inter Government Agreement signed by India and neighboring country for specific project(s).
- Considering the fact that import/ export of electricity involves issues of international relations; the DA will grant approval or otherwise only after taking concurrence of Govt. of India.

ELIGIBILITY AND OTHER TERMS AND CONDITIONS FOR PARTICIPATION

Import of Electricity

- Indian entities may import electricity from the generation plants located in the neighboring country(ies) directly or through Government/ Government Company/ a licensed trader of that country after taking approval of the DA as per guidelines; provided that the generation plant(s) has the permission to export power to India from the respective Government of the neighboring country.
- In case of import through bilateral agreement between two countries, the Govt. of India may designate an entity for import of power.

Export of Electricity

- Generating Companies/ Distribution Companies of India may export electricity generated by coal/ renewable energy/ hydropower, to entities of neighboring country(ies) directly / through trading licensee(s) of India, after taking approval of the DA.
- However, in case of electricity generated from coal based generating plants, export of electricity from India shall be allowed only where such electricity is generated utilizing imported coal/ spot e-auction coal/ coal obtained from commercial mining.
- Further, in case of electricity generated from gas based generating plants, export of electricity from India shall be allowed only where such electricity is generated utilizing imported gas.

- In case of export through bilateral agreement between two countries, the Govt. of India may designate an entity for export of power.
- Any Indian power trader may, after obtaining approval from the DA, trade in Indian Power Exchanges on behalf of any entity of neighboring country, for specified quantum as provided in the approval and complying with CERC Regulations.

FACTORS FOR CONSIDERATION OF DA FOR APPROVAL

- The DA shall grant approval for export/ import of electricity only after considering the generation capacity (as available) and the demand. Imports may normally be permitted only when the demand exceeds generation capacity (as available) in the country; and Exports may normally be permitted in case of capacity being more than the domestic demand. However, Govt. of India reserves the right to import/ export electricity from/ to neighboring countries for reason of larger policy interests.
- The DA shall consider the application for approval of participating Entity(ies) only after the receipt of the equity pattern of ownership of the said Entity(ies) along with other details as prescribed by the DA. In case where there is a change in the equity pattern, the participating Entity shall intimate the DA within thirty days from such change in equity pattern for continuation of the approval.

TARIFF FOR IMPORT

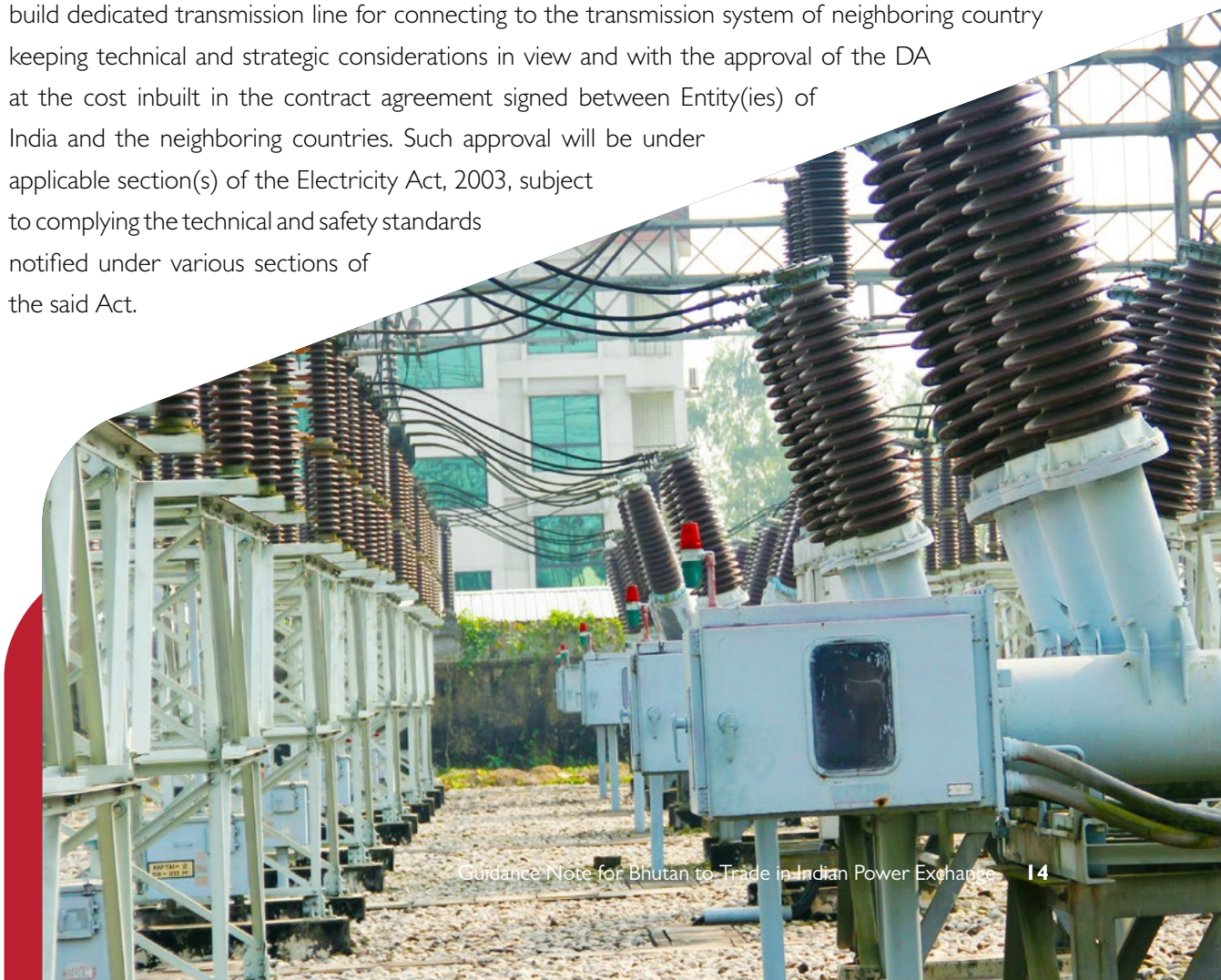
- The tariff for import of electricity by the Indian Entity(ies) as per above clauses shall be determined, through a process of competitive bidding as per the Tariff Policy of India/ through mutual agreement. Provided that in case of hydro projects, the tariff may be determined by CERC as per its Regulations, if approached by the generator through the govt. of the neighboring country and agreed by the Indian entities.
- Notwithstanding anything contained in above clause, where the tariff for import of electricity is mutually agreed by the Govt. of India and the Govt. of neighboring country, involving the participating entities of the two countries, the same shall be final. Provided the tariff for import had already been determined through Govt. to Govt. negotiations.

TARIFF FOR EXPORT

- Tariff for export of electricity through long term/ medium term/ short term agreements may be as mutually agreed or based on competitive bidding, subject to payment of the charges as applicable for transmission/ wheeling of electricity through the Indian grid.
- Notwithstanding anything contained in above clause where the tariff for export of electricity through cross border trade is mutually agreed by the Government of India and the government of neighboring country, the same shall be final. Provided the tariff for export had already been determined through Govt. to Govt. negotiations.

TRANSMISSION SYSTEM, SCHEDULING AND ACCOUNTING

- Transmission systems developed within Indian grid, for import/ export of electricity between India and the neighboring country, would normally be part of the integrated transmission system of India.
- The transmission interconnection between India and its neighboring country shall be planned jointly by transmission planning agencies of the respective governments based on the need for electricity trade in foreseeable future and sharing of information required for analysis and studies for such planning.
- The cross-border transmission lines may normally be constructed between the pooling stations of one country to the pooling stations of the other country for secure, safe and controlled operation of the grid.
- The interconnection between two pooling substations of different countries shall be monitored and controlled by the respective system operators of the two countries, with proper coordination.
- Transmission access priority for import/ export of electricity in India shall be determined as per the CERC Regulations.
- The transmission charges, scheduling, metering, accounting, deviation settlement, secure grid operations involving the Indian Grid and any other related operational mechanism shall be governed in accordance with the applicable Regulations of the Government of India.
- Ministry of Power shall notify nodal agency for each neighboring country which shall be responsible for settlement of grid operation related charges as per CERC regulations.
- Indian generating stations supplying electricity exclusively to neighboring country may be allowed to build dedicated transmission line for connecting to the transmission system of neighboring country keeping technical and strategic considerations in view and with the approval of the DA at the cost inbuilt in the contract agreement signed between Entity(ies) of India and the neighboring countries. Such approval will be under applicable section(s) of the Electricity Act, 2003, subject to complying the technical and safety standards notified under various sections of the said Act.



B. CENTRAL ELECTRICITY REGULATORY COMMISSION (CERC)-CROSS BORDER TRADE OF ELECTRICITY REGULATIONS, 2019

India has signed MoUs with its neighboring countries to improve power connectivity. Subsequent to the guidelines issued by Ministry of Power on Cross Border Trade of Electricity on 05.12.2016, and its subsequent revisions on 18.12.2018, to promote cross border trade of electricity with neighboring countries, Central Electricity Regulatory Commission (CERC) issued CERC (Cross Border Trade of Electricity) Regulations, 2019 on 08.03.2019.

INSTITUTIONAL FRAMEWORK

Table 3: Institutional Framework for Cross Border Electricity Trade

Agency	Responsibility
DA	Facilitating the process of approval and procedure for import and export of electricity and coordinate with the authority of neighboring country for all purposes.
Transmission Planning Agency	Planning of transmission system and coordinate with the Transmission Planning Agency of the concerned neighboring country. For India, this function shall be discharged by the DA.
Settlement Nodal Agency	For settling all charges pertaining to grid operations including operating / deviation and other charges related to transactions with a particular neighboring country. Also, shall be a member of the deviation pool, reactive energy pool and other regulatory pools for payment and settlement of all charges.
NLDC	System operator for cross border trade of electricity and shall be responsible for granting short-term open access and for billing, collection and disbursement of the transmission charges for short-term open access transactions in accordance with the Sharing Regulations.
Central Transmission Utility	For granting long-term access and medium-term open access with respect to cross border trade and for billing, collection and disbursement of the transmission charges in accordance with the Sharing Regulations.

TRADE THROUGH INDIAN POWER EXCHANGES

Any electricity trading licensee of India may trade in the Indian Power Exchanges on behalf of any Participating Entity of neighboring country, for the specified quantum with the approval of DA.

Application fee:

- • The applications for connectivity, long-term access and medium-term open access shall be accompanied by a non-refundable application fee in Indian Rupees as provided below, payable in the name and in the manner to be laid down by the Central Transmission Utility:

Table 4: Application Fee for Cross Border Electricity Trade

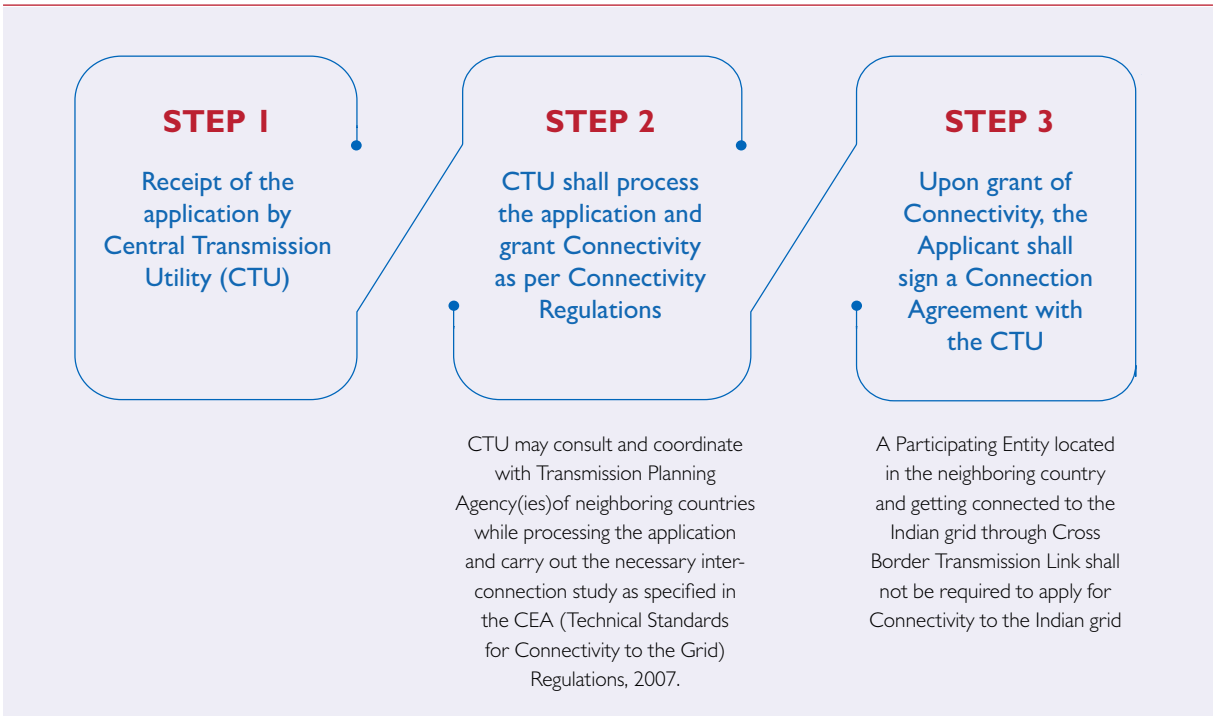
Sr. No.	Quantum of Power to be injected /Off taken into/ from Inter State Transmission System	Application fees (Rs. in Lakhs)	
		For Connectivity/ Long term Access	Medium-Term open Access
1.	Up to 100 MW	4	2
2.	More than 100 MW up to 500 MW	6	4
3.	More than 500 MW up to 1000 MW	12	6
4.	More than 1000 MW	18	8

- The fee for short-term open access applications shall be governed as per the Procedure issued under STOA Regulations..

Application for Grant of Connectivity

A detailed application procedure is explained in the further stages of these guidelines

Figure 6: Application Procedure for Cross Border Electricity Trade



Application for Short/medium/long-Term Open Access:

- The application for cross border trade of electricity shall be made to NLDC for short term open access and Central Transmission Utility for medium/long term open access under these Regulations.
- In addition, the applicant shall furnish the following:
- Approval from DA with regard to eligibility of the participating entity for cross border trade of electricity or copy of the Inter Government Agreement (IGA) wherever available; and
- Approval from DA in India and Competent Authority in neighboring country(ies) to use Cross Border Transmission Link(s) in case connectivity is not through dedicated transmission lines.
- Access Bank Guarantee as specified under Regulation 15 for long-term access.
- NLDC/Central Transmission Utility shall process the Application and grant open access in accordance with the Procedure made under STOA/connectivity Regulations.
- The Applicant upon grant, shall sign the Long Term / Medium Term Open Access Agreement,as the case may be, with Central Transmission Utility which shall contain the date of commencement of access, as the case may be, the point of injection/drawl of power into/from the Indian grid respectively.
- Implementation of the transmission system augmentation, if any, for grant of long-term access shall be undertaken only after the applicant has submitted the Access Bank Guarantee as specified in the below clauses of bank guarantee.

Timeframe for processing Long-Term Access and Medium-Term Open Access Application:

Table 5: Duration for processing applications

Application type	Duration for processing *
Long Term Access (where Transmission augmentation is required)	120 days
Long Term Access (where Transmission augmentation is not required)	90 days
Medium Term open access	40 days

** Note: the duration is considered from the last date of the month in which application is made.*

Treatment of delay in Transmission system and Generation projects:

- DA shall monitor the progress of generating station including units thereof in neighboring country along with transmission system for evacuation of power in consultation and coordination with Central Transmission Utility of India, Transmission Planning Agency(ies) of neighboring country(ies) and the developer of the generating station, at regular interval.
- The generating company located in the neighboring country, implementing agency(ies) and the transmission licensee(s) shall endeavor to commission the generating station, Cross Border Transmission Link(s) and the transmission system within India respectively in matching time-frame as far as practicable.

- In case of delay in commissioning of generating station or unit(s) thereof and associated dedicated transmission system in the neighboring country beyond the scheduled date agreed in the Long-Term Transmission Access Agreement, the generator shall be liable to pay full transmission charges from the date of operationalization of long-term access.
- In case of delay in commissioning of Cross Border Transmission Link, compensation if any to the generating company or transmission licensee or both, as the case may be, shall be as decided by the respective Governments.
- In the event of delay by the transmission licensee in commissioning of transmission system within India beyond its scheduled date and the generating company is ready with its generating station or unit(s), the transmission licensee shall pay transmission charges to generating company proportionate to commissioned generation capacity in case no alternative arrangement is made by the Central Transmission Utility. Provided that in case of non-payment of transmission charges by the transmission licensee to the generating company, such charges shall be recovered by the Central Transmission Utility from the CPBG furnished by the transmission licensee and paid to the generating company.

Access Bank Guarantee:

- An applicant seeking long-term access for cross border trade of electricity shall be required to furnish the application along with an Access Bank Guarantee valid for five (5) years from the date of operationalization of long-term access, for an amount of Rs. Five (5) Lakhs/MW corresponding to the quantum of long-term access sought.
- In case the grant of long-term access requires augmentation of transmission system in India, the Central Transmission Utility shall intimate the cost of augmentation within ninety (90) days from the date of the month in which the application is made and the Applicant shall furnish a fresh Access Bank Guarantee valid for five (5) years for an amount equivalent to the cost of such augmentation within one (1) month of intimation of the cost of augmentation by Central Transmission Utility.
- The Cross Border Customer who has been granted long-term access may approach Central Transmission Utility and seek permission to exit prior to the award of contract for execution of transmission system by the transmission licensee. All such requests shall be considered, and decision communicated to the applicant not later than thirty (30) days from the date of the request. Provided that where exit is permitted, the Central Transmission Utility may encash Rs. 20 lakhs from the Access Bank Guarantee submitted in terms of clause mentioned above, as the case may be, and return the balance amount to the Cross Border Customer.
- If a Cross Border Customer relinquishes transmission access granted under these Regulations after the award of the contract for execution of transmission system and before operationalization of long-term access, Access Bank Guarantee shall be encashed by the Central Transmission Utility.
- The quantum of Access Bank Guarantee submitted in terms of above clauses, as the case may be, shall be progressively reduced each year after the generating company begins to avail long term access corresponding to one fifth (1/5th) of its total value. On completion of each year, one fifth of the value of Access Bank Guarantee shall be returned to the Applicant each year up to fourth year and one-fifth of the Access Bank Guarantee shall be retained upto twelfth year of the long term access as a security towards relinquishment charges. The Applicant shall submit revised access bank guarantee accordingly.

Operationalization of Long-Term Access:

- The operationalization of long-term access for cross border trade of electricity shall start from the date indicated in the Long-Term Transmission Access Agreement or from the availability of the transmission system for operationalization of long-term access, whichever is later and the liability of payment of transmission charges shall begin from this date.
- Where the operationalization of long-term access is contingent upon commissioning of several transmission lines or systems and only some of the transmission lines or elements have been declared under commercial operations, long-term access to the extent which can be operationalized without affecting the security and reliability of the Indian Grid may be permitted for which the Long Term Transmission Access customer shall pay the transmission charges for the quantum of long-term access operationalized.
- The Cross Border Customer shall submit certificate regarding Commercial Operation declaration of the generating station or transmission system as required under Grid Code.

Metering Arrangements:

- Interface Meters (Main Meter, Check Meter and Standby Meter) shall be installed at both the ends of the Cross Border Transmission Link in accordance with CEA (Installation and Operation of Meters) Regulations.
- Before flow of electricity on the Cross Border Transmission Link, Transmission Planning Agencies of both the countries shall confirm the availability of Main Meter, Check Meter and Standby Meter to System Operator of respective country.
- Interface Meters as specified above, shall be open for inspection by any person authorized by the Transmission Planning Agencies or System Operators of the respective countries.

Data and Communication Facilities:

- Reliable and efficient voice and data communication systems shall be provided to facilitate necessary communication and data exchange, and supervision or control of the grid by the NLDC or RLDC, under normal and extraordinary conditions. Such communication system must be established from generating station or concerned grid substation(s) to control room of System Operator of a neighboring country and from there to control room of System Operator of India. Provided that the Cross Border Transmission Link shall necessarily have reliable and efficient voice and data communication systems with the System Operators on both the sides.
- All participating entities shall ensure that the voice and data communication facilities to telemeter power system parameters such as flow, voltage and status of switches or transformer taps etc. is installed in line with interface requirements as per the applicable Regulations of CERC. The associated voice and data communication system to facilitate voice and data flow up to appropriate data collection point on Central Transmission Utilitys system shall be established by the concerned Participating Entities as specified by Central Transmission Utility in the Connection Agreement.

System Recording Instruments:

Recording instruments including Data Acquisition System/Disturbance Recorder/Event Logging Facilities/ Fault Locator (including time synchronization equipment) shall be provided by all Participating Entities and shall always be kept in working condition in the Indian grid and transmission system of the neighboring country for recording of dynamic performance of the system.

Reactive Power Compensation:

- Reactive Power compensation and/or other facilities shall be provided by Participating Entities connected to Indian grid as far as possible in the low voltage systems close to the load points thereby avoiding the need for exchange of Reactive Power to/from Indian grid and to maintain voltage within the specified range.
- The Participating Entities already connected to the grid shall also provide additional reactive compensation as per the quantum and timeframe decided by respective Regional Power Committee(s) in consultation with NLDC. The Participating Entities shall provide information regarding the installation and functioning of the reactive compensation equipment on regular basis. Regional Power Committee(s) shall regularly monitor the status in this regard.

Cyber Security:

All participating entities shall have in place a cyber-security framework to identify the critical cyber assets and protect them so as to support reliable operation of the grid. NLDC shall monitor the progress in this regard.

System Operation:

Cross border trade of electricity shall be undertaken in a manner that ensures reliable, secure, and stable operation of the interconnected grid and does not jeopardize grid security at any point of time. For purposes of cross border trade of electricity, all grid operation related provisions shall be applicable as per the prevailing regulations of the commission.

Some of the key aspects are summarized below. The same may also be referred from the CERC cross border trade of electricity regulation 2019 and its amendments.

- System security aspects
- Declaration of transfer capability
- Scheduling
- Metering, energy accounting and settlement
- Curtailment of cross border electricity trades in case of contingency
- Event information
- Coordination between system operators

Payment of Charges and Payment Security Mechanism:

Following are the key charges and payments details summarized below that are enlisted in this regulation. The same may also be referred from the CERC cross border trade of electricity regulation 2019 and its amendments:

- Payment of transmission charges and other charges
- Transmission losses
- System operation fees and charges
- Payment security mechanism for transmission charges

C. DESIGNATED AGENCY (DA), CENTRAL ELECTRICITY AUTHORITY OF INDIA (CEA)- PROCEDURE FOR APPROVAL AND FACILITATING IMPORT/EXPORT (CROSS BORDER) OF ELECTRICITY BY THE DESIGNATED AUTHORITY, 2021

OBJECTIVE

- To facilitate coordination with nodal agencies/Authority of Neighboring Countries (ANC) for transmission system planning, joint system studies, surveys, preparation of feasibility study reports, system development, construction, erection, monitoring, testing, commissioning, operation and maintenance of transmission system for Import/Export (Cross Border) of electricity in transparent manner
- To lay down procedure for safety, security and coordinated operation of the interconnected national grids
- To facilitate grant of approval to eligible entities to participate in Import/Export (Cross Border) of Electricity
- To lay down procedure for grant of approval to an Indian generating station, supplying electricity exclusively to neighboring country for building a dedicated transmission line for connecting to the transmission system of neighboring country

FOLLOWING ARE THE KEY ASPECTS/MILESTONES FOR ESTABLISHMENT OF TRANSMISSION LINK DEDICATED FOR CROSS BORDER POWER EXCHANGE:

Cross Border transmission links:

- Joint Technical Team – Transmission (JTT-T)
- Planning of cross-border link.
- Implementation, Monitoring and Coordination of Cross Border Transmission Link
- Commissioning of Cross Border Transmission Link

Grid security, safety and coordination between the cross-border grid operators:

- Joint Operation Committee (JOC).
- Operating Philosophy
- System Security Aspects
- Protection Coordination
- Manpower Requirements
- Operational Liaison
- Operating Instructions

- Reactive Power Compensation
- Outage Planning
- Recovery Procedures
- Event Information
- Assessment of Available Transmission capability in cross border interconnections
- Assistance in Emergency
- Record of transmitted energy
- Settlement of grid operation related charges

APPROVAL FOR PARTICIPATING ENTITIES FOR IMPORT/EXPORT OF ELECTRICITY (CROSS BORDER):

- All import and export of electricity shall take place after due approval from the Govt. of India.
- Approval of DA will not be necessary where the power exchange is under the inter Govt. agreement signed by India and its neighboring country for specific projects. However, CERC regulations shall prevail.
    - The Indian entity of such transaction would submit the necessary information in format at Annexure-I or Annexure-II (available for download from the CERC website), as the case may be, to the DA, at least 30 days prior to start of the transaction.
    - The DA will advise the concerned entities/NLDC to facilitate scheduling of such cross border transaction.

Eligibility of Applicant for IMPORT of electricity by Indian entities:

- Indian Entity nominated by Government of India to import electricity from generating projects of neighboring country and sign PPAs with DISCOMs for the power being imported. OR
- o Indian entities may import electricity from the generation projects located in neighboring country(ies) directly or through Government or a Government Company or a licensed trader of that country after taking approval of the Designated Authority, provided that the generating company is not owned, directly or indirectly by any natural/legal personality(ies) whose effective control or source of funds or residence of beneficial owner, is situated in/ citizen of a third country with whom India shares land border and that third country does not have a bilateral agreement on power sector cooperation with India. For any relaxation in this provision, the Designated Authority will consult Ministry of Power and Ministry of External Affairs.
- The generation project(s) of the neighboring country should submit the permission to export power to India from the respective Government of the neighboring country.
- The Applicant shall submit a copy of Power Purchase Agreement (PPA) / the Letter of Intent (LOI) from generator of neighboring country, for import of such power.
- The Applicant shall submit the application to the Nodal Officer in the format enclosed at Annexure-I (available for download from the CERC website).

- The person making the application shall submit an affidavit stating he/she is the authorized person for submission.
- The Applicant shall submit an undertaking on affidavit that any change in the equity pattern of the generating company/trading licensee of the neighboring country from where electricity to be imported, shall be intimated to the DA within thirty (30) days.

Eligibility of Applicant for EXPORT of electricity by Indian Entities:

- Generating / Distribution Companies of India may export electricity generated by coal or gas or renewable energy or hydropower, to Entities of neighboring country(ies) directly or through trading licensee(s) of India, after taking approval of the Designated Authority.
- In case of electricity generated from Coal based generating plants, export of electricity is allowed only when imported coal / spot e-auction coal / coal obtained from commercial mining is utilized.
- Further, in case of electricity generated from Gas based generating plants, export of electricity is allowed only when imported gas is utilized. However, a declaration to be provided in both the cases.
- The Applicant shall submit a copy of Power Purchase Agreement (PPA) / the Letter of Intent (LoI) from entity of neighboring country, for export of such power.
- The Applicant shall submit the application to the Nodal Officer in the format enclosed as Annexure-II (available for download from the CERC website)..

Eligibility of Applicant for Trading in Indian Power Exchange(s):

- Indian power trader can trade the power of a generating station located outside the country, provided that:
    - The generation station is located in a country, with which India has a bilateral agreement on Power Sector Cooperation. And,
    - the generating station is not owned, directly or indirectly by any natural/ legal personality(ies) whose effective control or source of funds or residence of beneficial owner, is situated in/citizen of a third country with whom India shares land border and that third country does not have a bilateral agreement on power sector cooperation with India. For any relaxation in this provision, the Designated Authority will consult Ministry of Power and Ministry of External Affairs. .
- Indian Entity(ies) trading the power of domestic origin, in Day Ahead Market (DAM) in Power Exchanges will not require any approval from DA. However, if an Indian Entity intends to trade in other than DAM of Power Exchange, where establishment of one-to-one transaction is possible, the Entity shall require approval from The DA, up to specified quantum (MW) and duration.
- Any Indian power trader, on behalf of any Entity of neighboring country, may trade in Indian Power Exchanges, after obtaining approval from the DA, up to specified quantum (MW) and duration, provided, however that the entity on behalf of where the Indian Power Trader is trading belongs to the neighboring country which has an agreement on cooperation in the power Sector with India, and the generating asset from which power is being traded is also owned/controlled by the said country having agreement on Power cooperation with India.

- Applicant should furnish Power Purchase Agreement (PPA)/ Letter of Intent (LoI) with the entity of neighboring country for trade in Indian Power Exchange(s). And also should have consent of respective government of the neighboring country for allowing trade of power.
- The Applicant shall submit the application to the Nodal Officer in the format enclosed as Annexure-III (available for download from the CERC website).

Process for Grant of Approval:

- The application for approval of Participating Entity(ies) shall be considered only after the receipt of the equity pattern of ownership of the said Entities along with other details as may be prescribed by the DA.
- After receipt of the application, the proposal shall be examined as per provisions in the Guidelines, including the generation capacity and the demand. Imports may normally be permitted only when the demand exceeds generation capacity in the country; and Exports may normally be permitted in case of generation capacity being in excess of the demand.
- In case of trading in Indian power exchanges, maximum time period of one year will be allowed at a time from the date of approval.
- The DA may seek the comments from RPCs, Central Transmission Utility, Grid Controller of India Limited, etc.
- The DA will send the proposal for concurrence of Govt. of India (GoI), within 60 days from the date of receipt of the final application complete in all respects. The approval or otherwise of DA shall be communicated to the Applicant within 15 days from final communication received from GoI.
- After approval of the DA, the participating entity shall approach concerned authorities in the respective country for transmission access.

Obligation to Comply with Applicable Laws:

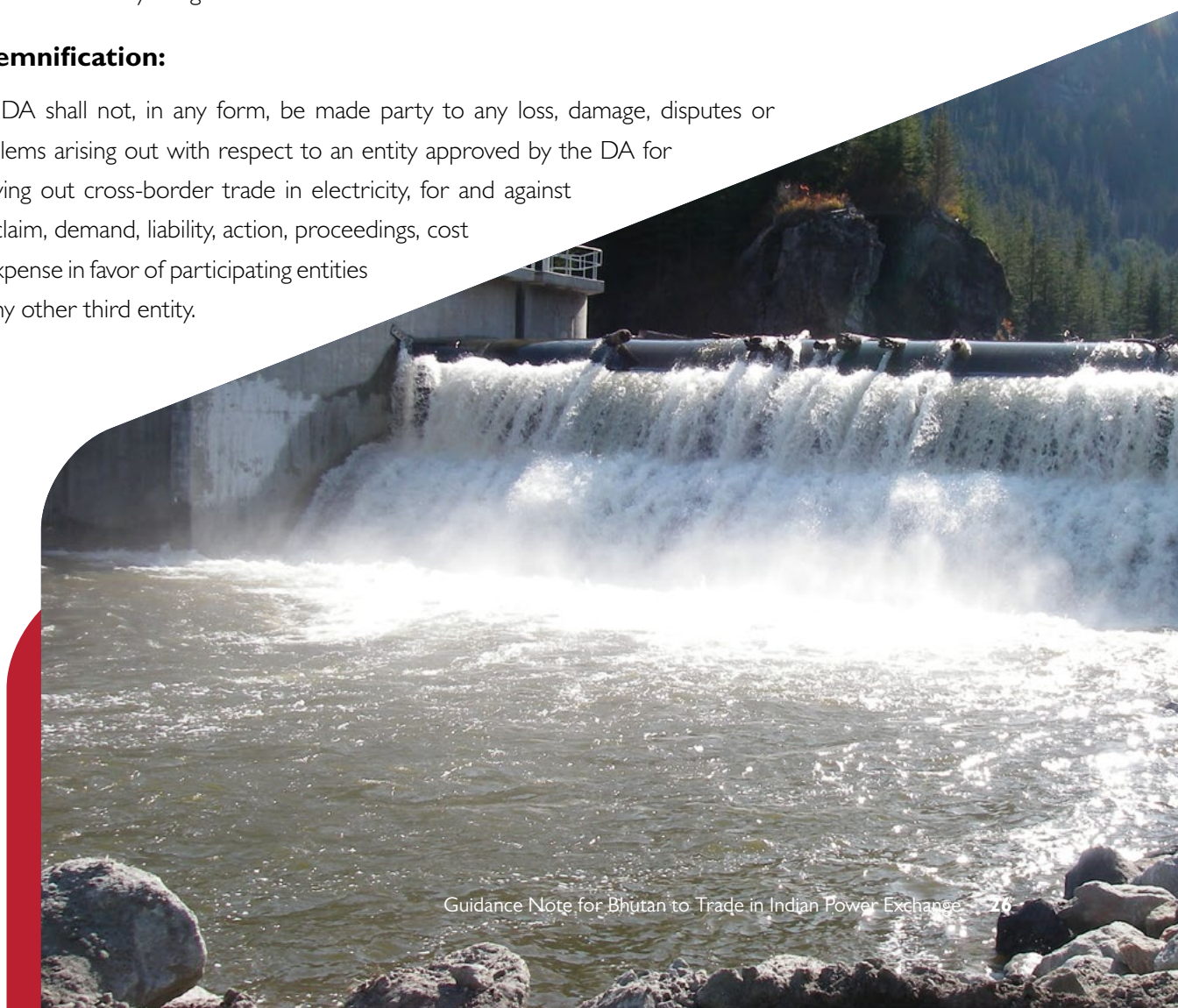
- Govt. of India reserves the right to import/ export electricity from/ to neighboring countries for reason of larger policy interests, and same shall be binding on the Participating Entity.
- The grant of approval for participation in Import/Export (Cross Border) of Electricity by the DA shall not entitle the applicant any rights or privileges with regard to applicable laws, rules and regulations of India.
- The Participating Entity shall submit a copy of PPA to DA, within 15 days of its date of signing.
- Participating Entity of India shall comply with the applicable regulations/ standards framed by CERC and CEA.
- The Participating Entity granted approval by DA for a period of more than one year shall need to apply for Long Term Open Access (LTOA) /Medium Term Open Access(MTOA) within six(6) months of approval by DA, failing which the approval by DA shall be deemed as cancelled.
- The Participating Entity granted approval by DA for a period of less than or equal to one year shall need to apply for Medium Term Open Access (MTOA)/Short Term Open Access (STOA) within three (3) months of such approval by DA, failing which the approval by DA shall be deemed as cancelled.

Procedure for Approval of DA for transaction through Indian Grid:

- The Indian trading licensees may apply to DA (format in annexure-V which is available for download from the CERC website) giving details of intended transaction through Indian Grid such as details of selling and buying entities, copy of tripartite PPA/ PSA (Power Purchase Agreement/ Power Sale Agreement), quantum and duration of intended transaction of electricity, details of Generating Station or any other related information as sought by DA.
- The Designated Authority will send the proposal for concurrence of Govt. of India, within 45 days from the date of receipt of the final application complete in all respects.
- The approval or otherwise of DA shall be communicated to the Applicant within 15 days from final communication received from GoI.
- Obligation to comply with By Laws:
  - The grant of transmission access shall be governed by relevant regulations of CERC.
  - Approvals granted for Transaction of electricity through Indian Grid under tripartite agreement may be reviewed by the GOI as and when deemed necessary by it.
  - NLDC shall inform DA regarding transaction of electricity through Indian grid through Short Term Open Access (STOA) on monthly basis.
  - Central Transmission Utility shall inform DA regarding transaction of electricity through Indian grid through Medium Term Open Access (MTOA)/ Long Term Open Access (LTOA) within seven days of grant of such transmission access.

Indemnification:

The DA shall not, in any form, be made party to any loss, damage, disputes or problems arising out with respect to an entity approved by the DA for carrying out cross-border trade in electricity, for and against any claim, demand, liability, action, proceedings, cost or expense in favor of participating entities or any other third entity.



D. CERC INDIAN ELECTRICITY GRID CODE

Central Electricity Regulatory Commission (CERC) has issued the Indian Electricity Grid Code (IEGC) Regulations, 2023 and these regulations have came into force from 1st October 2023. The following entities fall within the scope of these regulations: All Users, State Load Despatch Centres, Renewable Energy Management Centres, Regional Load Despatch Centres, National Load Despatch Centre, Central Transmission Utility, State Transmission Utilities, Licensees, Regional Power Committees, Settlement Nodal Agencies, Qualified Coordinating Agencies, and Power Exchanges, to the extent applicable.

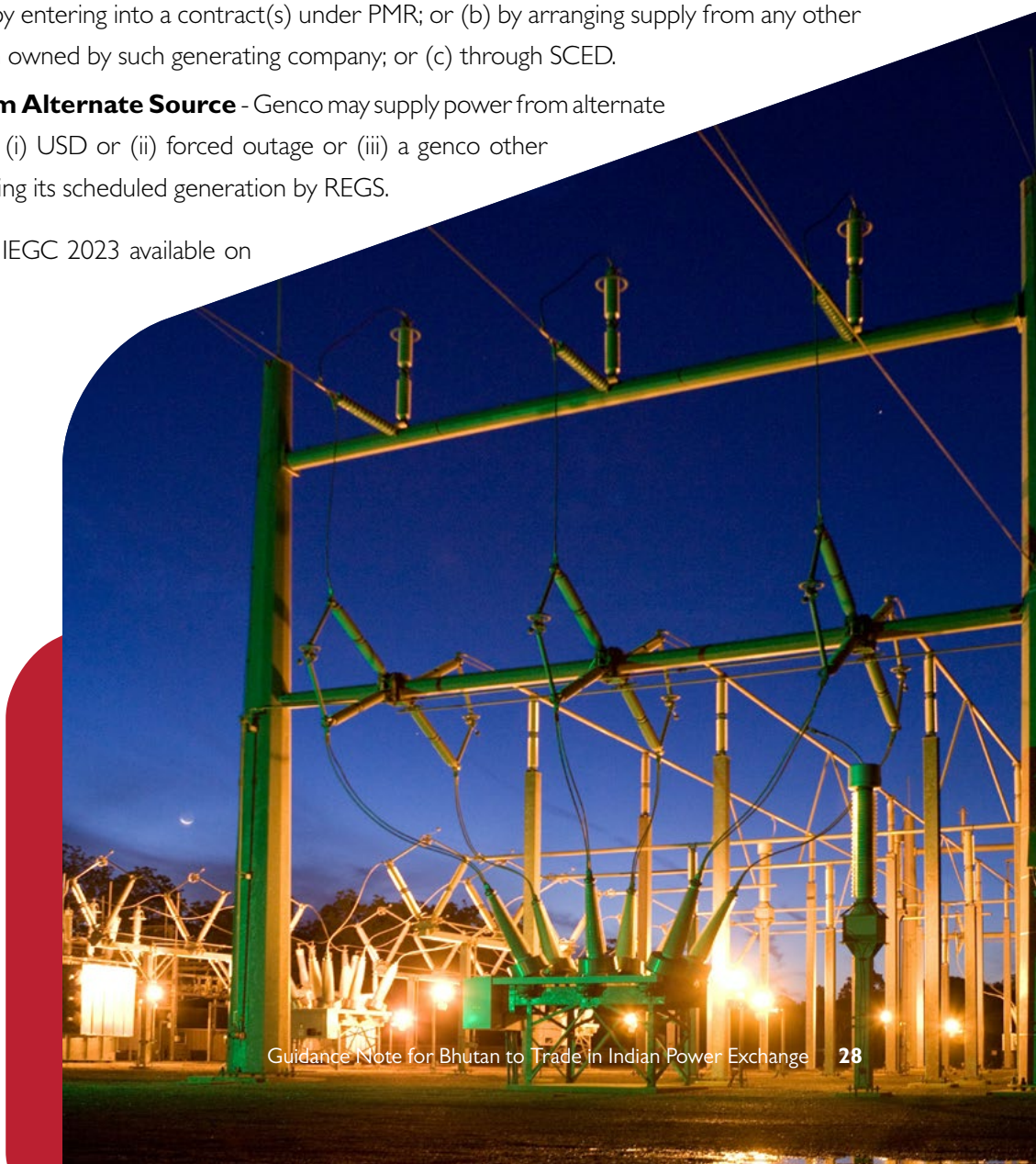
For stable, reliable and secure grid operation and to achieve maximum economy and efficiency of the power system, the grid code apart from the provisions relating to the role of various statutory bodies and organisations and functional linkages among them, contains extensive provisions pertaining to reliability and adequacy of resources; technical and design criteria for connectivity to the grid including integration of new elements, trial operation and declaration of commercial operation of generating stations and inter-state transmission systems; protection setting and performance monitoring of the protection systems including protection audit; unit commitment, scheduling and despatch criteria for physical delivery of electricity; integration of renewables; ancillary services and reserves; and cyber security.

The main chapters of the regulations are as follows:

- **Resource planning Code** - Integrated resource planning including demand forecasting, generation Resource Adequacy (RA) planning and transmission RA assessment, required for secure grid operation.
- **Connection Code** - Covers the technical and design criteria for connectivity, procedure and requirements for physical connection and integration of grid elements.
- **Protection Code** - Covers the protection protocol, settings, and audit plan of electrical systems.
- Commissioning & Commercial Operation Code - Aspects related to (i) drawl/injection of startup power, (ii) trial run operation (iii) documents & tests to be furnished before declaration of COD, (iv) requirements for declaration of COD.
- **Operating Code** - Covers aspects related to operation to be followed by concerned entities, to ensure integrity, stability & resilience of grid & achieve economy and efficiency in operation of power system.
- **Scheduling and Dispatch Code** - Deals with the procedure for scheduling injection and drawl of power by the regional entities and the modalities for exchange of information, including scheduling for intra-state and cross-border entities transacting power through the ISTS.
- **Cyber Security** - All users, NLDC, RLDCs, SLDCs, CTU and STUs, PXs, QCAs, SNAs, etc. to have cyber security framework as per IT Act, 2000; respective CEA Regulations & Guidelines.
- **Monitoring and Compliance Code** - Deals with monitoring of compliance of IEGC regulations.
- **Treatment of IEGC Regulation Under Change in Law** - Regulations shall not be treated under 'Change in law' in any of the agreements entered into by any of the Users covered under these regulations.

- **Key provisions of Scheduling and Dispatch Code:**
  - RLDC to be provided with details of GNA, connectivity, all power procurement contracts (except collective) by respective seller/buyer before commencement of scheduling of power under GNA/TGNA
  - Regional gencos connected at one ISTS substation or multiple substations within a state can be aggregated through a Qualified Coordinating Agency (QCA) to facilitate scheduling.
  - Minimum turn down level of thermal units shall be 55% or as per CEA regulations, whichever is lower.
- **Security Constrained Unit Commitment (SCUC):**
  - Objective: To commit a generating station, for reserves maximisation in the interest of grid security, without altering entitlements & schedule of buyers of the said generating station in day ahead time horizon.
  - It shall supplement procurement of reserves under ancillary regulations.
  - May be undertaken by NLDC for regional gencos u/s 62 of Act.
  - SCUC may be done three days in advance under certain circumstances.
- **Unit Shut Down (USD)** - If Genco, opts to go under USD, it can fulfil its obligation by arranging supply either (a) by entering into a contract(s) under PMR; or (b) by arranging supply from any other generating station owned by such generating company; or (c) through SCED.
- **Scheduling from Alternate Source** - Genco may supply power from alternate source in case of (i) USD or (ii) forced outage or (iii) a genco other than REGS replacing its scheduled generation by REGS.

For more details, refer IEGC 2023 available on CERC website.



E. CERC DEVIATION SETTLEMENT MECHANISM (DSM) REGULATION

OBJECTIVE OF DSM

The objective of this regulation is to maintain grid discipline and grid security as envisaged under the grid code through the commercial mechanism for deviation settlement through drawl and injection of electricity by the users of the grid.

SCOPE

These regulations shall be applicable to all grid connected regional entities and other entities engaged in inter-State purchase and sale of electricity.

ADHERENCE TO SCHEDULE AND DEVIATION

1. For a secure and stable operation of the grid, every grid connected regional entity shall adhere to its schedule as per the Grid Code and shall not deviate from its schedule
2. Any deviation shall be managed by the Load Dispatch Centre as per the Ancillary Services Regulations, and the computation, charges and related matters in respect of such deviation shall be dealt with as per the following provisions of these regulations.

COMPUTATION OF DEVIATION

1. Deviation in a time block for general sellers shall be computed as follows:

   Deviation-general seller (in MWh) = [(Actual injection in MWh) – (Scheduled generation in MWh)].

   Deviation-general seller (in %) = 100 x [(Actual injection in MWh) – (Scheduled generation in MWh)] / [(Scheduled generation in MWh)].

2. Deviation in a time block for WS sellers shall be computed as follows:

   Deviation-WS seller (in MWh) = [(Actual Injection in MWh) – (Scheduled generation in MWh)].

   Deviation-WS seller (in %) = 100 x [(Actual Injection in MWh) – (Scheduled generation in MWh)] / [(Available Capacity)].

3. Deviation in a time block for buyers shall be computed as follows:

   Deviation- buyer (in MWh) = [(Actual drawal in MWh) – (Scheduled drawal in MWh)].

   Deviation- buyer (in %) = 100 x [(Actual drawal in MWh) – (Scheduled drawal in MWh)] / [(Scheduled drawal in MWh)].

NORMAL RATE OF CHARGES FOR DEVIATIONS

1. The normal rate of charges for deviation for a time block shall be equal to the Weighted Average Ancillary Service Charge (in paise/kWh) computed based on the total quantum of Ancillary Services deployed and the net charges payable to the Ancillary Service Providers for all the Regions for that time block:

   Provided that for a period of one year from the date of effect of these regulations or such further period as may be notified by the commission, the normal rate of charges for deviation for a time block shall be equal to the higher of [the weighted average ACP of the Day Ahead Market segments of all the Power Exchanges; and the weighted average ACP of the Real Time Market segments of all the Power Exchanges, for that time block] subject to a ceiling of Rs 12 per kWh, until further orders. Provided further that in case of non-availability of ACP for any time block on a given day, ACP for the corresponding time block of the last available day shall be considered:

2. The normal rate of charges for deviation shall be rounded off to the nearest two decimal places.

Note: CERC vide its order dated 26.12.2022 wrt petition no 16/SM/2022 has decided that normal rate for charges for any time block shall be capped at Rs 10 per unit till further orders.

CHARGES FOR DEVIATION

1. The charges for deviation in a time block by a seller shall be payable by such seller as under:

Table 6: Charges for deviation payable by seller to Deviation and Ancillary Service Pool Account (As per CERC Regulations)

Entity	Charges for deviation payable to Deviation and Ancillary Service Pool Account	
Seller	Deviation by way of over injection	Deviation by way of under injection
For a general seller other than an RoR generating station or a generating station based on municipal solid waste	Zero: Provided that such seller shall be paid back for over injection @ the reference charge rate for deviation upto [*10% DGS or 100 MW, whichever is less*].	i. @ the reference charge rate up to [*10% DGS or 100 MW, whichever is less*]: ii. @ 120% of the normal rate of charges for deviation by way of under injection beyond [*10% DGS or 100 MW, whichever is less*] and up to [15% DGS or 150 MW, whichever is less]; and iii. @ 150% of the normal rate of charges for deviation beyond [*15% DGS or 150MW, whichever is less*].
For a general seller being an RoR generating station	Zero: Provided that such seller shall be paid back for over injection @ the reference charge rate for deviation upto [*10% DGS or 100 MW, whichever is less*].	i. @ the reference charge rate up to [*10% DGS or 100 MW, whichever is less*]; ii. @ the normal rate of charges for deviation by way of under injection beyond [*10% DGS or 100 MW, whichever is less*] and up to [*15% DGS or 150 MW, whichever is less*]; and iii. @ 110% of the normal rate of charges for deviation beyond [*15% DGS or 150 MW, whichever is less*].

For a general seller being a generating station based on municipal solid waste	Zero: Provided that such seller shall be paid back for over injection up to [*20% DGS*] @ contract rate, or in the absence of a contract rate, @ the weighted average ACP of the Day Ahead Market segments of all Power Exchanges for the respective time block.	i. Zero up to [*20% DGS*]: Provided that such seller shall pay back for the shortfall in energy against its schedule in any time block due to under injection up to [*20% DGS*] @ 50% of the contract rate, or in the absence of a contract rate, @ 50% of the weighted average ACP of the Day Ahead Market segments of all Power Exchanges for the respective time block; and ii. @ normal rate of charges for deviation beyond [*20% DGS*].
For WS seller being a generating station based on solar or hybrid of wind –solar resources	Zero: Provided that such seller shall be paid back for over injection as under: i. @ contract rate, or in the absence of a contract rate, @ the weighted average ACP of the Day Ahead Market segments of all Power Exchanges for the respective time block, up to [*10% DWS*]; and ii. @ 90% of the contract rate, or in the absence of a contract rate, @ 90% of the weighted average ACP of the Day Ahead Market segments of all Power Exchanges for the respective time block for deviation beyond [*10% DWS*] and up to [*15% DWS*]	i. Zero up to [*10% DWS*], and ii. @ 10% of contract rate or in the absence of a contract rate, @ the weighted average ACP of the Day Ahead Market segments of all Power Exchanges for the respective time block for deviation beyond [*10% DWS*] and up to [*15% DWS*], and iii. @ 50% of contract rate or in the absence of a contract rate, @ the weighted average ACP of the Day Ahead Market segments of all Power Exchanges for the respective time block for deviation beyond [*15% DWS*]: Provided that such seller shall pay back for the total shortfall in energy against its schedule in any time block due to under injection, @ the contract rate, or in the absence of a contract rate, @ the weighted average ACP of the Day Ahead Market segments of all Power Exchanges, for the respective time block.
For WS seller being a generating station based on wind resource	Zero: Provided that such seller shall be paid back for over injection as under: i. @ contract rate, or in the absence of a contract rate, @ the weighted average ACP of the Day Ahead Market segments of all Power Exchanges for the respective time block, up to [*15% DWS*]; and ii. @ 90% of the contract rate, or in the absence of a contract rate, @ 90% of the weighted average ACP of the Day Ahead Market segments of all Power Exchanges for the respective time block for deviation beyond [*15% DWS*] and up to [*20% DWS*].	i. Zero up to [*15% DWS*], and ii. @ 10% of contract rate or in the absence of a contract rate, @ the weighted average ACP of the Day Ahead Market segments of all Power Exchanges for the respective time block for deviation beyond [*15% DWS*] and up to [*20% DWS*], and iii. @ 50% of contract rate or in the absence of a contract rate, @ the weighted average ACP of the Day Ahead Market segments of all Power Exchanges for the respective time block for deviation beyond [*20% DWS*]: Provided that such seller shall pay back for the total shortfall in energy against its schedule in any time block due to under injection, @ the contract rate, or in the absence of a contract rate, @ the weighted average ACP of the Day Ahead Market segments of all Power Exchanges, for the respective time block.

Note: DGS means Deviation-general seller (in %); DWS means Deviation-WS seller (in%)

2. The charges for deviation in a time block by a buyer shall be payable by such buyer as under:

Table 7: Charges for deviation payable by buyer to Deviation and Ancillary Service Pool Account (As per CERC Regulations)

Entity	Charges for deviation payable to Deviation and Ancillary Service Pool Account	
Buyer	Deviation by way of under drawal	Deviation by way of over drawal
Buyer (other than the buyer with schedule less than 400 MW and the RE-rich State)	Zero: Provided that such buyer shall be paid back for under drawal as under: i. @ 90% of normal rate of charges, for deviation up to [*10% DBUY or100 MW, whichever is lower*]; ii. @ 50% of normal rate of charges, for deviation beyond [*10% DBUY or 100 MW, whichever is lower*] and up to [*15% DBUY or 200 MW, whichever is lower*].	i. @ normal rate of charges for deviation up to [*10% DBUY or 100 MW, whichever is lower*]; ii. @120% of normal rate of charges for deviation beyond [*10% DBUY or 100 MW DBUY, whichever is lower*] and up to [*15% DBUY or 200 MW, whichever is lower*]; and iii. @150% of normal rate of charges for deviation beyond [*15% DBUY or 200 MW, whichever is lower*].
Buyer (with schedule up to 400 MW)	Zero: Provided that such buyer shall be paid back for under drawal @ 90% of normal rate of charges for deviation up to [*20% DBUY or 40 MW, whichever is lower*].	i. @ normal rate of charges for deviation up to [*20% Deviation-buyer (in %) or 40 MW, whichever is lower*]; and ii. @120% of normal rate of charges for deviation beyond [*20% DBUY or 40 MW, whichever is lower*].
Buyer (being an RE Rich State)	Zero: Provided that such buyer shall be paid back for under drawal as under: i. @ 90% of normal rate of charges for deviation up to [*200 MW*]; and ii. @ 50% of normal rate of charges for deviation beyond [*200 MW*] and up to [*300 MW*].	i. @ normal rate of charges for deviation up to 200 MW; ii. @120% of normal rate of charges for deviation beyond [*200 MW*] and up to [*300 MW*]; and iii. @150% of normal rate of charges for deviation beyond [*300 MW*].

Note: *DBUY means Deviation-buyer (in %)*

2A. Notwithstanding anything contained in Table 5 and 6, the provisions of Clauses (2B) and (2C) as stipulated below shall apply irrespective of volume limit, in respect of the general seller other than an ROR generating station or a generating station based on municipal solid waste and in respect of the buyer, when the system frequency (hereinafter " f ") in a time block, is "below 49.95 Hz (i.e. f < 49.95 Hz)" or " above 50.03 Hz (i.e. f > 50.03 Hz).

2B. When f < 49.95Hz

(a) The general seller other than an ROR generating station or a generating station based on municipal solid waste shall be paid back for deviation by way over injection (i) @ 120% of reference charge rate when [49.90 Hz < f < 49.95 Hz]; and (ii) @ 150% of reference charge rate when [f ≤ 49.90];

(b) The general seller other than an ROR generating station or a generating station based on municipal solid waste shall pay for deviation by way under injection (i) @ 150% of reference charge rate or @ 120% of the normal rate of charge for deviation, whichever is higher, when [49.90 < f < 49.95]; and (ii) @ 200% of reference charge rate or @ 150% of the normal rate of charge for deviation, whichever is higher, when [f ≤ 49.90];

(c) The buyer shall be paid back for deviation by way of under drawl (i) @ 120% of normal rate of charge for deviation when [49.90 < f < 49.95]; and (ii) @ 150% of normal rate of charge for deviation when [f ≤ 49.90];

(d) The buyer shall pay for deviation by way of over drawl (i) @ 150% of normal rate of charge for deviation when [49.90 < f < 49.95]; and (ii) @ 200% of normal rate of charge for deviation when [f ≤ 49.90].

2C. When f > 50.03 Hz

(a) The general seller other than an ROR generating station or a generating station based on municipal solid waste shall be paid back for deviation by way over injection (i) @ 50% of reference charge rate when [50.03 < f < 50.05]; and (ii) @ zero when [f ≥ 50.05];

(b) The general seller other than an ROR generating station or a generating station based on municipal solid waste shall pay for deviation by way under injection (i) @ 75% of reference charge rate, when [50.03 < f < 50.05]; and (ii) @ 50% of reference charge rate, when [f ≥ 50.05];

(c) The buyer shall be paid back for deviation by way of under drawl (i) @ 50% of normal rate of charge for deviation when [50.03 < f < 50.05]; and (ii) @ zero when [f ≥ 50.05];

(d) The buyer shall pay for deviation by way of over drawl (i) @ 75% of normal rate of charge for deviation when [50.03 < f < 50.05]; and (ii) @ zero when [f ≥ 50.05].

3. (a) The charges for deviation for injection of infirm power shall be zero: Provided that upon such infirm power being scheduled, the charges for deviation for such power shall be as applicable for a general seller.

(b) The charges for deviation for drawl of start-up power before COD of a generating unit or for drawl of power to run the auxiliaries during shut-down of a generating station shall be payable at the reference charge rate or contract rate or in the absence of reference charge rate or contract rate, the weighted average ACP of the Day Ahead Market segments of all Power Exchanges for the respective time block, as the case may be.

4. The charges for inter-regional deviation caused by way of over drawl or under drawl or over injection or under-injection shall be payable or receivable, as the case may be, at the normal rate of charges for deviation.

4A. The charges for deviation in respect of cross-border transactions, caused by way of over drawl or under drawl or over injection or under-injection shall be payable or receivable, at the deviation charge rates and subject to volume limits as applicable to a seller (of respective category) or to a buyer (other than an RE-rich State), as the case may be.

5. Notwithstanding anything contained in regulations, in case of forced outage of a seller, the charges for deviation shall be @ the reference charge rate, for a maximum duration of eight time blocks or until the revision of its schedule, whichever is earlier.

6. In case of multiple contracts, the contract rate or the reference rate referred to as above shall be the weighted average of the contract rates of all such contracts.

7. In case of a State having net injection at the regional periphery, the deviation charges for such State shall be as applicable to a buyer.

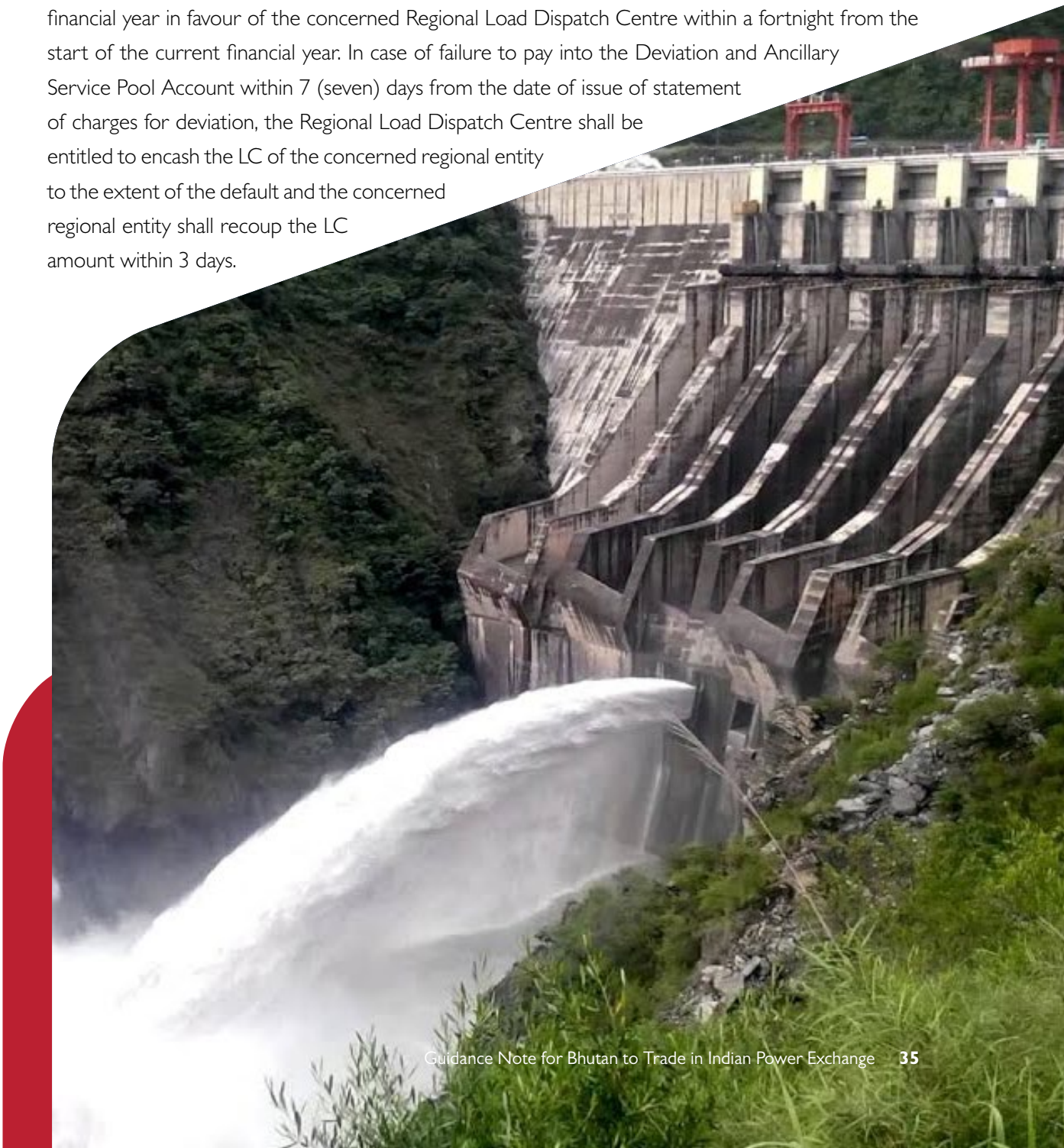
ACCOUNTING OF CHARGES FOR DEVIATION AND ANCILLARY SERVICE POOL ACCOUNT

1. By every Thursday, the Regional Load Dispatch Centres shall provide the data for deviation calculated as per Regulation 6 of these regulations, for the previous week ending on Sunday mid-night to the Secretariat of the respective Regional Power Committees.
2. After receiving the data for deviation from the Regional Load Dispatch Centre, the Secretariat of the Regional Power Committee shall prepare and issue the statement of charges for deviation prepared for the previous week, to all regional entities by ensuing Tuesday - Provided that transaction-wise DSM accounting for intra-state entities shall not be carried out at the regional level.
3. Separate books of accounts shall be maintained for the principal component and interest component of charges for deviation by the Secretariat of the Regional Power Committees.
4. There shall be a Deviation and Ancillary Service Pool Account to be maintained and operated by the Regional Load Dispatch Centre for the respective region - Provided that the Commission may by order direct any other entity to operate and maintain the Deviation and Ancillary Service Pool Account.
5. The Deviation and Ancillary Service Pool Account shall receive credit for:
    i. Payments on account of charges for deviation referred to in Table 5 and Table 6 and the late payment surcharge as referred to in 'Schedule of Payment of charges for deviation';
    ii. Payments made by:
        1. Secondary Reserve Ancillary Service (SRAS)Provider for the SRAS-down dispatched under the Ancillary Services Regulations;
        2. Tertiary Reserve Ancillary Service (TRAS) Provider for the TRAS-down dispatched under the Ancillary Services Regulations; and
        3. Such other charges as may be notified by the Commission.
6. Deviation and Ancillary Service Pool Account shall be charged for:
    i. payment to seller for over injection;
    ii. payment to buyer for under drawl;
    iii. the full cost of dispatched SRAS-up including the variable charge or the energy charge or the compensation charge, as the case may be, for every time block on a regional basis as well as the incentive for SRAS, payable to the concerned SRAS Provider as referred in the Ancillary Services Regulations;
    iv. the full cost towards TRAS-up including the charges for the quantum cleared and dispatched and the commitment charge for the quantum cleared but not dispatched as referred in the Ancillary Services Regulations; and
    v. such other charges as may be notified by the Commission..
7. In case of deficit in the Deviation and Ancillary Service Pool Account of a region, surplus amount available in the Deviation and Ancillary Service Pool Accounts of other regions shall be used for

settlement of payment: Provided that in case the surplus amount in the Deviation and Ancillary Service Pool Accounts of all other regions is not sufficient to meet such deficit, the balance amount shall be recovered through the RLDC Fees and Charges.

SCHEDULE OF PAYMENT OF CHARGES FOR DEVIATION

1. The payment of charges for deviation shall have a high priority and the concerned regional entity shall pay the due amounts within 7 (seven) days of the issue of statement of charges for deviation by the Regional Power Committee, failing which late payment surcharge @ 0.04% shall be payable for each day of delay.
2. Any regional entity which at any time during the previous financial year fails to make payment of charges for deviation within the time specified in these regulations, shall be required to open a Letter of Credit (LC) equal to 110% of their average payable weekly liability for deviations in the previous financial year in favour of the concerned Regional Load Dispatch Centre within a fortnight from the start of the current financial year. In case of failure to pay into the Deviation and Ancillary Service Pool Account within 7 (seven) days from the date of issue of statement of charges for deviation, the Regional Load Dispatch Centre shall be entitled to encash the LC of the concerned regional entity to the extent of the default and the concerned regional entity shall recoup the LC amount within 3 days.



F. CERC ANCILLARY SERVICES REGULATION, 2022

Ancillary Service is services in power system which is necessary to support the grid operation in maintaining power quality, reliability and security of the grid and comprises of Primary Reserve Ancillary Service, Secondary Reserve Ancillary Service, Tertiary Reserve Ancillary Service, active power support for load following, reactive power support, black start and such other services.

Primary Reserve Ancillary Service (PRAS) means the Ancillary Service which immediately comes into service through governor action of the generator or through any other resource in the event of sudden change in frequency.

Secondary Reserve Ancillary Service (SRAS) means the Ancillary Service comprising SRAS-Up and SRAS-Down, which is activated and deployed through secondary control signal.

A generating station or an entity having energy storage resource or an entity capable of providing demand response, on standalone or aggregated basis, connected to inter-State transmission system or intra-State transmission system, shall be eligible to provide Secondary Reserve Ancillary Service, as an SRAS Provider.

SRAS shall be activated and deployed by the Nodal Agency to maintain or restore grid frequency within the allowable band. SRAS shall be procured on regional basis by the Nodal Agency. An SRAS Provider willing to participate in SRAS shall be required to provide standing consent to the Nodal Agency for participation, which shall remain valid till it is modified or withdrawn.

Average of SRAS-Up and SRAS-Down MW data shall be calculated by the Nodal Agency for every 5 minutes in absolute terms using archived SCADA data at the Nodal Agency and reconciled with the data received at the control centre of the SRAS Provider and shall be used for payment of incentive

SRAS Provider shall be paid from the Deviation and Ancillary Service Pool Account, at the rate of their energy charge or compensation charge, as declared by the SRAS Provider.

The actual response of SRAS Provider against the secondary control signals from the Nodal Agency to the control centre of the SRAS Provider shall be monitored by the Nodal Agency, as per the procedure stipulated in the Detailed Procedure.

SRAS Provider shall be eligible for incentive based on the performance measured as per clause (2) of the CERC Ancillary Services Regulation, 2022 and the 5-minute MWh data calculated for SRAS-Up and SRAS-Down as per clause (11) of Regulation 10 of the CERC Ancillary Services Regulation, 2022 and aggregated over a day, as under Table 6.

Table 8: Incentive Rate based on Actual performance vis-à-vis secondary control signal for an SRAS Provider (As per CERC Regulations)

Actual performance vis-à-vis secondary control signal for an SRAS Provider	Incentive Rate (paise/kWh)
95 % and above	(+) 50
75 % to below 95%	(+) 40
60 % to below 75%	(+) 30
50% to below 60%	(+) 20
20 % to below 50%	(+) 10
Below 20%	(+) 0

Performance below 20% for two consecutive days by an SRAS Provider shall make the SRAS Provider liable for disqualification for participation in SRAS for a week by the Nodal Agency.

Accounting of SRAS shall be done by the Regional Power Committee on a weekly basis, based on SCADA data. No transmission charges or transmission losses or transmission deviation charges shall be payable for SRAS.

Tertiary Reserve Ancillary Service (TRAS) means the Ancillary Service comprising TRAS-Up and TRAS-Down and consists of spinning reserve or non-spinning reserve, which responds to dispatch instructions from the Nodal Agency.

A generating station or an entity is capable of varying its active power output or drawl or consumption, as the case may be, on receipt of dispatch instructions from the Nodal Agency.

TRAS shall be activated and deployed by the Nodal Agency on account of the secondary reserve has been deployed continuously in one direction for fifteen (15) minutes for more than 100 MW, in order to replenish the secondary reserve;

The Nodal Agency shall communicate to the power exchange(s), the quantum of requirement of TRAS-Up and TRAS-Down on day-ahead basis before commencement of the Day Ahead Market and incremental requirement.

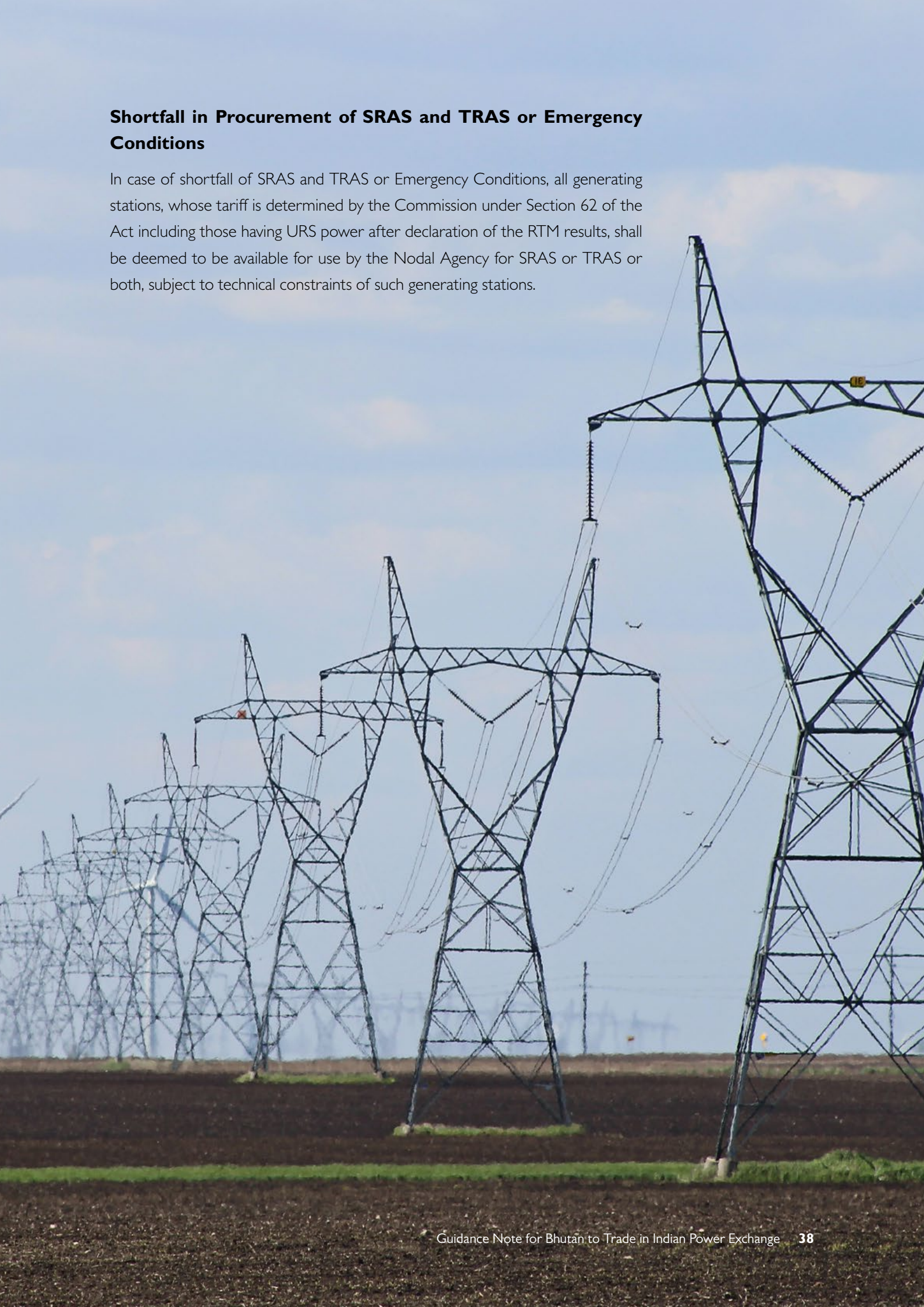
The price discovery for TRAS-Up shall be based on the principle of Uniform Market Clearing Price, subject to market splitting in case of congestion and the price discovery for TRAS-Down shall be based on the principle of Pay-as-bid.

Accounting of TRAS shall be done by the Regional Power Committee on a weekly basis, based on interface meter data and schedules.

No transmission charges or transmission losses or transmission deviation charges shall be payable for TRAS.

Shortfall in Procurement of SRAS and TRAS or Emergency Conditions

In case of shortfall of SRAS and TRAS or Emergency Conditions, all generating stations, whose tariff is determined by the Commission under Section 62 of the Act including those having URS power after declaration of the RTM results, shall be deemed to be available for use by the Nodal Agency for SRAS or TRAS or both, subject to technical constraints of such generating stations.



G. CERC OPEN ACCESS REGULATIONS 2008 INCLUDING LATEST AMENDMENT

SCOPE

These regulations shall apply for utilization of surplus capacity available on the inter-State transmission system by virtue of margins available due to variation in power flows and margins available due to in-built spare transmission capacity created to cater to future load growth or generation addition.

DEFINITION OF OPEN ACCESS

The non-discriminatory provision for the use of transmission lines or distribution system or a associated facilities with such line or system by any licensee or consumer or a person engaged in generation in accordance with the regulations specified by the appropriate commission.

PRE-REQUISITES FOR CRITERIA FOR OPEN ACCESS

- Minimum contract demand should be 1 MW
- Connectivity should be 11kV or above
- Already installed 0.2 class accuracy ABT (availability-based tariff) energy meter along with 0.2 class CT/PT unit.
- NOC (No objection certificate) from SLDC

TYPES OF OPEN ACCESS

There is three types of open access:

1. Long term open access (contracts up to 25 years of validity)
2. Medium term open access (contracts up to 1-3 years of validity)
3. Short term open access (contracts up to 1-12 months of validity)

NODAL AGENCY

Nodal agency for bilateral transactions shall be the RLDC of the region where the point of drawal of electricity is situated and for collective transection it shall be NLDC.

SUBMISSION OF OPEN ACCESS APPLICATION

- An open access consumer or Power exchange (on behalf of buyers and sellers) intending to avail open access to use of transmission system shall make an application to Nodal agency.
- The application for a bilateral transaction shall contain the details, such as names and location of supplier and buyer, contracted power (MW) to be scheduled and interface at which it is referred to, point of injection, point of drawal, starting time block and date, ending time block and date, and such other information that may be required in the detailed procedure.

APPLICATION FEE

- An application made for each bilateral transaction or the collective transaction shall be accompanied by a non-refundable fee of Rupees five thousand (Rs.5000/-) only:
- Provided that the fee for bilateral transaction on the day of the application or on the day immediately following the day of the application may be deposited within three working days of submission of the application.

PROCEDURE FOR ADVANCE SCHEDULING FOR BILATERAL TRANSACTIONS

- An application for advance scheduling for a bilateral transaction may be submitted to the nodal agency up to the fourth month, the month in which an application is made being the first month: Provided that separate application shall be made for each month, and for each transaction.
    - An application for inter-State scheduling during the fourth month shall be made up to the last day of the first month.
    - An application for inter-State scheduling during the third month shall be made up to five (5) days prior to the close of the first month.
    - An application for inter-State scheduling in the second month shall be made with the nodal agency up to ten (10) days prior to the close of the first month.
- All applications shall be taken up together for consideration.
- Wherever the nodal agency rejects an application, it shall convey its reasons to the applicant in writing.
- Provided that while accepting the application, open access granted to any person prior thereto shall not be withdrawn.

CONGESTION MANAGEMENT

The grant of all applications at a particular stage of advance scheduling is likely to cause congestion in one or more of the transmission corridors to be used, it shall conduct electronic bidding for grant of open access for the available surplus transmission capacity among the applicants at that stage. It is also provided that, if any person does not participate in the bidding process he shall be deemed to have withdrawn his application.

PROCEDURE FOR SCHEDULING OF BILATERAL TRANSACTIONS ON FIRST-COME-FIRST-SERVED BASIS

- The applications for grant of open access for the second month, received 4 days prior to date of the bilateral transaction and the applications for grant of open access during the first month shall be considered on first-come-first-served basis, and such transactions shall be scheduled subject to availability of the required transmission capacity.
- All these applications shall be processed and decided within three (3) days of their receipt.

PROCEDURE FOR SCHEDULING FOR DAY-AHEAD TRANSACTIONS

All applications for bilateral transactions received within three days prior to the date of scheduling and up to 1500 hrs of the day immediately preceding the date of scheduling shall be clubbed and treated at par, and shall be processed after processing of the applications for collective transactions received till 1500 hrs.

PROCEDURE FOR SCHEDULING OF TRANSACTIONS IN A CONTINGENCY

In the event of a contingency, the buying utility may locate a source of power to meet short-term contingency requirement even after the cut-off time of 1500 hrs of the preceding day and apply to the nodal agency for open access and scheduling and in that event.

REVISION OF SCHEDULE

- The open access schedules accepted by the nodal agency in advance and on first-come-first-served basis may be cancelled or revised downwards by the applicant by giving a minimum five (5) days' notice, excluding the day on which notice is served and the day from which revised schedules are to be implemented.
- The applicant shall continue to be liable to pay transmission charges as per the schedule originally approved, if the period of revision or cancellation is up to five (5) days.
- If the period of revision or cancellation exceeds five (5) days, transmission charges for the period beyond five (5) days shall be payable in accordance with the revised schedule and for the first five days (5) in accordance with the original schedule
- In case of cancellation, operating charges shall be payable for five (5) days or the period of cancellation in days, whichever is less.

CURTAILMENT IN CASE OF TRANSMISSION CONSTRAINTS

- When for the reason of transmission constraints or to maintain grid security, it becomes necessary to curtail power flow on a transmission corridor, the transactions already scheduled may be curtailed in the manner decided by the Regional Load Despatch Centre, if in its opinion such curtailment is likely to relieve the transmission constraint or is likely to improve grid security.

TRANSMISSION CHARGES

In case of bilateral transactions, for use of the inter-State transmission system, the transmission charges at the rate specified hereunder shall be payable by the applicant for the energy approved for transmission at the point(s) of injection:

Table 9: Charges by type of transition

Type of Transaction	Transmission Charges (Total) (Rs./MWh)
Bilateral, intra-regional	30
Bilateral, between adjacent regions	60
Bilateral, wheeling through one or more intervening regions	90

OPERATING CHARGES

- Operating charges at the rate of Rs. 2,000 /- per day or part of the day for each bilateral transaction for each of the Regional Load Despatch Centre 12 involved and at the rate of Rs.2,000 /- per day or part of the day for each State Load Despatch Centre involved shall be payable by the applicant.
- In case of the collective transaction, operating charges shall be payable by the power exchange @ Rs.5000/- per day to the National Load Despatch Centre for each State involved and Rs.2,000 /- per day for the State Load Despatch Centre involved for each point of transaction
- All buyers within a State shall be clubbed together and all sellers within a State shall be clubbed together by the power exchange (with necessary coordination with the State Load Despatch Centre) and each of the groups shall be counted as a single entity by National Load Despatch Centre for levy of operating charges and for scheduling:

  Provided that for levy of operating charges for State Load Despatch Centre and levy of the intra-State transmission charges, each point of injection or drawal in the State network shall be counted separately.

  Note 1 The operating charges include fee for scheduling, system operation and collection and disbursement of charges.

  Note 2 The operating charges collected by the nodal agency shall be in addition to the fees and charges specified by the Commission under sub-section (4) of Section 28 of the Act.

PAYMENT OF TRANSMISSION CHARGES AND OPERATING CHARGES

In case of the bilateral transaction, the applicant shall deposit transmission and operating charges within three (3) working days of grant of application and in case of collective transactions, the power exchange shall deposit these charges by the next working day falling after the day on which its application was processed to Nodal Agency.

DEFAULT IN PAYMENT OF OPEN ACCESS CHARGES

- In case of default in payment of the application fee or the charges specified under these regulations, the nodal agency may, in its discretion, decide not to schedule the transaction, or to cancel the scheduling of already scheduled transaction or not to entertain any application of such persons in future until such time the default is cured.
- The person/entity committing default in payment shall pay simple interest at the rate of 0.04% for each day of default.

UNSCHEDULED INTER-CHANGE (UI) CHARGES

- Based on net metering on the periphery of each regional entity, composite UI accounts shall be issued for each regional entity on a weekly cycle and transaction-wise UI accounting, and UI accounting for intra-State entities shall not be carried out at the regional level.
- The State utility designated for the purpose of collection / disbursement of UI charges from / to intra-

State entities shall be responsible for timely payment of the State's composite dues to the regional UI pool account.

- Any mismatch between the scheduled and the actual drawl at drawl points and scheduled and the actual injection at injection points for the intra State entities shall be determined by the concerned State Load Dispatch Centre and covered in the intra-State UI accounting scheme.
- Unless specified otherwise by the concerned State Commission, UI rate for intra-State entity shall be 105% (for over-drawls or under generation) and 95% (for under-drawls or over generation) of UI rate at the periphery of regional entity.

SPECIAL ENERGY METERS

- Special energy meter shall be installed by Central Transmission Utility for and at the cost of regional entities and by STU for and at the cost of intra-state utility.
- Special Energy Meters installed shall be capable of time-differentiated measurements for time block wise active energy and voltage differentiated measurement of reactive energy in accordance with Annexure – 2 to Chapter–6 of the Indian Electricity Grid Code.
- Special Energy Meters shall always be maintained in good condition and Special Energy Meters shall always be maintained in good condition.

TRANSMISSION LOSSES

- The buyers and sellers of the electricity shall absorb apportioned energy losses in the transmission system as estimated by the RLDC and SLDC.
- The energy losses shall be accounted for by providing a differential between schedules at the points of supply, inter-utility transfer and drawl of electricity.
- The applicable transmission losses for the regional transmission system as well as for State network shall be declared in advance and shall not be revised retrospectively.

POWER EXCHANGES IN INDIA

A. INDIAN ENERGY EXCHANGE (IEX) OVERVIEW

IEX is India's premier energy exchange. IEX was inaugurated on 27th June 2008.

IEX has 95% market share, Electricity volume CAGR of 33% since 2008, 6000+ MW average daily trade, having more than 6700+ participants which includes 4450 industries, 70 commercial, 50 DISCOMs, 567 Conventional generators, 1747 RE generators and obliged entities and, 126 E SCERT Entities.

IEX offers various products to trade in the following market types:

I. Conventional Electricity Market- Following products/trade types are offered in this segment:

1. Day Ahead Market (DAM): since Jun'08, total of 65,149 MUs was traded in FY21
2. Term Ahead Market (TAM): since Sep'09, total of 5561 MUs of power was traded in FY 21
3. Real Time Market (RTM): Since Jun'20, total of 19,908 MUs were traded in FY 21
4. Cross Border Electricity Trade: Since April 2021

II. Green Market: Following products/trade types are offered in this segment:

1. Green Term Ahead Market: Since Aug'20
2. Green Day-Ahead Market: Since Oct'21

III. Certificate Market: Following products/trade types are offered in this segment:

1. Renewable Energy Certificates: Since Feb'11
2. Energy Saving Certificates: Since Sep'17

Figure 7: IEX Market Segments

Source: Indian Energy Exchange website (https://www.iexindia.com/)

KEY FEATURES OF IEX

- Publicly listed in NSE and BSE.
- IEX First Indian energy exchange to get ISO Certifications for quality management, Information security management and environmental management since August 2016.
- IEX is approved and regulated by the Central Electricity Regulatory Commission and has been operating since 27 June 2008.
- Registered first Open Access Consumer (OA) Introduced Term Ahead Market (TAM) in FY'2009.
- Introduced Renewable Energy Certificate (REC) in the market Traded first non- solar REC in FY'2011.
- Launched Energy Saving Certificate Publicly listed its securities in FY'2017.
- From a meager 13 BU electricity volume traded in the year 2011, trade in the electricity market has grown to 102 BU in fiscal year 2022. In the last five years, electricity volumes have grown at a CAGR of 17%.
- Company is actively working towards every aspect of the 2030 Sustainable Development Goals - Ensure Access to Affordable, Reliable, Sustainable and Modern energy for all. It is supporting the Government of India's 'Power for all' vision with a 24x7 power on demand.
- IEX pioneered the commencement of cross border electricity trade in April 2021 with Nepal in its Day Ahead Market followed by Bhutan from January 2022. Through this market, endeavor is to

build a regional power market beginning with grid connected countries like Nepal, Bangladesh, and Bhutan. An integrated power market at the regional level will lead to availability of competitively priced power, transparent and efficient power procurement, resource optimization at the regional level, and enhanced energy security and access.

- IEX has most competitive electricity market, green market, certificates market as well as is a pioneer in cross-border electricity trade. The Exchange has been providing most competitive power prices which serves as the benchmark and reference for prices across the long-term, medium and short-term markets.
- With IEX's endeavor to strengthen the customer centricity and satisfaction and, Value Added Service (VAS), it would soon emerge as "a-one-stop-shop for the green generators.
- IEX is constantly innovating, reimagining, and strengthening technology at both exchange and enterprise level, working in partnership with global and domestic leaders, to build a future-ready exchange platform.
- IEX is integrated with National open access Registry (NOAR), operated and hosted by Grid India.

PRODUCT-WISE KEY STATISTICS

Table 10: IEX Product-wise Key Statistics (as per Q4FY22)

	DAM+TAM	RTM	Green Power	REC	Escerts
Market Share	94.2%	99.9%	80%	72%	97%
State Utilities	29 States 5 UTs	29 States 4 UTs	29 States 3 UTs	29 States 5 UTs	29 States 5 UTs
Generators	Total Power: 600+			1216	112
Industrial Consumers	Total Power: 4600+			593	59
Average Daily Volumes	206MU	50MU	12MU	NA	NA

Source: Indian Energy Exchange website (https://www.iexindia.com/)

RISKS AND COMPLIANCES

IEX focus of the Risk Management framework is primarily to identify the perceived risks in the current structure of market dynamics including strategic, operational, and external risks (IT and Technology, Liquidity, Legal, Regulatory, Business concentration, Compliance, Market)

Cyber security risk of the SEBI listing obligation and the focus of the Risk Management framework is primarily to identify the perceived risks in the current structure of market dynamics including strategic, operational, and external risks.

For more information refer Annexure II.

B. POWER EXCHANGE INDIA LIMITED (PXIL) OVERVIEW

PXIL has started operations in short term exchange market since October 2008 and offers alternative platform to India Energy exchange. It offers exchange products as approved by CERC such as DAM, Intraday, Term ahead and Weekly Contracts etc.

PXIL offers various products/trade types:

1. Day Ahead Market: since Sep' 09
2. Renewable Energy Certificates: Since Mar'11
3. 24X7 Intraday: Since Jul'15
4. Real Time Market: Since Jun' 20

KEY FEATURES OF PXIL

- PXIL, which is India's first institutionally promoted Power exchange by NSE and NCDEX, was established in 2008.
- PXIL is approved and regulated by the Central Electricity Regulatory Commission and has been operating since October 2008.
- Introduction of PRATYAY, web-based application, easier workflow to members.
- Handles power trading and transmission clearances simultaneously.
- Exchange is a central counterparty to all trades done on the platform.
- P-NEST new trading platform has modularity, Flexibility, scalability, reduced time to market.
- PXIL focus on the risk management, same day pay in for DAM, min-max margin, reports etc.
- Real Time Electricity market:
    - PXIL started RTM on June 1st, 2020
    - It is designed for half hourly market, auction sessions are conducted during even time blocks of the hour with delivery to commence from one hour after the closure of the trade session
    - It provides DISCOM's an opportunity to access the market for any last-minute requirement.

C. HINDUSTAN POWER EXCHANGE LIMITED (HPX) OVERVIEW

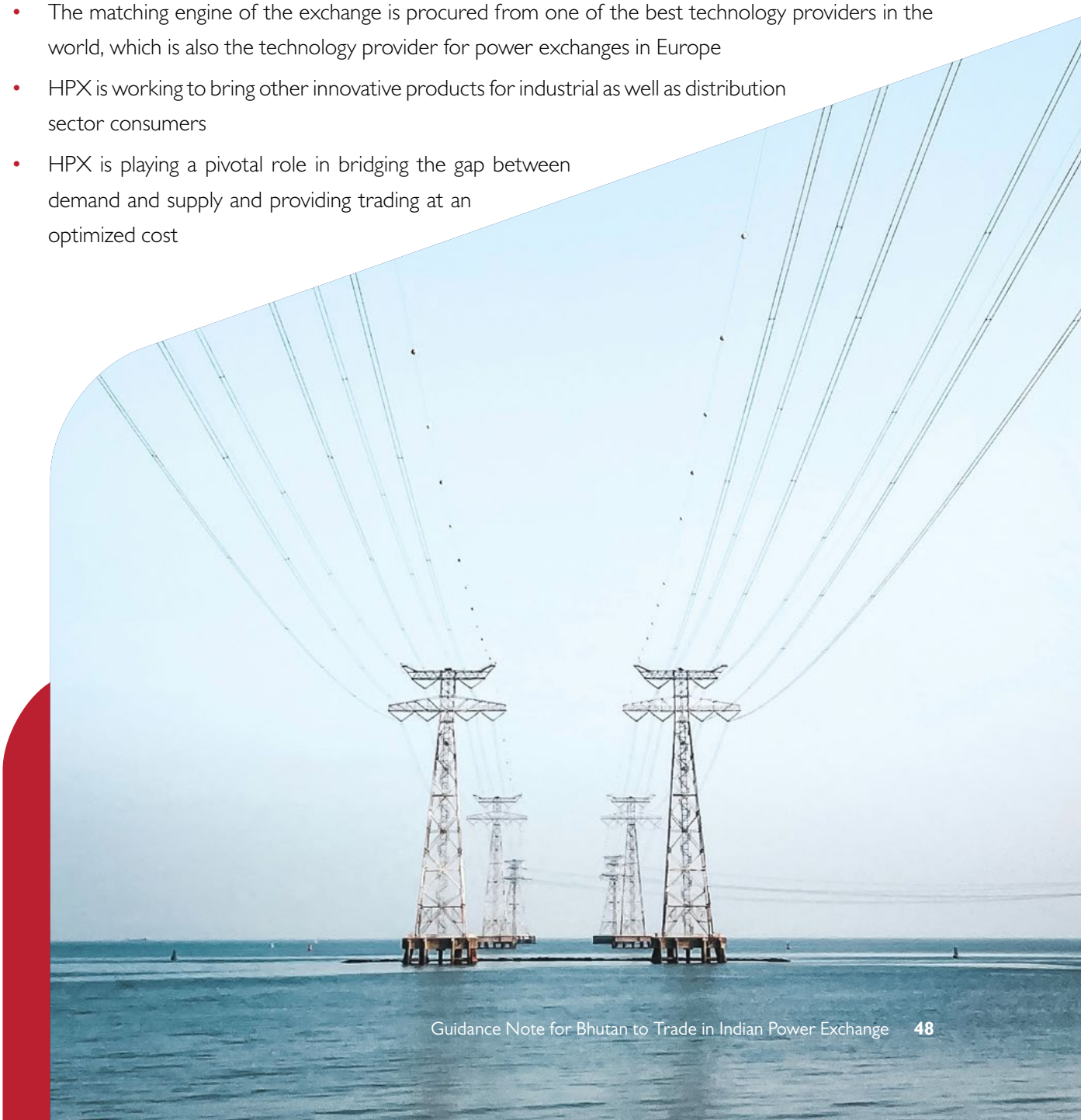
HPX is third energy exchange which commenced operation from 06th July 2022. It is promoted by the 3 leading institutions, PTC INDIA Ltd, BSE Investment Ltd. and ICICI Bank Ltd.

HPX offers various products/trade types across both Conventional and Green markets:

1. Day Ahead Market
2. Term Ahead Market
3. Green Term Ahead Market
4. Renewable Energy Certificate

KEY FEATURES OF HPX:

- The matching engine of the exchange is procured from one of the best technology providers in the world, which is also the technology provider for power exchanges in Europe
- HPX is working to bring other innovative products for industrial as well as distribution sector consumers
- HPX is playing a pivotal role in bridging the gap between demand and supply and providing trading at an optimized cost



PRODUCTS ON POWER EXCHANGE (THEIR TIMELINE AND TRADING PROCESS)

A. DAY-AHEAD MARKET (DAM)AND GREEN-DAY AHEAD MARKET (G-DAM)

DAY AHEAD MARKET (DAM)

Overview

It is a physical electricity trading market for deliveries for any/some/all 15-minute time block in 24 hours of next day starting from mid night. The prices and quantum of electricity to be traded are determined through a double-sided closed auction bidding process.

Features of DAM are as follows:

1. Trading of 15-minutes contracts
2. Double-sided anonymous auction bidding process
3. Clearance obtained from SLDC by buyers and sellers based on availability of network and Availability Based Tariff (ABT) meters
4. Congestion management through market splitting and determining Area Clearing Price (ACP) specific to an area
5. Risk management through the requisite margin, including any additional margin as specified for the respective trading segment or the type of contracts

Congestion Management

Market-splitting methodology shall be adopted for congestion management. Grid bottlenecks are relieved by comparison of the calculated contractual flow with the transmission capacity available for spot trading, and if the flow exceeds the capacity, the prices are adjusted on both sides of the bottleneck so that the flow equals the capacity. If the flow does not exceed the capacity, a common price is established for the whole area.

If the flow exceeds the capacity at the common price for the whole market area, it is split in a surplus part and a deficit part. The price is reduced in the surplus area (sale > purchase) and increased in the deficit area (purchase > sale). This will reduce the sale in the deficit area and increase the purchase in the surplus area. In the same way, it will reduce the purchase and increase the sale in the deficit area.

DAM trading Process

DAM trading process is divided in six sessions:

1) Bidding

- Participants enter bids for sale or purchase of power for delivery on the following day. (T+1 day)
- Bids for a total of 96 blocks of 15 minute each can be entered.
- Bidding session: 1000 hrs. - 1100 hrs.
- Bids can be single and/or block including linked bids:
  - Single bids: 15-Minute bids for different price and quantity pairs can be entered through this type of order. Partial execution of the bids entered is possible.
  - Block bids: Relational Block Bid for any 15-min block or series of 15-min blocks during the same day can be entered. Although no partial execution is possible i.e. either the entire order will be selected or rejected.
- The bids so entered are stored in the central order book. The bids entered during this phase can be revised or cancelled till end of bid call period (i.e.1100 hrs. of trading day)

2) Matching

- At the end of the bidding session, bids for each 15-minute time block are matched using the price calculation algorithm. (available in IEX bye-laws)
- All purchase bids and sale offers are aggregated in the unconstrained scenario. The aggregate supply and demand curves are drawn on Price-Quantity axes. The intersection point of the two curves gives the market clearing price (MCP) and market clearing volume (MCV) corresponding to price and quantity of the intersection point.
- MCP and MCV are determined for each block of 15 minutes as a function of demand and supply which is common for the selected buyers and sellers.
- Selected members are intimated about their partially or fully executed bids and other trade related information.
- By 1145 hrs, transmission corridor required to fulfill successful transactions are sent to NLDC.

The example below illustrates price calculation. Assume the price tick as below:

Price (Rs/kWH)	0	1	1.1	2	2.1	2.5	3	3.3	4	4.1	5					20

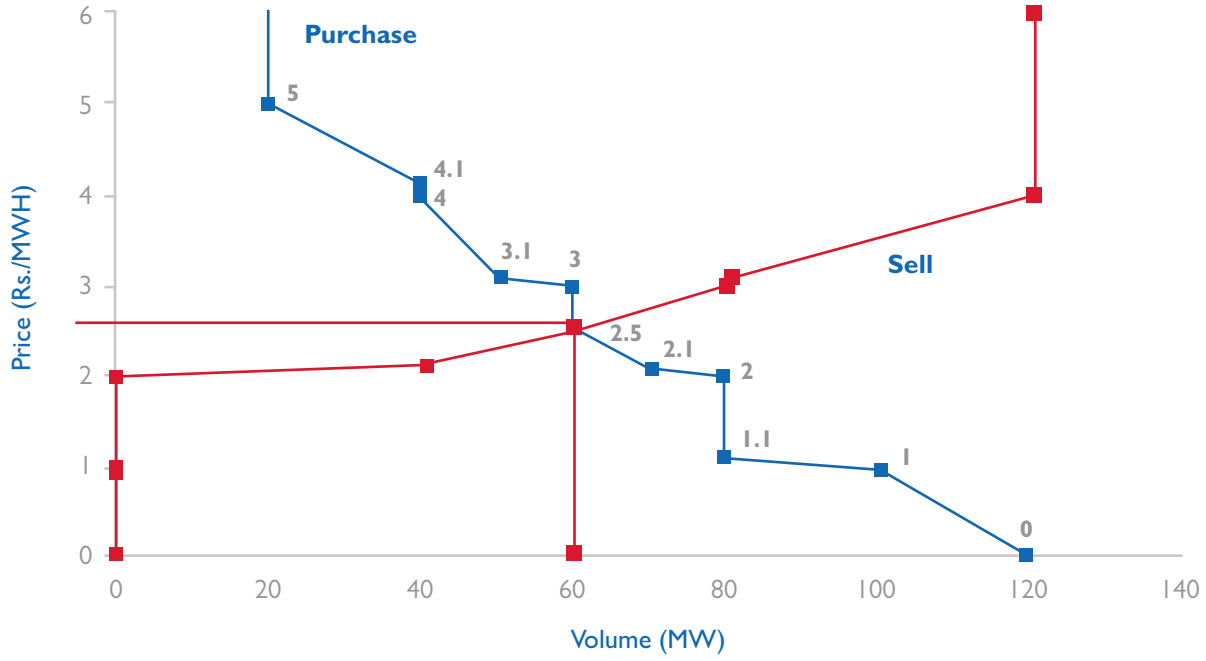
For the sake of simplicity we assume only 3 portfolios are entered. The quantity entered by each portfolio A, B and C for the specific price tick is as shown below:

Portfolio A. MW	20				20	20	20	10	0							0
Portfolio B. MW	60			60	50	40	40	40	40	40	20					20
Portfolio C. MW	40	20	0	0	-40	-60	-80	-81	-120							-120

The algorithm will then add the entire purchase quantum and sell quantum after the bidding session and look for a solution where the net transaction is zero i.e. the buy quantum is equal to the sell quantum.

SUM. Purchase	120	100	80	80	70	60	60	50	40	40	20			20
SUM. Sell	0			0	-40	-60	-80	-81	-120					-120
Net Transaction	120	100	80	80	30	0	-20	-31	-80	-80	-100			-100

The demand-supply graph in such scenario is shown below:



3) Transmission corridors and funds availability

- Preliminary MCP and MCV are used to calculate the provisional obligation of the selected participants and the provisional power flow.
- Funds available in the settlement accounts of the participants are verified based on the provisional obligation.
- In case of insufficient funds in the account, the bids entered by such a participant are deleted.
- Required corridor capacity and provisional power flow is sent to NLDC for scrutiny and corridor allocation is requisitioned based on availability.
- By 1215 Hrs, NLDC reverts with actual transmission corridor availability during all 15-minute time blocks across congestion prone bid areas

4) Results

- Based on the reserved transmission capacity intimated by NLDC, IEX recalculates MCP and MCV as well as area clearing price (ACP) and area clearing volume (ACV). See Market splitting for more info.

- ACP is used for the settlement of the contracts. On receipt of final results, obligations are sent to the Clearing Banks for Pay In from buying Members at 13.30 hrs and the bank is asked to confirm the same.

5) Confirmation

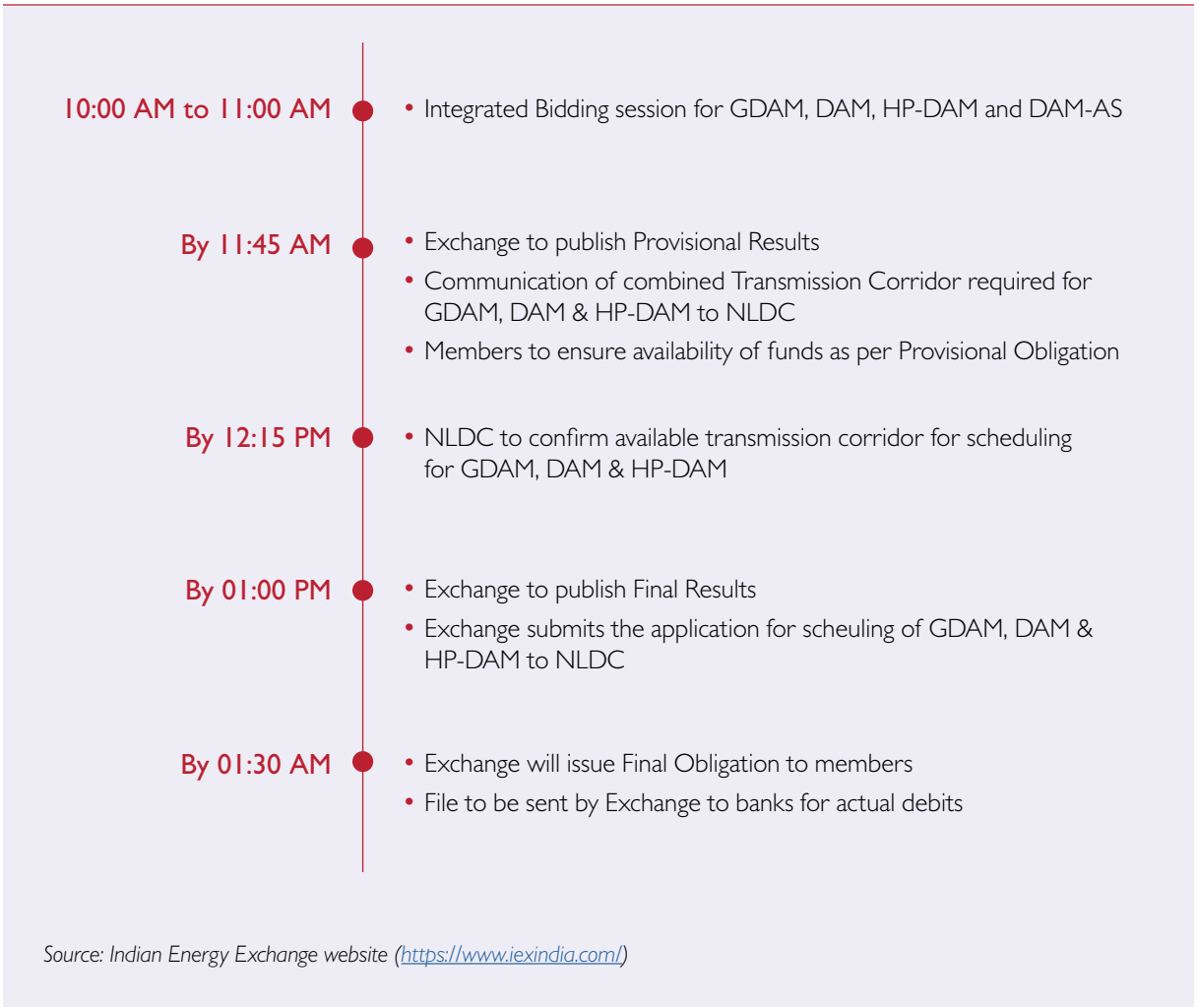
- Final results for confirmation and application for scheduling of collective transactions are sent to NLDC.
- NLDC sends the details of the schedule to respective SLDCs.

6) Scheduling

- RLDCs /SLDCs incorporate Collective Transactions in the Daily schedule.
- A scheduled transaction is considered deemed delivery.
- Deviations from schedules are dealt under UI or Deviation Settlement or Imbalance Settlement regulations. The Regional Entities (those connected at Inter State Transmission System networks) are governed by CERC Regulations and Embedded Entities (those connected to state transmission or distribution network) are governed by respective State Commission's regulations.

7) Timeline

Figure 8: Timeline for DAM trading Process



Source: Indian Energy Exchange website (https://www.iexindia.com/)

GREEN DAY AHEAD MARKET (GDAM)

Overview

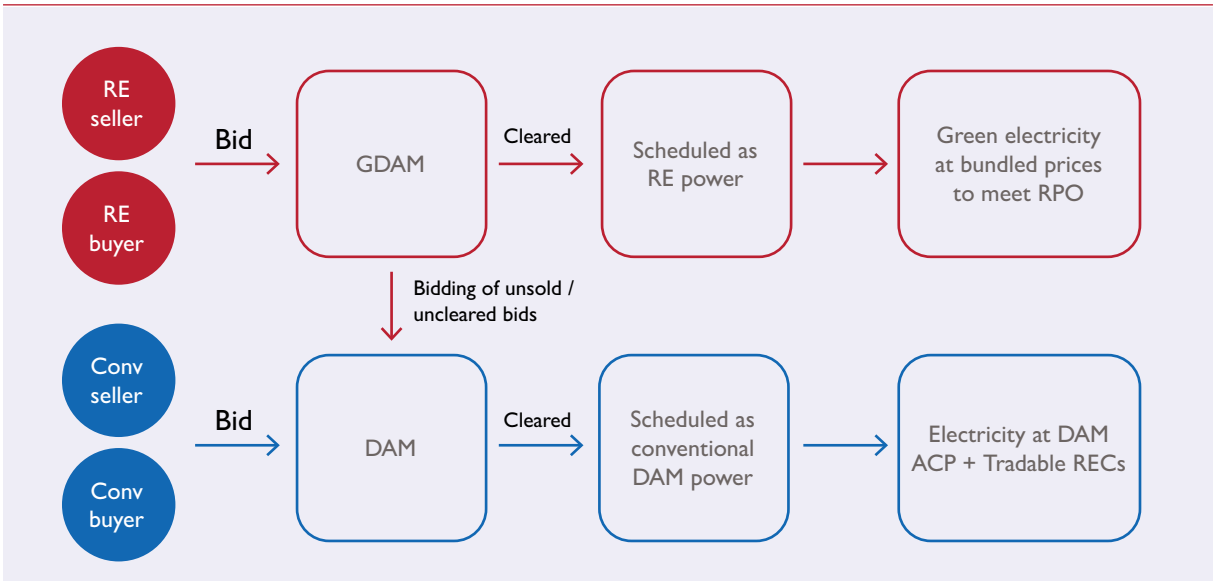
The Green Day ahead Market allows anonymous and double-sided closed collective auction in renewable energy on the day-ahead. The Exchange now invites bids for conventional and renewable in an integrated way through separate bidding windows. The clearing takes place in a sequential manner – first in the renewable segment having the must-run status, considering the availability of the transmission corridor, followed by conventional segment. IEX allows the market participants to transfer the unselected bid in renewable segment and at a different price.

Key Feature

1. Bid categories for Buyers and Sellers – Solar, Non-Solar and Hydro
2. Separate quantity limit for sellers in each category i.e., Solar, Non-Solar and Hydro
3. Participants at either premium or discount price can use 'Order Carry forward (OCF)' at the time of placing bid to carry forward uncleared bids to conventional DAM.
4. Trading of 15- minute contracts
5. Double-sided anonymous closed bidding auction
6. Buyers and sellers submit NOC from respective SLDC based on availability of network
7. Congestion management through market splitting and determination of ACP
8. Separate price formation for green and conventional power.
9. Risk management through the requisite margin, including any additional margin as specified for the respective trading segment or the type of contract.

Trading Process

Figure 9: GDAM Trading Process



Source: Indian Energy Exchange website (https://www.iexindia.com/)

Figure 10: Timeline for GDAM Trading

10:00 AM to 11:00 AM	• Integrated Bidding session for GDAM, DAM, HP-DAM and DAM-AS
By 11:45 AM	• Exchange to publish Provisional Results • Communication of combined Transmission Corridor required for GDAM, DAM & HP-DAM to NLDC • Members to ensure availability of funds as per Provisional Obligation
By 12:15 PM	• NLDC to confirm available transmission corridor for scheduling for GDAM, DAM & HP-DAM
By 01:00 PM	• Exchange to publish Final Results • Exchange submits the application for scheuling of GDAM, DAM & HP-DAM to NLDC
By 01:30 AM	• Exchange will issue Final Obligation to members • File to be sent by Exchange to banks for actual debits

Source: Indian Energy Exchange website (https://www.iexindia.com/)

B. TERM-AHEAD MARKET (TAM) AND GREEN TERM-AHEAD MARKET (G-TAM)

TERM-AHEAD-MARKET (TAM)

It provides a range of products allowing participants to buy/sell electricity on a term basis for a duration of up to 12 weeks ahead.

Currently, products in the Term Ahead Market include Intra-day, Day-ahead Contingency, Daily and Weekly contracts to help participants manage their electricity portfolio for different durations.

Some common features:-

1. Trading of Region specific contracts
2. Firm Delivery
   The contracts under Term Ahead Market can be used to ensure delivery of electricity for a few days in advance.
3. Delivery Blocks: | RTC | Day | Night | Peak | Hourly |
   FBA -- Firm Base – 24 Hrs.
   FNT -- Firm Night – 8 Hrs. (0-7 & 23-24)
   FDY -- Firm Day – 11Hrs. (7-18)
   FPK -- Firm Peak – 5 Hrs. (18-23)

1) Intra Day Contracts:-

- Region specific 20 hourly intra-day contracts for delivery on the same day.
- The contracts are available for trading from 00:30 hrs to 20:00 hrs on a daily basis through continuous trading process
- In case of congestion in inter-regional corridors, the exchange can restrict buyers to buy from particular regions for certain contracts. The trading and delivery cycle is as explained below:

Table 11: Timelines for Intra-Day Contracts

Market type	Symbol	Trading start time	Trading end time	Delivery Period (Delivery on the same day)
Intraday	ITD-H05-AR	00:30 hrs	01:30 hrs	04:00:00 - 05:00:00
Intraday	ITD-H06-AR	00:30 hrs	02:30 hrs	05:00:00 - 06:00:00
Intraday	ITD-H07-AR	00:30 hrs	03:30 hrs	06:00:00 - 07:00:00
Intraday	ITD-H08-AR	00:30 hrs	04:30 hrs	07:00:00 - 08:00:00
Intraday	ITD-H09-AR	00:30 hrs	05:30 hrs	08:00:00 - 09:00:00
Intraday	ITD-H10-AR	00:30 hrs	06:30 hrs	09:00:00 - 10:00:00
Intraday	ITD-H11-AR	00:30 hrs	07:30 hrs	10:00:00 - 11:00:00
Intraday	ITD-H12-AR	00:30 hrs	08:30 hrs	11:00:00 - 12:00:00

Market type	Symbol	Trading start time	Trading end time	Delivery Period (Delivery on the same day)
Intraday	ITD-H13-AR	00:30 hrs	09:30 hrs	12:00:00 - 13:00:00
Intraday	ITD-H14-AR	00:30 hrs	10:30 hrs	13:00:00 - 14:00:00
Intraday	ITD-H15-AR	00:30 hrs	11:30 hrs	14:00:00 - 15:00:00
Intraday	ITD-H16-AR	00:30 hrs	12:30 hrs	15:00:00 - 16:00:00
Intraday	ITD-H17-AR	00:30 hrs	13:30 hrs	16:00:00 - 17:00:00
Intraday	ITD-H18-AR	00:30 hrs	14:30 hrs	17:00:00 - 18:00:00
Intraday	ITD-H19-AR	00:30 hrs	15:30 hrs	18:00:00 - 19:00:00
Intraday	ITD-H20-AR	00:30 hrs	16:30 hrs	19:00:00 - 20:00:00
Intraday	ITD-H21-AR	00:30 hrs	17:30 hrs	20:00:00 - 21:00:00
Intraday	ITD-H22-AR	00:30 hrs	18:30 hrs	21:00:00 - 22:00:00
Intraday	ITD-H23-AR	00:30 hrs	19:30 hrs	22:00:00 - 23:00:00
Intraday	ITD-H24-AR	00:30 hrs	20:30 hrs	23:00:00 - 24:00:00

Source: Indian Energy Exchange website (https://www.iexindia.com/)

2) Day Ahead Contingency

- 24 contracts of one hour each for delivery on the next day.
- The contracts are available for trading from 15:00 hrs to 23:00 hrs on daily basis through continuous trading process.

Table 12: Timelines for Day-Ahead Contingency Contracts

Market type	Symbol	Trading start time	Trading end time	Delivery Period (Delivery on the next day)
Day Ahead	DAC-H01-AR	15:00 hrs	21:30 hrs	00:00:00 - 01:00:00
Day Ahead	DAC-H02-AR	15:00 hrs	22:30 hrs	01:00:00 - 02:00:00
Day Ahead	DAC-H03-AR	15:00 hrs	23:00 hrs	02:00:00 - 03:00:00
Day Ahead	DAC-H04-AR	15:00 hrs	23:00 hrs	03:00:00 - 04:00:00
Day Ahead	DAC-H05-AR	15:00 hrs	23:00 hrs	04:00:00 - 05:00:00
Day Ahead	DAC-H06-AR	15:00 hrs	23:00 hrs	05:00:00 - 06:00:00
Day Ahead	DAC-H07-AR	15:00 hrs	23:00 hrs	06:00:00 - 07:00:00
Day Ahead	DAC-H08-AR	15:00 hrs	23:00 hrs	07:00:00 - 08:00:00
Day Ahead	DAC-H09-AR	15:00 hrs	23:00 hrs	08:00:00 - 09:00:00
Day Ahead	DAC-H10-AR	15:00 hrs	23:00 hrs	09:00:00 - 10:00:00
Day Ahead	DAC-H11-AR	15:00 hrs	23:00 hrs	10:00:00 - 11:00:00
Day Ahead	DAC-H12-AR	15:00 hrs	23:00 hrs	11:00:00 - 12:00:00
Day Ahead	DAC-H13-AR	15:00 hrs	23:00 hrs	12:00:00 - 13:00:00
Day Ahead	DAC-H14-AR	15:00 hrs	23:00 hrs	13:00:00 - 14:00:00
Day Ahead	DAC-H15-AR	15:00 hrs	23:00 hrs	14:00:00 - 15:00:00

Market type	Symbol	Trading start time	Trading end time	Delivery Period (Delivery on the next day)
Day Ahead	DAC-H16-AR	15:00 hrs	23:00 hrs	15:00:00 - 16:00:00
Day Ahead	DAC-H17-AR	15:00 hrs	23:00 hrs	16:00:00 - 17:00:00
Day Ahead	DAC-H18-AR	15:00 hrs	23:00 hrs	17:00:00 - 18:00:00
Day Ahead	DAC-H19-AR	15:00 hrs	23:00 hrs	18:00:00 - 19:00:00
Day Ahead	DAC-H20-AR	15:00 hrs	23:00 hrs	19:00:00 - 20:00:00
Day Ahead	DAC-H21-AR	15:00 hrs	23:00 hrs	20:00:00 - 21:00:00
Day Ahead	DAC-H22-AR	15:00 hrs	23:00 hrs	21:00:00 - 22:00:00
Day Ahead	DAC-H23-AR	15:00 hrs	23:00 hrs	22:00:00 - 23:00:00
Day Ahead	DAC-H24-AR	15:00 hrs	23:00 hrs	23:00:00 - 24:00:00

Source: Indian Energy Exchange website (https://www.iexindia.com/)

3) Daily Contracts

- Daily contracts are region specific contracts for all the five regions for different block of hours.
- The contracts are available for trading on a rolling basis i.e. everyday eight daily contracts of the following week will be available to members for trading.
- Please refer to the trading calendar for more details on trading days for different daily contracts.
- The delivery of traded contract shall begin 2 days after the trading day as depicted here.

Figure 11: Daily Contracts Trading Cycle

DAILY						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
	T_1	2	**3**	**4**	**5**	**6**
7	**8**	**9**	**10**	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

Source: Indian Energy Exchange website (https://www.iexindia.com/)

4) Weekly Contracts

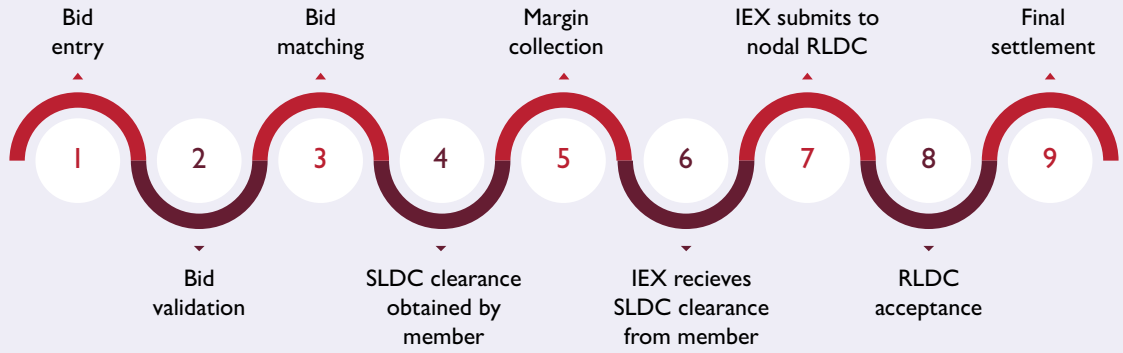
Weekly contracts are region specific contracts for all the five regions for different block of hours. Trading in such contracts is through open auction on every Wednesday, Thursday, and Friday of the month with delivery starting at T+5 and concluding at T+11 when trades are on Wednesday and on T+4 and T+10 respectively when trades take place on Thursday as depicted here.

Figure 12: Weekly Contracts Trading Cycle

WEEKLY						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
	1	2	T_3	4	5	6
7	**8**	**9**	**10**	**11**	**12**	**13**
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

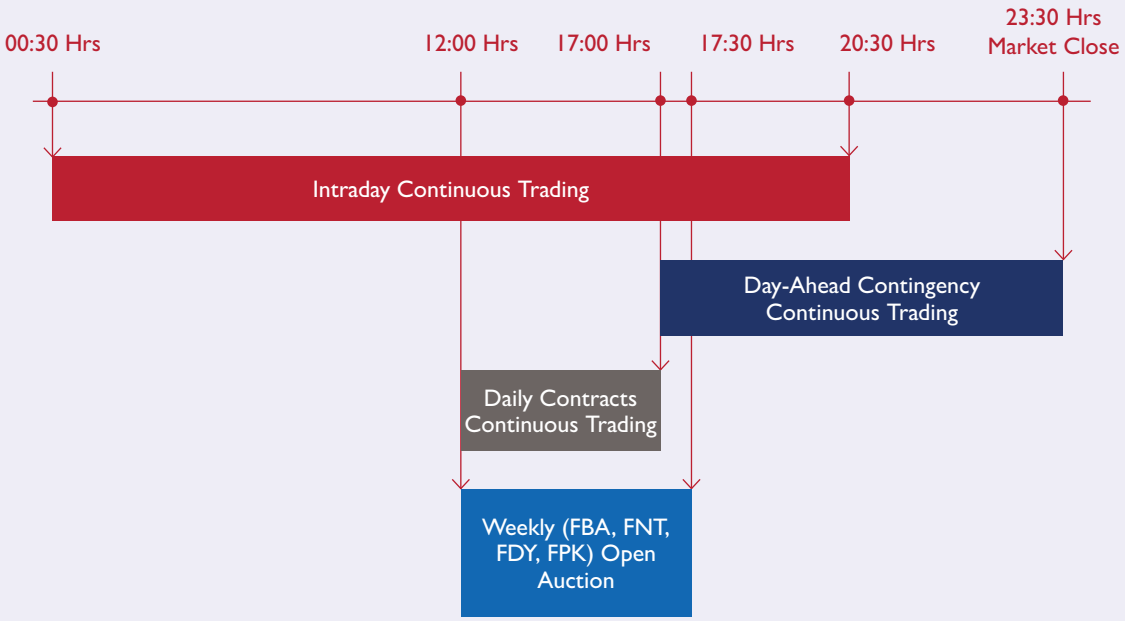
Source: Indian Energy Exchange website (https://www.iexindia.com/)

Figure 13: Weekly Contracts Trading Process



Source: Indian Energy Exchange website (https://www.iexindia.com/)

Figure 14: TAM Trading Timeline



Source: Indian Energy Exchange website (https://www.iexindia.com/)

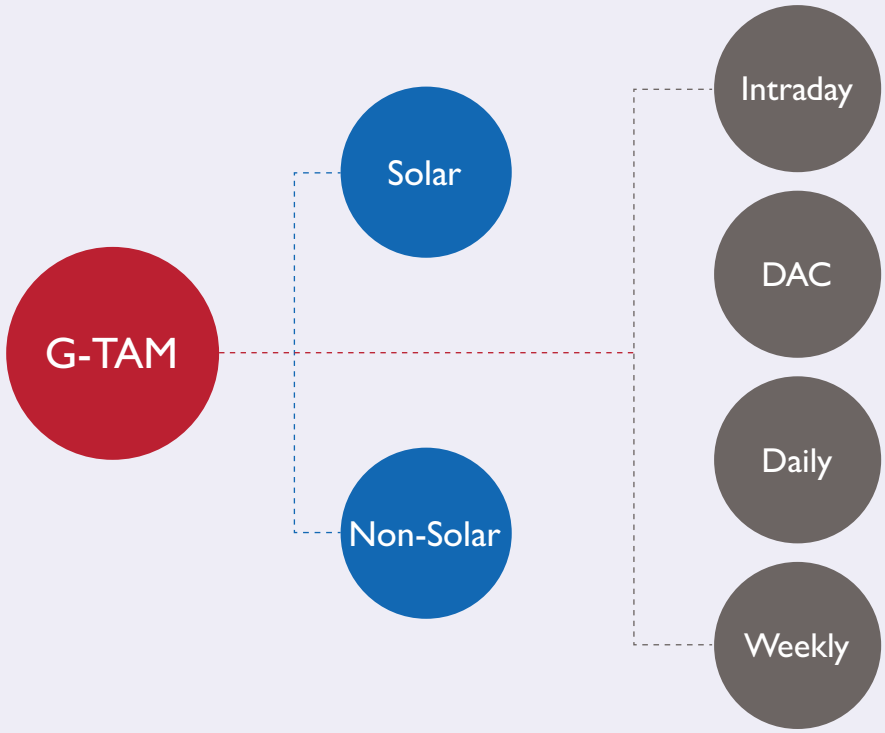
GREEN TERM AHEAD MARKET

The new market segment features contracts such as Green-Intraday, Green-Day-ahead Contingency (DAC), Green-Daily and Green-Weekly. The matching mechanism is continuous/spot trading for Green-Intraday, Green-DAC and Green-Daily contracts whereas double sided open auction process to be implemented for Green-Weekly.

Some common features:

1. A market mechanism to facilitate accomplishment of national renewable energy capacity addition and effective integration of green energy in the country
2. Trading of 15-minute time block in G-Intraday and G-DAC; whereas trading of certain time of blocks in G-Daily and G-Weekly
3. All contracts under G-TAM are at national level
4. Continuous trading in G-Intraday, G-DAC and G-Daily; whereas double sided open auction bidding process for G-Weekly
5. Exchange to manage risk management leveraging bank balance, requisite margin, including any additional margin as specified for the respective trading segment or the type of contracts There will be several products available for trading under G-TAM segment

Figure 15: GTAM Products



Source: Indian Energy Exchange website (https://www.iexindia.com/)

1) G-TAM Intraday Contracts

- There are 15-min block wise 80 contracts of Intraday
- These contracts are available in both Solar and Non-Solar attribute
- These contracts are standardized and nationalized and a total number of 160 contracts in Intraday for G-TAM
- Matching mechanism is to be continuous/spot based
- Trading and CNS timelines will be the same as in existing TAM market

2) G-TAM DAC Contracts

- These are 15-min block wise 96 contracts of DAC
- These contracts to be available in both Solar and Non-Solar attribute
- These contracts will be standardized and nationalized and a total number of 192 contracts in DAC for G-TAM
- Matching mechanism to be continuous/Spot based
- Trading and CNS timelines to be the same as in existing TAM market

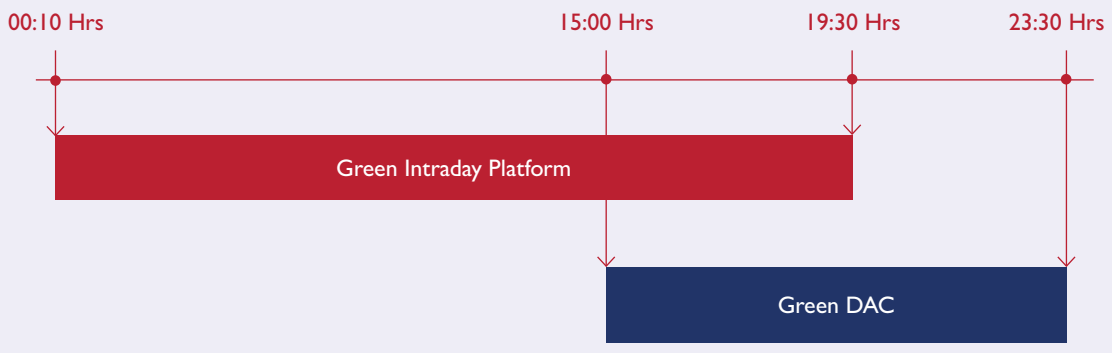
3) G-TAM: Daily Contracts

- These contracts to be nationalized
- Trading timelines to be in parallel with existing TAM market
- There are separate contracts for Solar and Non-Solar attribute
- Matching mechanism in Daily of G-TAM to be spot/continuous trading

4) G-TAM: Weekly Contracts

- These contracts will be nationalized
- Trading timelines will be in parallel with existing TAM market
- There will be separate contracts for Solar and Non-Solar attribute
- Matching mechanism in Weekly of G-TAM will be double side open auction

Figure 16: GTAM Trading Timeline



Source: Indian Energy Exchange website (https://www.iexindia.com/)

C. REAL TIME MARKET (RTM)

The market features a new auction session every half an hour with power to be delivered after 4 time blocks or an hour after gate closure of the auction. The price and quantum of electricity trading is determined through a double-sided closed auction bidding process.

Market features:

1. Trading of 15 minute contracts
2. Double-sided anonymous auction bidding process
3. Buyers and sellers to obtain Clearance from SLDC by based on availability of network and ABT meters
4. Exchange to publish Area Clearing Price (ACP) and Area Clearing Volume (ACV)
5. Exchange to manage risk management leveraging bank balance, requisite margin, including any additional margin as specified for the respective trading segment or the type of contracts

The trading process is divided into four key session:

1) Bid Session

- 48 bid sessions during the day
- Each bid session for a duration of 15 minutes
- First bid session to start at 2245 hrs
- 15-minute gap between two consecutive bid sessions
- Single and/or block including linked bids :
- Single bids: 15-Minute bids for different price and quantity pairs can be entered through this type of order. Partial execution of the bids entered is possible.
- Block bids: Block Bid for any 15-min block or series of 15-min blocks during the same day can be entered. Although no partial execution is possible i.e. either the entire order will be selected or rejected.
- The bids so entered are stored in the central order book. The bids entered can be revised or cancelled till gate closure.

2) Matching Session

- At the end of the bid session, bids for each 15-minute time block are aggregated and matched using double sided closed auction methodology as also pursued in day-ahead market.
- The Area Clearing Price (ACP) and Area Clearing Volume (ACV) are determined for each block of 15 minutes as a function of demand and supply which is common for the selected buyers and sellers.
- Selected participants are intimated about their partially or fully executed bids and other trade related information within 1 time block after closure of auction period.

- Funds availability
  - Exchange uses ACP and ACV used to calculate the obligation of the selected participants and their power flow.
  - Bid limit shall be in accordance to the funds available in the settlement accounts of the participants.

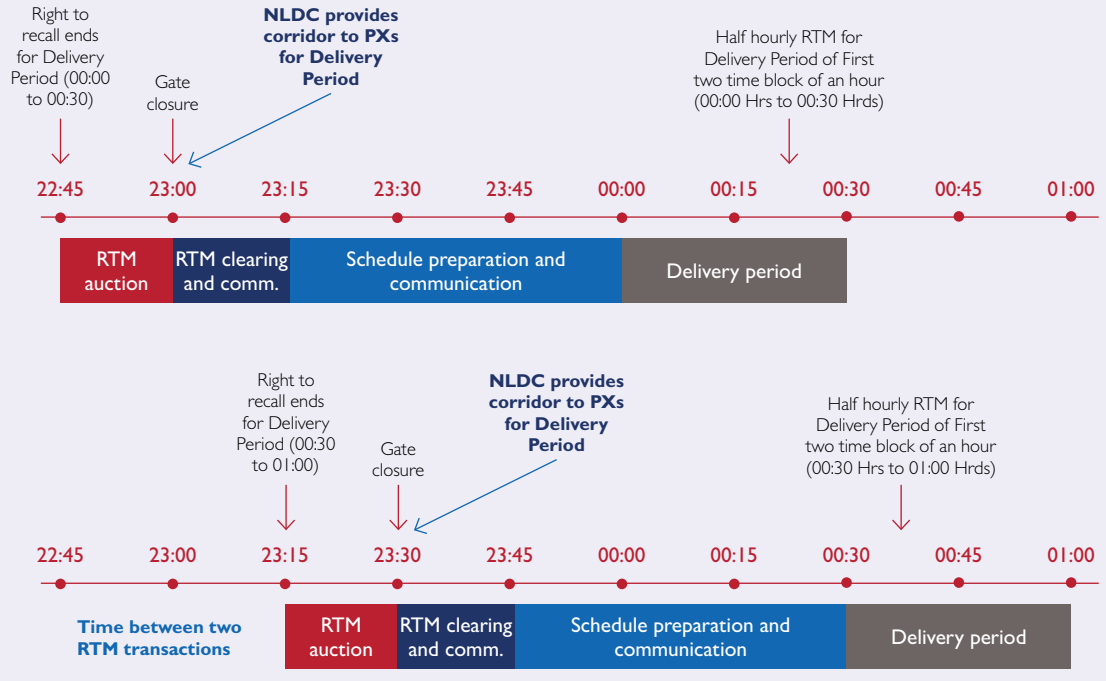
3) Financial Settlement

- Pay In / Pay Out (PI/PO) will be done on T/ T+1 date respectively subjected to banking hours and holidays

4) Result Session

- IEX to intimate Area Clearing Price (ACP) and Area Clearing volume (ACV).
- Exchange to send final results for confirmation and application for scheduling of Collective transactions-RTM to NLDC.
- NLDC sends the details of the schedule to respective RLDCs.
- RLDCs /SLDCs incorporate Collective Transactions-RTM in the Daily schedule.
- A scheduled transaction is considered deemed delivered.
- Deviations from schedules are dealt under UI or Deviation Settlement Regulations or Imbalance Settlement Regulations. The Regional Entities connected at ISTS networks are governed by CERC Regulations and Embedded Entities and entities connected to state transmission or distribution network are governed by respective State Electricity Regulatory Commission's Regulations.

Figure 17: RTM Trading Process



Source: Indian Energy Exchange website (https://www.iexindia.com/)

Table 13: RTM Trading Timeline

				Trading Window			Delivery Period	
Market	Market type	Session	Trading date	Start time	End time	Delivery date	Delivery start time	Delivery end time
RTM	Auction	1	T	22:45	23:00	T+1	0:00	0:30
RTM	Auction	2	T	23.:15	23:30	T+1	0:30	1:00
RTM	Auction	3	T	23:45	0:00	T+1	1:00	1:30
RTM	Auction	4	T	0:15	0:30	T	1:30	2:00
RTM	Auction	5	T	0:45	1:00	T	2:00	2:30
RTM	Auction	6	T	1:15	1:30	T	2:30	3:00
RTM	Auction	7	T	1:45	2:00	T	3:00	3:30
RTM	Auction	8	T	2:15	2:30	T	3:30	4:00
RTM	Auction	9	T	2:45	3:00	T	4:00	4:30
RTM	Auction	10	T	3:15	3:30	T	4:30	5:00
RTM	Auction	11	T	3:45	4:00	T	5:00	5:30
RTM	Auction	12	T	4:15	4:30	T	5:30	6:00
RTM	Auction	13	T	4:45	5:00	T	6:00	6:30
RTM	Auction	14	T	5:15	5:30	T	6:30	7:00
RTM	Auction	15	T	5:45	6:00	T	7:00	7:30
RTM	Auction	16	T	6:15	6:30	T	7:30	8:00
RTM	Auction	17	T	6:45	7:00	T	8:00	8:30
RTM	Auction	18	T	7.:15	7:30	T	8:30	9:00
RTM	Auction	19	T	7:45	8:00	T	9:00	9:30
RTM	Auction	20	T	8:15	8:30	T	9:30	10:00
RTM	Auction	21	T	8:45	9:00	T	10:00	10:30
RTM	Auction	22	T	9:15	9:30	T	10:30	11:00
RTM	Auction	23	T	9:45	10:00	T	11:00	11:30
RTM	Auction	24	T	10:15	10:30	T	11:30	12:00
RTM	Auction	25	T	10:45	11:00	T	12:00	12:30
RTM	Auction	26	T	11:15	11:30	T	12:30	13:00
RTM	Auction	27	T	11:45	12:00	T	13:00	13:30
RTM	Auction	28	T	12:15	12:30	T	13:30	14:00
RTM	Auction	29	T	12:45	13:00	T	14:00	14:30
RTM	Auction	30	T	13:15	13:30	T	14:30	15:00
RTM	Auction	31	T	13:45	14:00	T	15:00	15:30
RTM	Auction	32	T	14:15	14:30	T	15:30	16:00
RTM	Auction	33	T	14:45	15:00	T	16:00	16:30
RTM	Auction	34	T	15:15	15:30	T	16:30	17:00
RTM	Auction	35	T	15:45	16:00	T	17:00	17:30
RTM	Auction	36	T	16:15	16:30	T	17:30	18:00
RTM	Auction	37	T	16:45	17:00	T	18:00	18:30
RTM	Auction	38	T	17:15	17:30	T	18:30	19:00
RTM	Auction	39	T	17:45	18:00	T	19:00	19:30
RTM	Auction	40	T	18:15	18:30	T	19:30	20:00
RTM	Auction	41	T	18:45	19:00	T	20:00	20:30
RTM	Auction	42	T	19:15	19:30	T	20:30	21:00
RTM	Auction	43	T	19:45	20:00	T	21:00	21:30
RTM	Auction	44	T	20:15	20:30	T	21:30	22:00
RTM	Auction	45	T	20:45	21:00	T	22:00	22:30
RTM	Auction	46	T	21:15	21:30	T	22:30	23:00
RTM	Auction	47	T	21:45	22:00	T	23:00	23:30
RTM	Auction	48	T	22:15	22:30	T	23:30	24:00

Source: Indian Energy Exchange website (https://www.iexindia.com/)

POWER EXCHANGE TRADE KEY CONSIDERATION/ APPROACHES

A. KEY CONSIDERATIONS FOR TRADING IN POWER EXCHANGES

Guidance on deciding to trade electricity through power exchange (this will also include taking decision to trade in bilateral or power exchange route for short-term requirements).

CONSIDERATIONS FOR DETERMINATION OF TRADE QUANTUM AND PRICE FOR BIDDING

- Domestic demand and generation projection for optimal scheduling of volume for trading through power exchange.
- Need for optimal management of reservoir levels and generations from power plants to schedule trade as per market price trends
- Need to control domestic demand variations as per projected demand
- Need for compliance to grid discipline requirements (DSM)- real time management of variations of demand, system frequency and river inflows for minimizing deviations from scheduled import/ sale.

KEY FACTORS INFLUENCING POWER EXCHANGE PRICES IN INDIA

Prices in the power exchanges varies based on demand and supply situation of bids. These bids depend on many factors and some of the most critical once is described below:

- **Coal availability**: Indian systems are majorly dependent on coal-based power plants. As on 31 Oct 2022, nearly 50% of total installed capacity are coal-based power plants. Availability of coal for these power plants plays a crucial role in generation of electricity. In case of non-availability of coal to power plants from India as well imported coal has high implications on generation of electricity. In absences of coal availability for their allocated power plants in short term, states increase the drawl requirement by procuring electricity through power exchanges and demand increases substantially. Due to this, demand bids increase as compared to supply and prices also vary during this period.
- **Fuel prices**: There are many power plants in India dependent on imported fuels such as coal and gas. In case of variation in fuel prices, supply of fuel gets disrupted and generation from these plants may reduce, which enhances procurement through power exchanges.

- **Variation in generation from Renewable sources (RE)**: Another important factor impacting prices are generation from renewable energy sources such as wind, solar, biomass, bagasse, small hydro etc. Nearly 29% of installed capacity in India is renewable energy (this excludes large hydro based plants). Generation from RE varies from month to month based on the seasonality and weather. During the winters generally the generation from solar and wind is low and procurement of trade during the low RE generation results in states procuring more power from electricity exchanges. Accordingly, price fluctuates.
- **Variation in hydro power generation**: India has nearly 11% of its installed capacity as hydro power. Also, India imports hydro power from Bhutan through long-term contract. Variation in generation from these plants, increases the buy bids in through power exchanges and can have implications on prices.
- **Weather condition and seasonal variation**: Electricity demand supply situation in the country has high dependence on weather condition and seasons. Demand rises in the agriculture period due to running of pumps, during summers due to increase in demand of electricity because of air conditioning load, during festive seasons due to higher consumption, etc. Any changes in weather condition drastically changes the electricity demand in the country which impacts the demand/supply side power requirements from the power exchanges.
- **Outages and shutdown of large power plants**: In India there are many power plants which has allocation and PPAs with multiple states. In case of shut down or outages of any large unit, the demand tends to shift to power exchange.
- **Availability of reserve generation and merchant capacity** which are being traded through power exchanges plays critical role in supply side availability and thus may have impact on prices.

TRANSMISSION INTERCONNECTION/CORRIDOR AVAILABILITY CONSIDERATIONS

Availability of transmission line corridor for trading of electricity is a critical requirement. The same needs to be available for short term trades. Grid-India publishes the report of such availability with international countries in advance.

Based on availability of transmission corridor, such quantum can be traded from power exchanges on short-term basis subject to approvals.

FEES AND CHARGES RELATING TO POWER EXCHANGE TRADE

Fees and charges applicable for trading in the power exchange are governed by the CERC Open Access regulations 2008 as mentioned above in section 3. An illustration and explanation for each set of charges is presented below):

A. CHARGES TO COMPUTE LANDED PURCHASE COST TO BHUTAN FROM INDIAN POWER EXCHANGE

Let's say, Bhutan wants to procure 100MW of power from Indian power exchange through power trader in Day ahead market (DAM) at Round the Clock (RTC) basis.

Bidding Price: As the 100MW is required for 24hrs then total 2400 MWh (100 X 24hrs) are required for the day. The bidding shall be done at 10:00 - 12:00 a day before delivery date. After double sided anonymous auction bidding process at power exchange a supply and demand curves are drawn on price quantity axes. The intersection point of two curves gives us clearing price (if there is congestion in any corridor same shall be deal by market splitting methodology). The average of all the 96 block gives us breakeven price for round the clock (RTC). Hence the breakeven price for 2nd Feb 2022 is INR 4868.09/MWh for RTC.

Transmission charge: For cross border buy trade, Central Transmission Utility drawl transmission charge is applicable which is updated on monthly basis on Grid Controller of India Limited's Website for coming month (notified in last week of every month). For Bhutan the point of drawl/injection shall be in the periphery of West Bengal, hence we have considered INR 379.8/MWh for the month of Feb 2022 (mentioned on annexure IV of Notification of Transmission charges payable by DICs (Designated Interstate Consumers) for Billing Month of February, 2022, available for download from the CERC website).

Transmission Losses: Transmission losses are notified by Grid Controller of India Limited on their website on weekly basis for coming week. For illustration of these charges we considered as 3.69% for the 1st week of Feb (Grid Controller of India Limited's Notification is enclosed).

NLDC Application Fee: NLDC shall charge application fee per the given formula.

NLDC Application Fee = INR 5,000.00* / (No of Successful Portfolios i.e. 757 on 2nd Feb 2022)
= INR ~6.61
* INR 5000 is the NLDC application fee for collective transection paid by power exchange.

NLDC Scheduling & Operating Charges: NLDC shall also charge the scheduling and operating charge as per the formula i.e. INR 1 X (Total no. MWh traded on particular day) or maximum INR 200 whichever is lesser. Hence for our case maximum of INR 200 is levied.

Power exchange transection fee: As per the latest power market regulation 2021, no power exchange shall charge more than 2 paise/KWh from either party. Hence INR 20/MWh shall be levied for our case. And that GST @18% shall be levied on power exchange transection fee.

Power trader transection fee: As per the Trading License Regulations, 2020, for Cross Border Trade of Electricity, the trading margin shall be decided mutually between the Trading Licensee and the seller. For understanding purpose, we are assuming 5paise/KWh or INR 50/MWh.

In view of above we computed all the values in below table 1 and computed per approximate landed unit cost (KWh).

Table 14: Purchase Cost Analysis for Bhutan from Indian Power Exchange

Purchase Cost Analysis for Bhutan from Indian Power Exchange				
Sr No.	Description		Data	Remarks
1	Volume to be purchased in an Hour in MW		100	Assumed
2	No. of Hours		24	
3	No. of Days		1	
4	**IEX breakeven price (RTC) in INR per MWh**		**4868.09**	As per IEX RTC DAM charge on a given day
	Adjustment of POC/ Transmission Charge ,Transmission Losses			
5	Unit purchased from power exchange in MWh		2400	
6	Drawl transmission Charges	379.8/MWh	911520.000	Taken from Grid Controller of India Limited's transmission charge report for a given month
7	Transmission losses	3.69%	2311.44	Taken from Grid Controller of India Limited's transmission loss report for a given week
		INR. /MWh	**INR**	
8	Cost of Energy as per Market Clearing Price	4868.09	11683416	
9	Injection CTU Transmission Charges	379.8/MWh	911520	
10	NLDC Application Fee in INR Per Day*		6.6	*Formula shown above

11	NLDC Scheduling & Operating Charges in INR Per Day*	1.000	200	*Formula shown above
12	Power exchange Transaction Fees in INR Per MWh	20.00	48000	As per CERC power market regulation 2021
13	GST on power exchange transection fee	18%	8640	
14	Trader Transaction Fees in INR Per MWh	50.00	120000	Assumed trader margin to be INR 50 per MWh
15	Total amount to be paid in INR		12771783	
16	Cost per Unit as per Bid Volume in INR (per Kwh)		5.32	
17	Cost per Unit as per Schedule in INR (per Kwh)		5.53	

B. CHARGES OF DEVIATION SETTLEMENT MECHANISM (DSM)

The objective of DSM is to ensure, through a commercial mechanism that users of the grid do not deviate from and adhere to their schedule of drawl and injection of electricity in the interest of security and stability of the grid.

The DSM account is handled by respective Regional Power Committees in India and in case of Bhutan, the relevant nodal entity is Eastern Regional Power committee (ERPC). DSM data is notified by ERPC on weekly basis on their website http://erpc.gov.in/ui-and-deviation-accts/. These charges are computed as per the deviation settlement mechanism regulation 2022 (principal regulation) and their amendment.

Payable: - The amount which will be payable by the entity due to over drawl/ under injection.

Daily Base DSM Charge means the sum of charges for deviations for all time blocks in a day payable or receivable as the case may be, excluding the additional charges.

A sample calculation of DSM charges, as per regulation 2022, and amendments thereof, for cross border transaction is as below:

Table 15: Sample calculation for DSM charges

	To Period	Schedule (A)	Actual (B)	Deviation X=(B-A)	Deviation ABS Y= ((ABS(X))	Status (X<0=UD or X>0 =OD)	As per ERPC DSM	Total Receivable (P)	Total Payable (M)
		MW	MW	MW	MW			Rs	Rs
00:00	00:15	321.83	311.86	-9.96	9.96	UD	UD	-12,898	-
00:15	00:30	321.44	313.06	-8.38	8.38	UD	UD	-8,393	-
00:30	00:45	293.95	301.13	7.18	7.18	OD	OD	-	6678

- For a specific time block schedule (A) and Actual (B) data will be taken from EPRC site.
- Then deviation will be calculated by taking the difference (X=(B-A))
- Then absolute value will be taken for that deviation (Absolute value of X)
- Then we need to check the status of that time block (UD/OD). If the value of X is negative then will be considered as UD or else OD
- Post that total receivable value (P) and total payable (M) value will be calculated (rate*deviation)
- Here we have taken Rs. 432, Rs. 445 and Rs.372 as Normal Rates for DSM calculations for the respective time blocks.
- Then total amount will be calculated by adding (P+M)
- This is the process for DSM calculation for each specific time block.

*Normal rate as defined in CERC DSM Regulation, 2022

Provided that from the date of effect of these regulations or such further period as may be notified by the commission, the normal rate of charges for deviation for a time block shall be equal to the higher of [the weighted average ACP of the Day Ahead Market segments of all the Power Exchanges; and the weighted average ACP of the Real Time Market segments of all the Power Exchanges, for that time block] subject to a ceiling of Rs 12 per kWh till further orders.

C. TRADING MARGIN/TRANSACTION CHARGES

Electricity Trading margins are charges by the Indian traders on the quantum of power and based on the other terms and conditions as per contract. These charges add to the net cost in case of buy or deducted in case of sale of electricity for computation of net landed price.

CASE STUDIES: EXPERIENCE OF PARTICIPATION IN POWER EXCHANGE

There are multiple examples of entities participating in the power exchange in energy sector in India and other South Asian Countries, from which inspiration and learnings can be derived. A few of such examples are discussed below which have been compiled based on discussions with concerned officials from Bihar's Power Management Cell, MP Power Management Company Ltd (MPPMCL) and Nepal Electricity Authority.

A. CASE STUDY – BIHAR

Bihar is a state in the eastern part of India. The state has two power distribution companies namely North Bihar Power Distribution Company Ltd. and South Bihar Power Distribution Company Ltd. Also, the state has separate generation company named Bihar State Power Generation Company Ltd. and transmission company called Bihar State Power Transmission Company Ltd. Currently State Load Despatch Center is operating under the transmission company.

Power procurement and trade related decision in the state is being undertaken by a holding company Bihar State Power Holding Company Ltd.'s dedicated sub-group called Power Management Cell (PMC), which also performs activities relating to regulatory filing, litigation management in addition to power procurement and cell decisions. Chief Engineer supported by two Superintending Engineers and one Executive Engineer currently heads the Cell. A team of 10-15 Assistant Engineers, Junior Engineers, Account Officers, Information Technology officers etc. supports the senior team.

The Power Management Cell (PMC) has been assigned the responsibility to ensure Round the Clock (RTC) availability of required quantum of power in the State (on behalf of both DISCOMs) while complying with prevalent rules, regulations and directives of statuary bodies and coordinating with Inter-regional agencies. Key related role of the PMC are:

- Demand forecast for day-ahead, short-term, medium-term and long-term
- Supply availability assessment
- Power Procurement/Sale Planning and execution for - Day-Ahead (DAM), Intra-day (TAM), Real Time (RTM) Sell and Buy, Short and Medium-term (Banking, DEEP and Bilateral)
- Optimal dispatch scheduling and compliance of merit order of dispatch
- Ensuring of Renewable Power Obligation (RPO) Compliance through short-term/ Renewable Energy Certificate (REC) purchase

- Compliance with institutional and regulatory directives
- Coordination with ERPC and ERLDC on inter-regional operational and technical aspects
- Representation at BERC/ CERC for activities related to power procurement

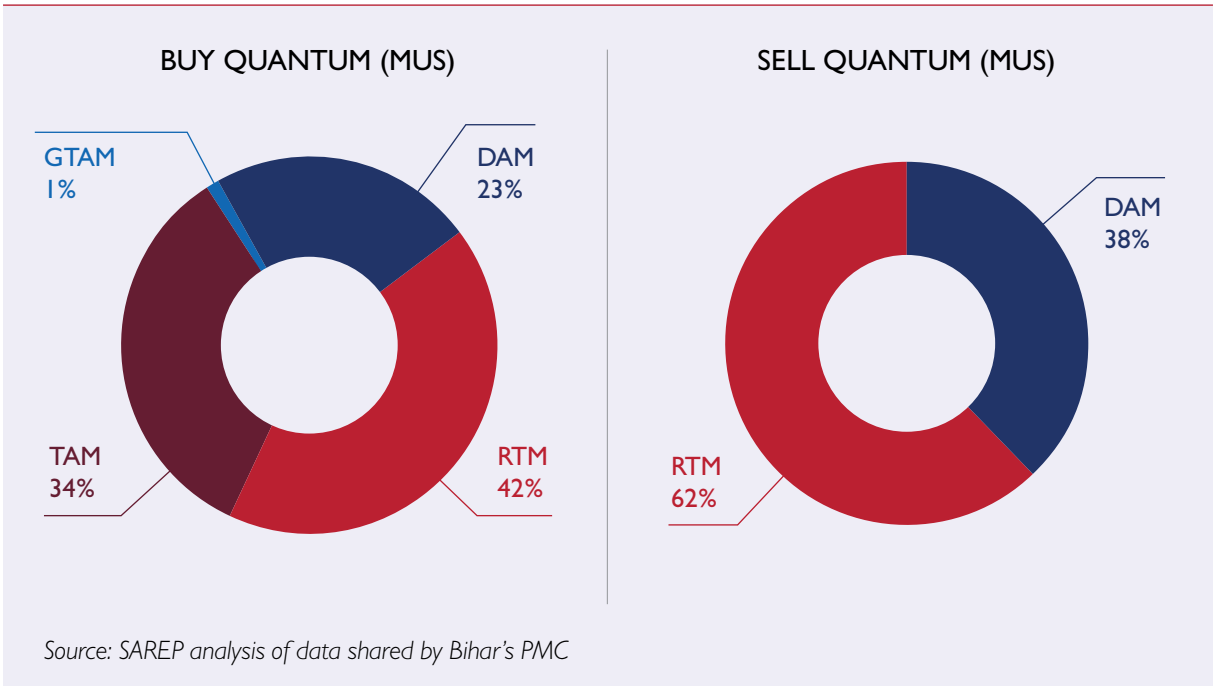
For power-exchange based trade, Bihar state has been trading power through a trader since beginning who provides capacity building and preparatory assistance. For performing activities such as demand forecasting, estimation of adequacy of supply and gap analysis, trading decision support and scheduling activities, PMC takes support of external consultants under Portfolio Management Services (PMS). PMS services provider helps in conducting following key services:

- Short term/ medium term load forecasting
- Supply availability assessment
- Devising spot- market and bilateral market participation strategies
- Scheduling and dispatch planning
- Price forecasting
- Periodic capacity building support

PMC service provider shares an IT enabled tool through which power trading related activities are supported.

Decisions for trading is being taken by PMC with assistance of Trader and PMS Service provider. For buying power convent of head of the organization is being taken, however selling decisions are mainly taken by PMC. Total demand of the state is around 7000 MW. Trading in power exchange by Bihar varies from day-to-day basis and the state sells and buys power from the power exchanges. The state trades power in nearly all the available products of power exchanges. Segment wise break-up of the trade is provided below for the month of July' 2023:

Figure 18: Bihar's Power Exchange Transactions



Source: SAREP analysis of data shared by Bihar's PMC

Real time management of power system is being performed and monitored by State Load Dispatch Center and PMC do not play role in real-time DSM management.

KEY LEARNINGS

- A dedicated cell is responsible for taking power trading decisions
- Trade decisions are taken based on the support of trader
- Bihar take assistance of Portfolio Management Service (PMS) provider for demand assessment, supply side analysis, price forecasting, trading strategy formulation, scheduling services etc. PMS services are provided by IT enabled solution

B. CASE STUDY – MADHYA PRADESH (MP)

Madhya Pradesh (MP) is a state in the central part of India and is among the largest state. The state has mainly three power distribution companies namely Madhya Pradesh **Madhya** Kshetra Vidyut Vitaran Company Limited (MPMaKVVCL), Madhya Pradesh **Paschim** Kshetra Vidyut Vitran Company Ltd. (MPPaKVVCL), and MP **Poorva** Kshetra Vidyut Vitaran Company Limited (MPPoKVVCL). Also, the state has a separate generation company named M.P. Power Generating Company Limited (MPPGCL) and a transmission company called Madhya Pradesh Power Transmission Company Ltd. Currently State Load Dispatch Center is operating under the transmission company in the state.

The bulk power procurement and bulk sale of electricity within the state, as well as power trade-related decisions, are managed by a distinct entity, MP Power Management Company Ltd (MPPMCL). This company was established as a residual entity following the unbundling of generation, transmission, and distribution functions from the former Madhya Pradesh State Electricity Board (MPSEB). For performing trading activities, MPPMCL has constituted a 24x7 control room where staff are deployed round-the-clock to assess, schedule, and trade power. About 3 officers operate in three shifts in the control room. Long-term power procurement planning is separately being handled; however, the control room's key role is to trade in short-term markets.

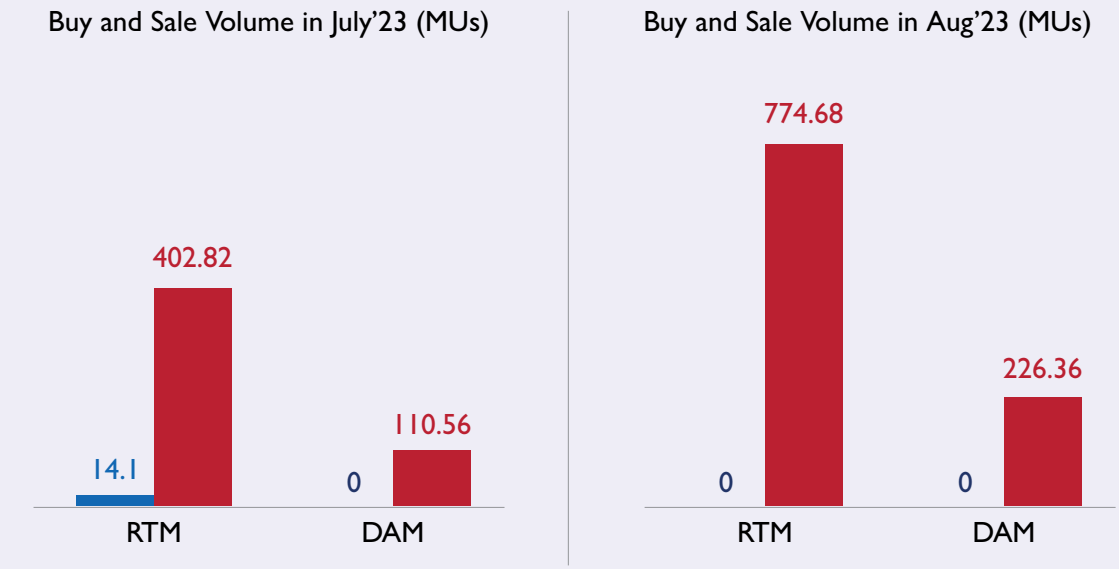
For power-exchange-based trade, the MP state has been directly trading power in power exchanges. For performing trading-related activities such as demand forecasting, estimation of adequacy of supply and gap analysis, trading decision support, and scheduling activities, PMC takes the support of external consultants under Portfolio Management Services (PMS). PMS services provider helps in conducting the following key services to MPPMCL:

- Short-term/ medium-term load forecasting
- Supply availability assessment
- Devising spot- market and bilateral market participation strategies
- Scheduling and dispatch planning
- Price forecasting
- Periodic capacity-building support

PMS service provider shares an IT-enabled tool through which power trading-related activities are supported.

Decisions for trading is being taken by MPPMCL staff with PMS service provider. For trading power through power exchanges, Chief General Manager of MPPMCL is being authorized. Total demand of the state is around 11000 MW. Trading volume in power exchange by MP varies significantly and the state sells and buys power from the power exchanges. The state trades power in nearly all the available products of power exchanges. Major segment wise break-up of the trade is provided below for the month of July and August' 2023:

Figure 19: Madhya Pradesh's Power Exchange Transactions



Source: SAREP analysis of data shared by MPPMCL

KEY LEARNINGS

- Dedicated 24x7 control room for performing trading activities such as demand assessment, generation assessment, bidding in power exchange markets etc.
- State is a direct member of power exchange
- MP takes the assistance of Portfolio Management Service (PMS) provider for demand assessment, supply side analysis, price forecasting, trading strategy formulation, scheduling services etc. PMS services are provided by IT-enabled solution

C. CASE STUDY – NEPAL

Nepal is a hydro-rich nation, geographically located adjacent to the northern part of India. The Nepal Electricity Authority (NEA) serves as the integrated utility in Nepal and engages in electricity trading with India. Nepal became the first country in the South Asia region to participate in Indian power exchanges for electricity trading in 2021. The country's peak electricity demand is approximately 1.83 GW, with an annual energy demand of 10,686 GWh. Cross-border electricity is exchanged through various transmission and distribution lines, including those at 400kV, and 132kV, connecting Nepal and India.

Additionally, Nepal has obtained authorization to sell electricity in the short Indian electricity market through various generation assets. The country exports surplus electricity during the rainy season, primarily from May to November, when demand is lower and generation is higher. Conversely, Nepal imports electricity mainly during the winter months, from December to May, due to reduced electricity generation and increased demand.

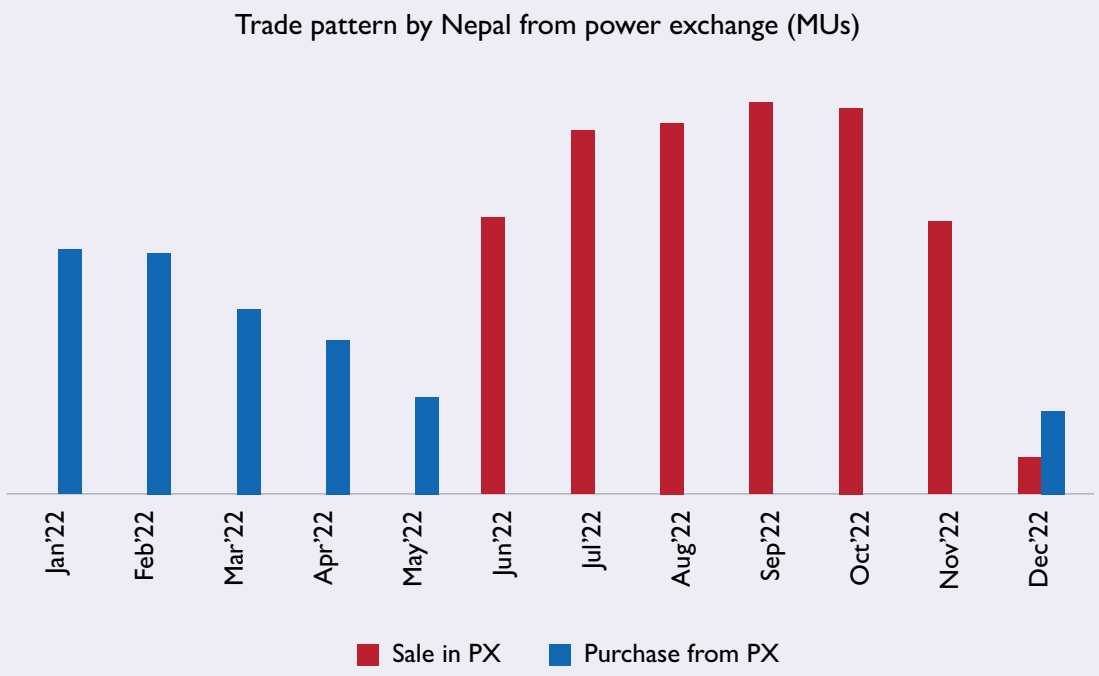
Nepal procures electricity from India through bilateral contracts with Indian traders. To optimize its short-term power procurement from India and diversify sourcing options based on demand and prevailing prices, Nepal is exploring the power exchange market. Electricity trading through the power exchange primarily occurs via the 400kV Dhalkebar-Muzaffarpur (D-M) interconnection and the 132kV Tanakpur-Mahendranagar (T-M) transmission interconnection between Nepal and India.

Electricity trading involving the Indian trader is facilitated by Nepal's Load Dispatch Center (LDC) and Power Trade Department (PTD) of NEA. Below are the key differences in the roles of PTD and LDC:

Key role of PTD, NEA in power exchange based transcation	Key Role of LDC, NEA in power exchange based transcation
• Secure permission from the Distribution Authority (DA) in India for trading and submission of all required information. • Execute an agreement with the trader for power exchange. • Secure open access in the Indian system through the trader. • Obtain permissions from NEA management and the Electricity Regulatory Commission (ERC) in Nepal.	• Identifying the quantum of trade and price for bidding in consultation with the NEA senior team. • Optimizing the power procurement portfolio and ensuring a selling strategy for clearance. • Coordinating with NEA senior management for trading-related exceptions. • Coordinating with the trader for the submission of bids. • Incorporating the quantum based on the cleared volume in the power exchange. • Verifying invoices/bills relating to power exchange and forwarding them to the Finance Directorate.

As mentioned above, Nepal engages in both buying and selling electricity in the Day-Ahead Market. The monthly trade volume is provided below for year 2022:

Figure 20: Nepal's Power Exchange Transactions



Source: SAREP analysis of data shared by NEA; Grid-India's monthly reports (https://posoco.in/)

The NEA functional team benefits from various capacity-building and handholding support provided by USAID from time to time.

NEA's trading activity in the power exchange generally fluctuates and remains below 10 MUs. NEA exclusively engages in trading within the Day-Ahead Market (DAM) segment of the power exchange.

KEY LEARNINGS
• The Load Dispatch Center (LDC) plays a crucial role in making trade and operational decisions in collaboration with NEA's trading department.

CONCLUSION AND WAY FORWARD

Bhutan is engaged in the cross-border trading of power through Indian power exchange from January 2021 mainly to purchase electricity. The power exchange platforms in India are well established, mature, and stable platforms for sourcing short term electricity requirements. With dynamic changes in the energy sector in Bhutan, there is a need to enhance cross border trading arrangements in the Indian short-term power market by participating in the Power Exchange (PX) platform both as a buyer and seller to reap commercial benefits by optimizing power procurement cost.

Considering the learnings from the case studies in the above section, and characteristics of the South Asia Region, the following key components can play a key role:

- A dedicated Cell/24x7 control room which shall be responsible for taking power trading decisions
- IT Infrastructure and granular data availability for participating in Real Time Market (RTM) is essential
- Continuous training of participating team and plants on applicable cross-border regulations

As a way forward, the following recommendations are being proposed:

- Strengthening of real time data collection, archiving, sharing, and maintaining information system for taking informed decision(s) for participating in power exchange, integrating with SAED (South Asia Energy database) in order to have deeper BBIN regional market insights
- Strengthening of BPSO to coordinate demand forecasting, scheduling, load curtailments, etc.
- Strengthening the generation forecasting ecosystem of Bhutan
- Developing sophisticated integrated and real time model for Optimal Bidding Volume and Price for Trading of Power through Power Exchange
- Preparedness for selling of electricity (metering arrangements, communication, tools, etc.)
- Preparedness to participate in RTM and ancillary market in power exchange
- Periodic hands-on training and capacity building exercise on power markets, changes in the Indian regulations, deviations settlement, technology enablement and implementation
- Drafting required regulations, rules, procedures (if any) for Bhutan for operating in Indian power market in a fully integrated manner as well as within the BBIN sub-regional market in near future
- Formation of a separate power trading company in Bhutan with necessary authority to take decision related on day-to-day basis related to buying and selling on PX platform. (incl. applicable legal and regulatory requirements) in long term

USAID looks forward to supporting relevant institutions in Bhutan through SAREP to develop suitable processes for implementation of the above recommendations.

BIBLIOGRAPHY

- Central Electricity Authority (CEA) Monthly Executive Summary Report
- Grid-India Monthly Report
- Grid-India Monthly Cross Border Transfer Capability Report
- Study on Bhutan's Readiness for Regional Power Market Integration – Revised Draft Report, June 2022 of USAID and USEA developed under SAREH

REFERENCES

Following websites have been referred while preparing this document:

- Bihar State Power Holding Company Ltd. (https://www.bsphcl.co.in/)
- Central Electricity Authority (https://cea.nic.in/)
- Central Electricity Regulatory Commission (https://cercind.gov.in/)
- Central Transmission Utility, India (https://www.ctuil.in/)
- Druk Green Power Corporation Limited (https://www.drukgreen.bt/en/)
- Grid India (https://posoco.in/en/)
- Hindustan Power Exchange (https://www.hpxindia.com/)
- Indian Energy Exchange (https://www.iexindia.com/)
- MP Power Management Company Ltd (https://www.mppmcl.com/)
- National Statistics Bureau (https://www.nsb.gov.bt/)
- Nepal Electricity Authority (https://www.nea.org.np/)
- Power Exchange India Limited (https://powerexindia.in/)
- Power Grid Corporation of India Limited (https://www.powergrid.in/)
- PTC India Limited (https://www.ptcindia.com/)
- South Asia Energy Database (https://www.southasiaenergydatabase.org/home)

ANNEXURES

ANNEXURE I

IMPORTANT GRID CORRIDOR AND THEIR POWER TRANSFER CAPABILITY

i. India-Bhutan

1. Kurichu HEP-Geylephu –Salakati 132kV – 95 MW
2. Deothang/ Motonga-Rangia 132kV - 95 MW
3. Chukha HEP- Birpara I 220kV -243 MW
4. Chukha HEP- Birpara II 220kV -243 MW
5. Mal – Birpara 220kV – 242 MW
6. Tala HEP-Siliguri I 400kV - 1001 MW
7. Tala HEP-Siliguri II 400kV - 1001 MW
8. Tala-Mal-Siliguri 400kV- 1001 MW
9. Jigmeling- Alipurduar I 400kV- 2002 MW
10. Jigmeling- Alipurduar II 400kV- 2002 MW

ANNEXURE II

IMPORTANT LINKS AND REFERENCE

i. IEX Business Rules, Rules and bye-laws

- Business rules of IEX are available at the following link https://www.iexindia.com/Uploads/LegalDocument/23_06_2022IEX_Business_Rules_23.06.2022.pdf
- Rules of IEX are available at the following link https://www.iexindia.com/Uploads/LegalDocument/03_05_2022IEX%20Rules_03.05.2022.pdf
- Bye-Laws of IEX are available at the following link https://www.iexindia.com/Uploads/LegalDocument/03_05_2022IEX%20Bye%20Laws_03.05.2022.pdf

ii. PXIL Business Rules, Rules and bye-laws

- Business rules of PXIL are available at the following link https://powerexindia.in/media/Documents/PXIL%20Business%20Rules_sep2022.pdf
- Rules of PXIL are available at the following link https://powerexindia.in/media/Documents/PXIL_Rules_april2022.pdf
- Bye-Laws of PXIL are available at the following link https://powerexindia.in/media/Documents/PXIL_Bye_Laws_april2022.pdf

iii. HPX Business Rules, Rules and bye-laws

- Business rules of HPX are available at the following link https://www.hpxindia.com/downloads/Business_Rules_of_HPX.pdf
- Rules of HPX are available at the following link https://www.hpxindia.com/downloads/Rules_of_HPX.pdf
- Bye-Laws of HPX are available at the following link https://www.hpxindia.com/downloads/Bye_laws_of_HPX.pdf

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