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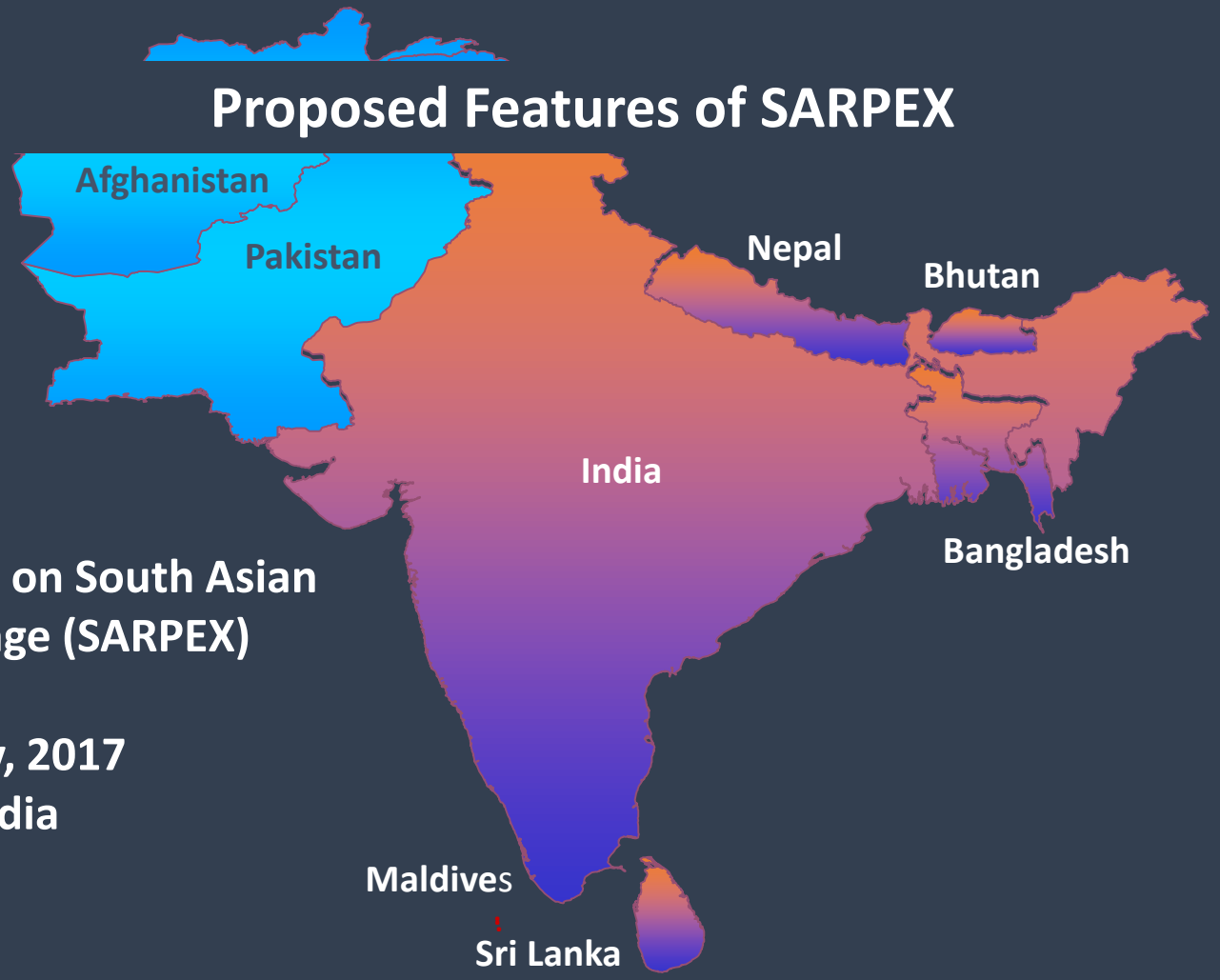
# Proposed Features of SARPEX




First meeting of core team on South Asian Regional Power Exchange (SARPEX)

7th - 9th February, 2017
New Delhi, India

Presented by:
Dr. Puneet Chitkara
Yasir Altaf

# Outline

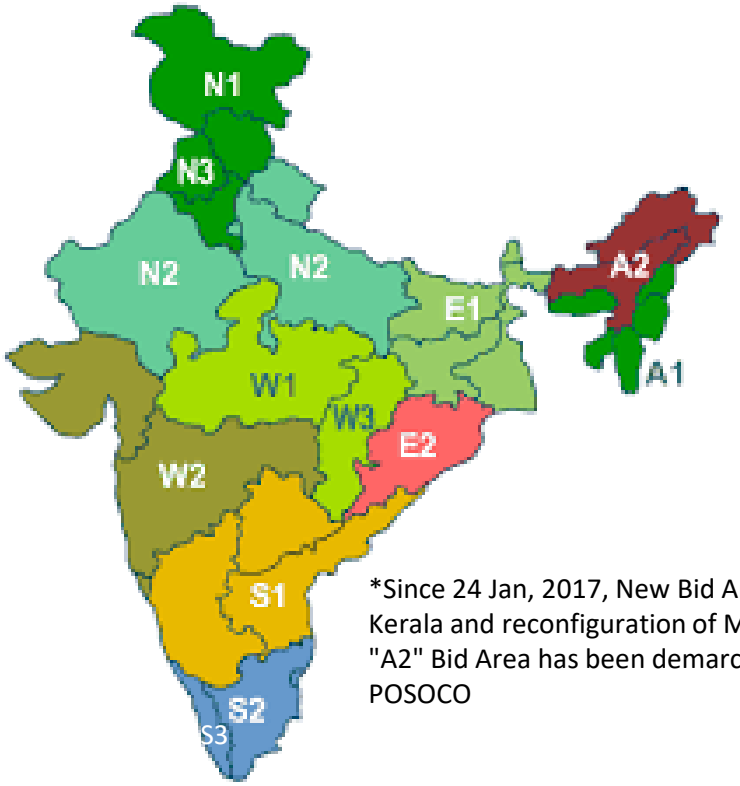
- Formation of New Bid Areas - Bangladesh, Nepal and Bhutan
- Transmission Access and Allocation
- Operational Rules – Scheduling, Deviation and Settlement, Transmission Charges and Losses
- Timelines for SARPEX Operations
- Currency for Trades

# FORMATION OF BID AREAS IN SARPEX

# Key considerations in the formation of Bid Areas

- Bid areas determine the prices paid or charged by buyers or sellers in any specific geography in keeping with the grid constraints
- In case of transmission constraints, separate markets are formed in the congested areas which requires creation of separate bid areas (market splitting principle)
- Other factors for creation of a separate Bid area may be economic, political or technical, network topography in nature

**Existing Bid Area definitions in India***



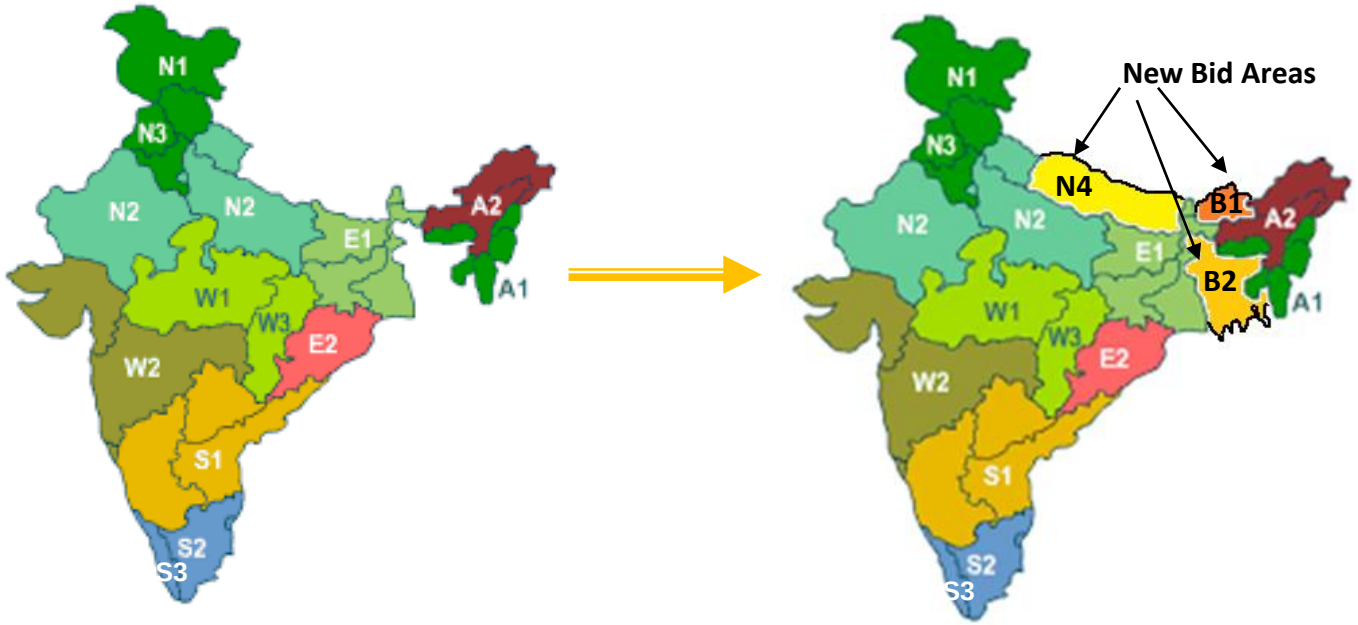

*Since 24 Jan, 2017, New Bid Area "S3" for Kerala and reconfiguration of Meghalaya in "A2" Bid Area has been demarcated by POSOCO

*Disclaimer: This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.*

# SARPEX Bid Areas

**Retaining the Indian Bid Areas**

**Additional Areas for each new country**

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- Creation of individual bid areas for each country may be desired due to the following
  - Differences in the Sovereign Laws, Power Sector Structure, Grid operation related processes and procedures
  - Perceived constraints in the cross border transmission lines
  - Settlement of Deviations from schedules
  - Alignment of time differences
  - Settlement of currency related issues

# TRANSMISSION ACCESS AND ALLOCATION

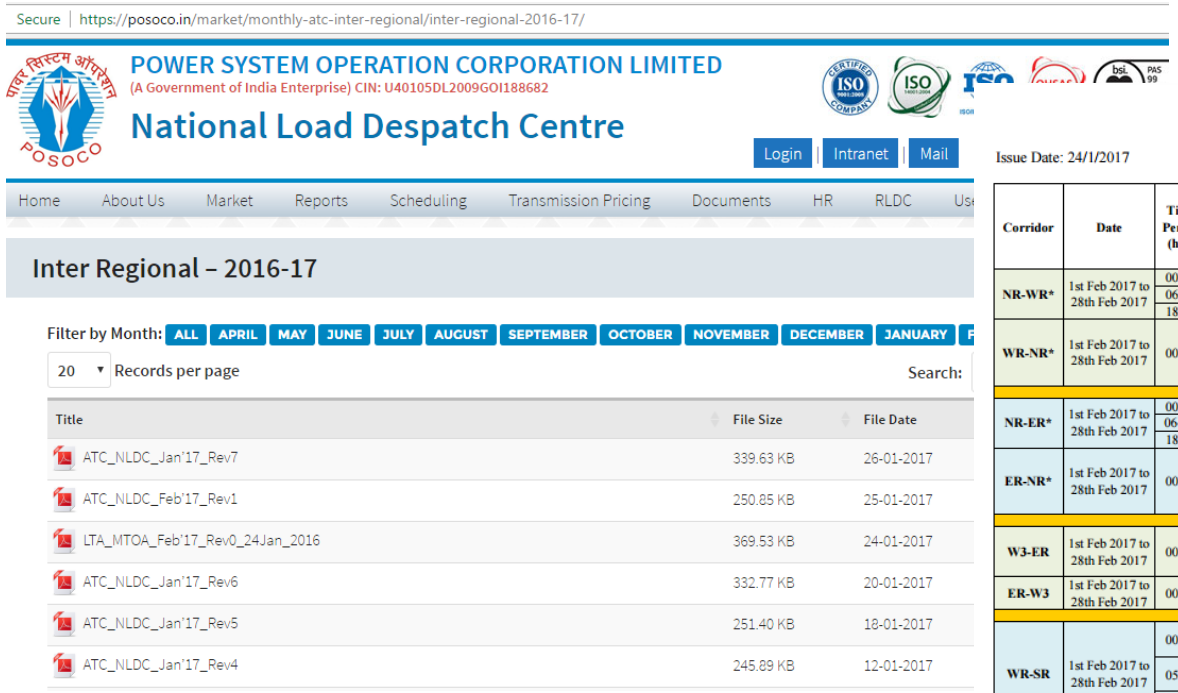
# Transmission Capacity Allocation to Exchanges in India

- The total available margins in transmission lines are assessed by the National Load Dispatch Center in advance through simulation studies and made public through websites
- Further, CERC has defined the priority order for execution of various types of transactions (highest to lowest)
  - Long term -> medium term -> short term bilateral contracts -> **Power Exchanges** -> day ahead and contingency categories of bilateral contracts
- Exchanges rely on the residual transmission capacity allocated to them after accounting for transmission requirements of the above transactions

# Transmission Capacity Allocation to Exchanges in India

- The Power Exchanges work out a provisional solution after closure of the bidding and submit market clearing prices and volumes to the NLDC for validation
- NLDC validates the provisional trades against the available margins and in case of congestion, limits are indicated to the Power Exchanges.
- The Power Exchanges then re-work out the final solution keeping in view the limits given by NLDC

# Declaration of Transmission Availability – Inter Regional Grid



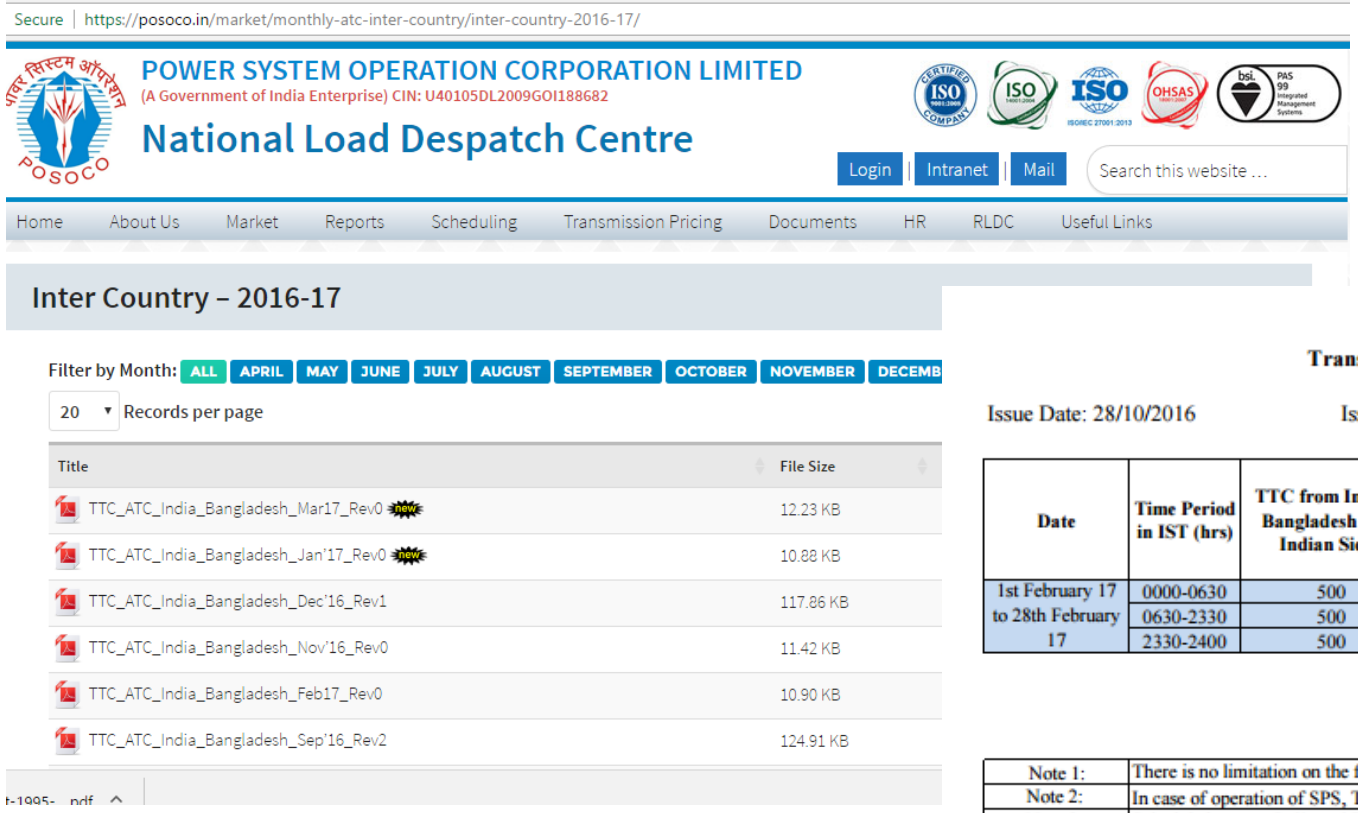

**National Load Despatch Centre**
**Total Transfer Capability for February 2017**

Issue Date: 24/1/2017 Issue Time: 1700 hrs Revision No. 1

| Corridor | Date | Time Period (hrs) | Total Transfer Capability (TTC) | Reliability Margin | Available Transfer Capability (ATC) | Long Term Access (LTA)/ Medium Term Open Access (MTOA) # | Margin Available for Short Term Open Access (STOA) | Changes in TTC w.r.t. Last Revision | Comments |
|---|---|---|---|---|---|---|---|---|---|
| NR-WR* | 1st Feb 2017 to 28th Feb 2017 | 00-06 | 2500 | 500 | 2000 | 55 | 1945 | | STOA margin revised considering changes in LTA and MTOA |
| | | 06-18 | | | | 65 | 1935 | | |
| | | 18-24 | | | | 55 | 1945 | | |
| WR-NR* | 1st Feb 2017 to 28th Feb 2017 | 00-24 | 6950 | 500 | 6450 | 6850 | 0 | -50 | Revised considering changes in LTA and MTOA and due to high generation in Rihand-Singrauli-Anpara complex |
| NR-ER* | 1st Feb 2017 to 28th Feb 2017 | 00-06 | 2000 | 200 | 1800 | 193 | 1607 | | STOA margin revised considering changes in LTA and MTOA |
| | | 06-18' | 2000 | | 1800 | 303 | 1497 | | |
| | | 18-24 | 2000 | | 1800 | 193 | 1607 | | |
| ER-NR* | 1st Feb 2017 to 28th Feb 2017 | 00-24 | 4000 | 300 | 3700 | 2931 | 769 | -200 | Revised considering changes in LTA and MTOA and due to high generation in Rihand-Singrauli-Anpara complex |
| W3-ER | 1st Feb 2017 to 28th Feb 2017 | 00-24 | No limit is being specified. | | | | | | |
| ER-W3 | 1st Feb 2017 to 28th Feb 2017 | 00-24 | No limit is being specified. | | | | | | |
| WR-SR | 1st Feb 2017 to 28th Feb 2017 | 00-05 | 4400 | 750 | 3650 | 3384 | 266 | 400 | Revised considering present Maharashtra Demand/Generation and voltage profile at Sholapur (PG), Parli (PG) etc. during night hours. STOA margin revised considering changes in LTA and MTOA. |
| | | 05-22 | 4000 | | 3250 | | 0 | | |
| | | 22-24 | 4400 | | 3650 | | 266 | 400 | |
| SR-WR * | 1st Feb 2017 to 28th Feb 2017 | 00-24 | No limit is being Specified. | | | | | | |
| ER-SR | 1st Feb 2017 to | 00-06 | 2650 | 0 | 2650 | 2565 | 85 | | |
| | | 06-18' | | | | 2650 | 0 | | |

Source: POSOCO website

# Declaration of Transmission Availability – Inter Country




**Natioanl Load Despatch Centre, New Delhi**
**Transfer Capability between India and Bangladesh for February 2017**

Issue Date: 28/10/2016 Issue Time: 1745 hrs Revision No. 0

| Date | Time Period in IST (hrs) | TTC from India to Bangladesh from Indian Side* | Reliability Margin | Available Transfer Capability (ATC) | Long Term Access (LTA)/ Medium Term Open Access (MTOA) # | Margin Available for Short Term Open Access (STOA) | Changes in TTC w.r.t. Last Revision | Limiting constraint | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 1st February 17 to 28th February 17 | 0000-0630 | 500 | 0 | 500 | 210 | 290 | | No constraints from Indian Side. | |
| | 0630-2330 | 500 | | 500 | 210 | 290 | | | |
| | 2330-2400 | 500 | | 500 | 210 | 290 | | | |

| | |
|---|---|
| Note 1: | There is no limitation on the flow on HVDC Bheramera from the Indian side during normal conditions. |
| Note 2: | In case of operation of SPS, Transfer Capability will be revised accordingly. |
| Note 3: | Schedule between India and Bangladesh will be prepared using the above table till the next revision |
| Note 4: | Transfer Capabiliy between India and Bangladesh in the above table has been evaluated ignoring the constraints from Bangladesh side. |

Source: POSOCO website

# Transmission Capacity Allocation to Exchanges in SARPEX

- Any deviation from the existing regulations and procedures for allocation of transmission capacities may be a long drawn process
  - Each country's existing mechanism for transmission capacity allocation may be retained for SARPEX
- Thus, the priority and capacity allocated to SARPEX is proposed to constitute the residual capacity left after accommodating all the long term, medium and short term bilateral contracts

# OPERATING RULES FOR SARPEX

# Operating Rules for SARPEX

## Participation Pre-Requisites

- In SARPEX, all trades are expected to be through the Indian Grid; while the operational control of respective grids of Countries is within their own jurisdiction.
- Thus, provision of NOC to allow access to the Indian Grid in absence of standardized Open Access Regulations
- As a long-term recommendation, formation of a Joint Association of System Operators to foster efficient available transmission capability determination and congestion monitoring

# Operating Rules for SARPEX

## Scheduling

- Unlike Bilateral Contracts, where delivery points are mutually agreed by counter parties, the delivery points are pre-determined in Exchange in order to have a uniform price for all the buy and sale transactions
- The interconnection of the cross-border transmission line and the inter-state transmission network of India (International periphery) may be the delivery point for buy or sale of power by Member Countries
- Nodal Agencies (trading companies) for each member country to coordinate trading on Exchange
  - The nodal agency will furnish the schedule of drawl and injection to the concerned authorities on both the sides of International Periphery
  - In case of multiple interconnections of the Member Countries with India, the nodal agency will be responsible for scheduling separately at each interconnection

# Operating Rules for SARPEX

## Deviation Settlement

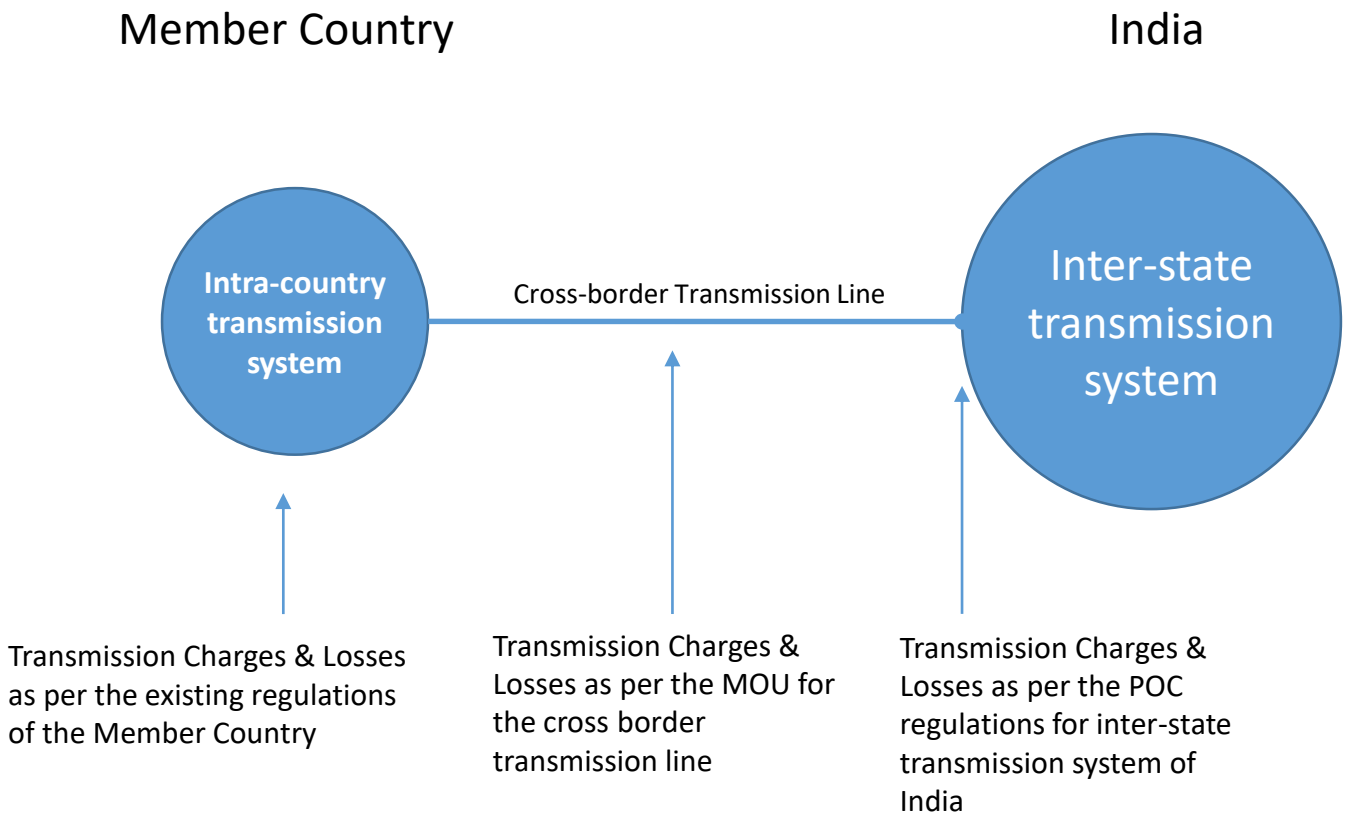
- Deviation is the mismatch in scheduled and actual injection / drawl of power to / from the grid. Inadvertent deviations from schedule may pose threats to the grid stability and security
- Nodal Agency to be responsible for overall settlement of deviations at the International Periphery and penalties would be as per the applicable DSM rates of CERC
- Deviation settlement may be pro-rated in the case of multi Nodal Agency involvement for different transaction types
  - Example: a generator scheduled for 100 MW through nodal agency A under a long-term PPA and 50 MW on Exchange through agency B. If the actual injection of the generator is 120 MW, the deviation on the two agencies will be determined proportionally, i.e. agency A and agency B will be responsible for a deviation of 20 MW and 10 MW respectively

# Operating Rules for SARPEX

## Transmission Charges & Losses

- Currently, all the Member Countries have their own mechanisms for estimation and application of transmission charges and losses on the entities using the grid
  - In case of cross border bilateral contracts, the charges are levied in accordance with the MOU / contractual terms
  - The POC injection and drawal charges and losses for various interconnection points of cross-border transmission lines in the Indian grid are already in place
  - Likewise, the transmission charges and losses for the cross border transmission line are also in place under the prevailing cross border bilateral agreements
- Hence, it is proposed that the transmission charges and losses be according to the existing regulations in the Member Countries

# Transmission charges and loss allocation in SARPEX




- Both Buyers and Sellers to absorb losses
  - Buyers: Inject more than contracted power (Contracted Power + Losses)
  - Sellers: Draw less than contracted power (Contracted Power – losses)

# Illustrative: What a consumer on Exchanges Pay

| Parameter | Buy Side | | Sell Side | | Comments |
|---|---|---|---|---|---|
| | *Rs/kWh* | *%* | *Rs/kWh* | *%* | |
| **Bid Quantity (MW)** | **108** | | **100** | | Quantity Bid at SARPEX |
| Price in SARPEX | 2.50 | | 2.50 | | Price discovered in SARPEX |
| PoC Withdrawal / Injection Losses | | 0.02 | | 0.02 | POC Charges & Losses applicable on Member Country for using the ISTS network of India |
| PoC Withdrawal / Injection Charges | 0.20 | | 0.20 | | |
| Cross Border Line Losses | | 0.02 | | 0.02 | Cross Border Transmission line connecting the delivery point in India with the Member Country |
| Cross Border Line Charges | 0.10 | | 0.10 | | |
| Member Country Losses | | 0.04 | | 0.04 | Member Country Transmission Charges & Losses for use of its internal transmission network |
| Member Country Charges (Rs/kWh) | 0.20 | | 0.20 | | |
| Operating Charges | 0.03 | | 0.03 | | Operating Charges of NLDC (0.01 Rs/kWh) and Transaction Fee for SARPEX (0.02 Rs/kWh) |
| **Quantum Received / Injected @ Member Country Bus (MW)** | **100** | | **108** | | Quantity Received / Injected by the Member Country |
| Landed/Received Price @ Member Country Bus | 3.29 | | 1.81 | | Landed Price to Member Country / Net back Price to Member Country Generator |

# OPERATING TIMELINES FOR SARPEX

# Time Zones and deviation in BBIN

**Time zones observed in BBIN relative to UTC**

| Country | Time zone (In Hours) | IST Deviation (In Minutes) |
|---|---|---|
| India | UTC + 5:30 | - |
| Bhutan | UTC + 6:00 | +30 minutes |
| Bangladesh | UTC + 6:00 | +30 minutes |
| Nepal | UTC + 5:45 | +15 minutes |

Mismatches in time-zones has implications on coordination of DAM operational activities

# Coordination Challenges in operating SARPEX due to Time Mismatches

Electricity Dispatch at the “day boundary” for three consecutive days

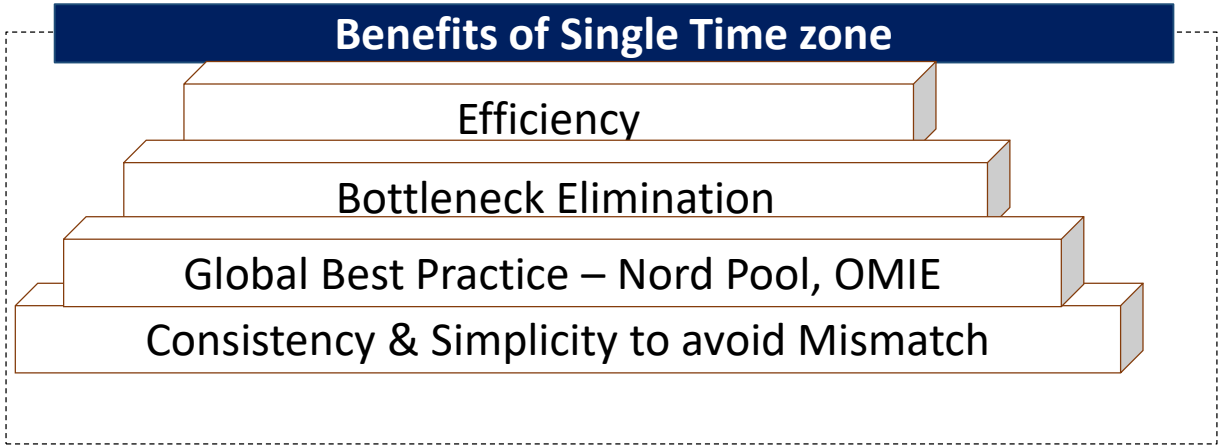
| | D-2 | | | | | | D-1 | | | | | | D | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Slots** | **41** | **48** | **49** | **71** | **95** | **96** | **1** | **2** | **41** | **49** | **95** | **96** | **1** | **2** | **41** | **49** | **95** | **96** |
| **India** | 10:00 | 11:45 | 12:00 | 17:30 | 23:30 | 23:45 | 00:00 | 00:15 | 10:00 | 12:00 | 23:30 | 23:45 | 00:00 | 00:15 | 10:00 | 12:00 | 23:30 | 23:45 |
| **Nepal** | 10:15 | 12:00 | 12:15 | 17:45 | 23:45 | 00:00 | 00:15 | 00:30 | 10:15 | 12:15 | 23:45 | 00:00 | 00:15 | 00:30 | 10:15 | 12:15 | 23:45 | 00:00 |
| **Bhutan** | 10:30 | 12:15 | 12:30 | 18:00 | 00:00 | 00:15 | 00:30 | 00:45 | 10:30 | 12:30 | 00:00 | 00:15 | 00:30 | 00:45 | 10:30 | 12:30 | 00:00 | 00:15 |
| **Bangladesh** | 10:30 | 12:15 | 12:30 | 18:00 | 00:00 | 00:15 | 00:30 | 00:45 | 10:30 | 12:30 | 00:00 | 00:15 | 00:30 | 00:45 | 10:30 | 12:30 | 00:00 | 00:15 |

**Coordination Issues**

**Day D-2** **Day D-1** **Day D**

**Dispatch periods at the “day boundary” i.e. Slot 95 and Slot 96 may lead to coordination issues. While these slots belong to Day “D-1” in India, they belong to Day “D” i.e. the next day in Bhutan, Bangladesh and Nepal**

# Benefits of a Single Time Zone for Operations in SARPEX




**A single reference time zone and operating timeline is recommended for SARPEX.**

# Proposed Operating Timelines for SARPEX

## Key Activities in DAM on SARPEX

### Bidding Day "D-1"

| Activity | Description | Time | Time zone |
|---|---|---|---|
| a | Bid Start Time | 10:00 | IST |
| b | Gate Closure Time | 12:00 | IST |
| c | Unconstrained Solution | 13:00 | IST |
| d | Corridor Availability | 14:00 | IST |
| e | Constrained Solution | 15:00 | IST |
| f | Pay-in | 15:30 | IST |
| g | Schedule Confirmation | 17:30 | IST |
| h | Final Scheduling | 18:00 | IST |

### Dispatch "D"

| Activity | Description | | Time | Time zone |
|---|---|---|---|---|
| a | Dispatch | Start Time | 00:00 | IST |
| | | End Time | 23:45 | IST |

### Pay-Outs "D+1"

| Activity | Description | Time | Time zone |
|---|---|---|---|
| a | Pay-out | 14:00 | IST |

*D – Current Day

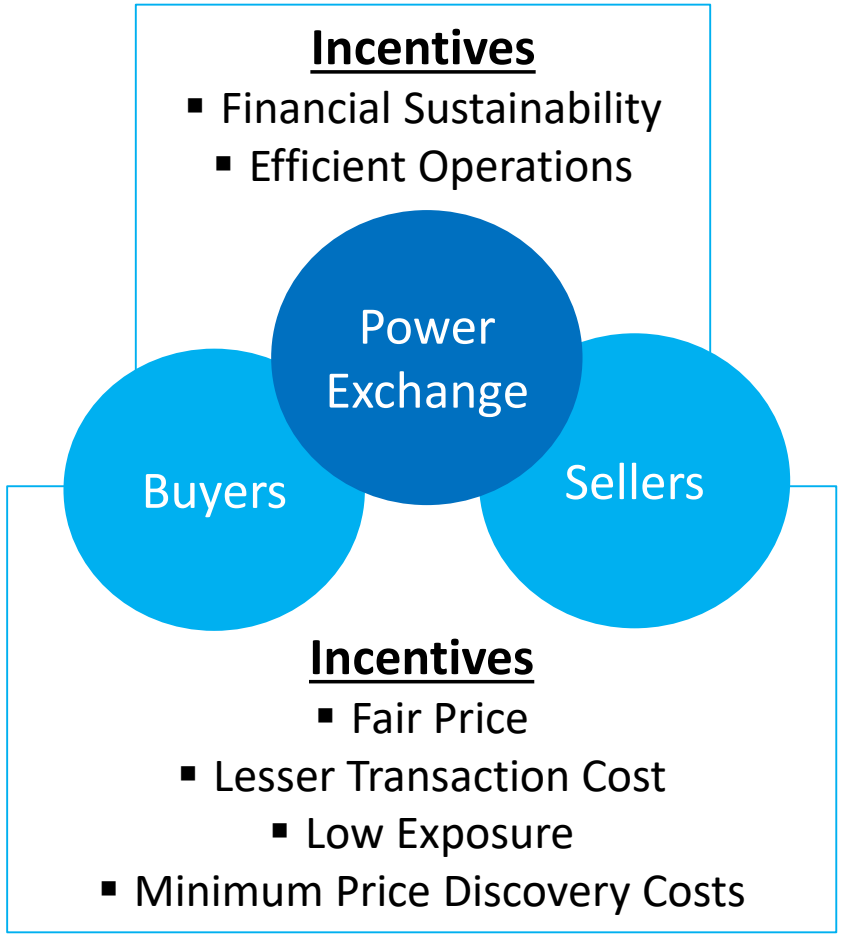
**All the operations and transactions could be aligned to a single Reference Time Zone of India in order to avoid any mismatch in the operational activities by following the individual country Time Zones**

# CURRENCY IN SARPEX

# Currency for Power Trading on SARPEX

**Key Considerations – Single v. Multiple Currency**

- Stakeholder's Preference
- Volumes traded based on currency
- Physical Market Structure
- Market Efficiencies
  Consumer Distribution
  Nature of Products
- Financial Market
- Currency Liquidity
  Market Liquidity
  Infra Development
  Trade Balances



# Benefits of a Single Currency in SARPEX

- A Single Currency allows for the following:
  - Clear, non-discriminatory, transparent information dissemination
  - Liquidity and price stability
  - Exchange's financial exposure reduced
  - Lower transaction costs due to fewer intermediaries
  - Examples: Nord Pool, OMIE, APX, EPEX

**The choice of currency has a bearing on market design, bidder participation and consequently liquidity as well. The ease with which participants can transact, translates into greater participation which in turn aids in increasing market competitiveness**

# Appropriate Approach for Currency in SARPEX

*Trade Agreements and Treaties between BBIN recommend the use of a mutually agreeable currency*

**Option 1 - Single Currency**

- Banks take on fluctuation exposure
- Ease of pricing – lowers chance of currency arbitrage through power exchange

**Option 2 – Currency Service**

- Exchange takes on fluctuation exposure
- Convenience to Buyers and Sellers
- Enhanced market infrastructure to enable efficient and timely operations

- Typically, countries with developed financial markets and equitable geographical distribution of bidders among participating countries warrant the multiple currency system. Also, it increases complexity and exposes the Power Exchange to currency rate fluctuations
- INR may be favorable over multiple currency for SARPEX since it is simple, lowers transaction costs, is widely used which helps achieve the Exchange's liquidity objective and foster participation.

# QUESTIONS AND ANSWERS