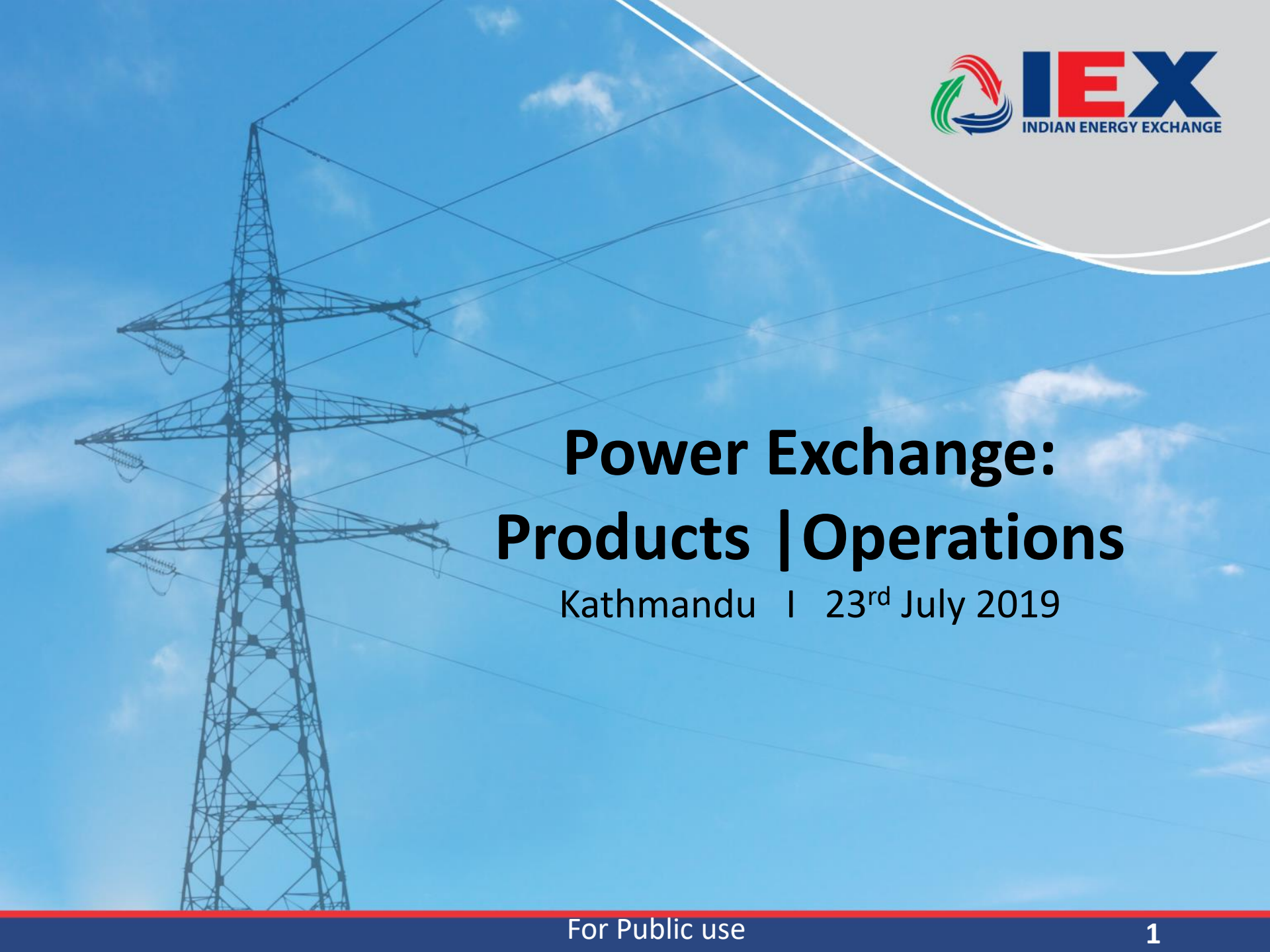


Power Exchange: Products |Operations

Kathmandu I 23rd July 2019

In this presentation

- Exchange Products & Operations
- Exchange Snapshot
- Cross Border Electricity Trade –

  International Scenario & SAARC Status
- Way Forward

EXCHANGE PRODUCTS & OPERATIONS

Key Functions

Trading

- ✓ Bid accumulation
- ✓ Calculation of Provisional result
- ✓ Publishing provisional results
- ✓ Calculation of Final result (with technical constraints)
- ✓ Publishing final results
- ✓ Publishing Daily Obligation reports

Surveillance

- ✓ Round the clock
- ✓ Checking of Collateral
- ✓ Checking of Permissible Quantity as per NoC & Margins
- ✓ Deviation from Bidding Pattern
- ✓ Daily MIS reporting
- ✓ Real time support to members

Clearing

- ✓ Pre-Trade Margin Check
- ✓ Post Trade Margin Call
- ✓ Daily Obligation settlement
  - ✓ Pay In
  - ✓ Pay Outs
- ✓ Risk Management
- ✓ Bank Reconciliation of Settlements Accounts
- ✓ Daily NLDC/SLDC charges Payment

Delivery

- ✓ Update NoC
- ✓ Calculation of transmission capacity requirement between various points based on market clearing volume
- ✓ Interaction with NLDC for transmission capacity availability
- ✓ Market splitting in case of transmission congestion
- ✓ Delivery schedule for every portfolio
- ✓ Scheduling with SLDCs
- ✓ Member communication for schedule and trade related reports
- ✓ Monthly and weekly reporting to various organizations such as CERC & S/O
- ✓ Monthly REA data verification
- ✓ Real Time Congestion Management

- ✓ Over 3 Lakh contracts traded
- ✓ All activities performed for 1200-1500 portfolio daily
- ✓ Precision and adherence to timelines

IEX Market Segments

Day-Ahead Market since June,08	• *Delivery for next day* • *Price discovery: Closed , Double-sided Auction*
Intraday Market & Day-Ahead Contingency Round the clock since Jul'15	• *Intraday: For Delivery within the same day* • *Day Ahead Contingency: Another window for next day* • *Gate closure : 2.5 hours*
Term-Ahead Contracts since Sep'09	• *For delivery up to 11 days* • *Daily Contracts, Weekly Contracts*
Renewable Energy Certificates since Feb'11	• ***Green Attributes as Certificates*** • ***Sellers :*** *RE generators not under feed in tariffs* • ***Buyers:*** *Obligated entities; 1MWh equivalent to 1 REC*
Energy Saving Certificates since 27th Sept'17	• ***1 ESCert = 1 mtoe*** *(metric Tonne of Oil Equivalent)*

Auction **Continuous**

DAY AHEAD MARKET

Features of Day Ahead Market

A closed double-sided anonymous auction for **each 15-min time block** for the following day

The intersection between the aggregated sale and purchase curves defines the market clearing price (MCP)

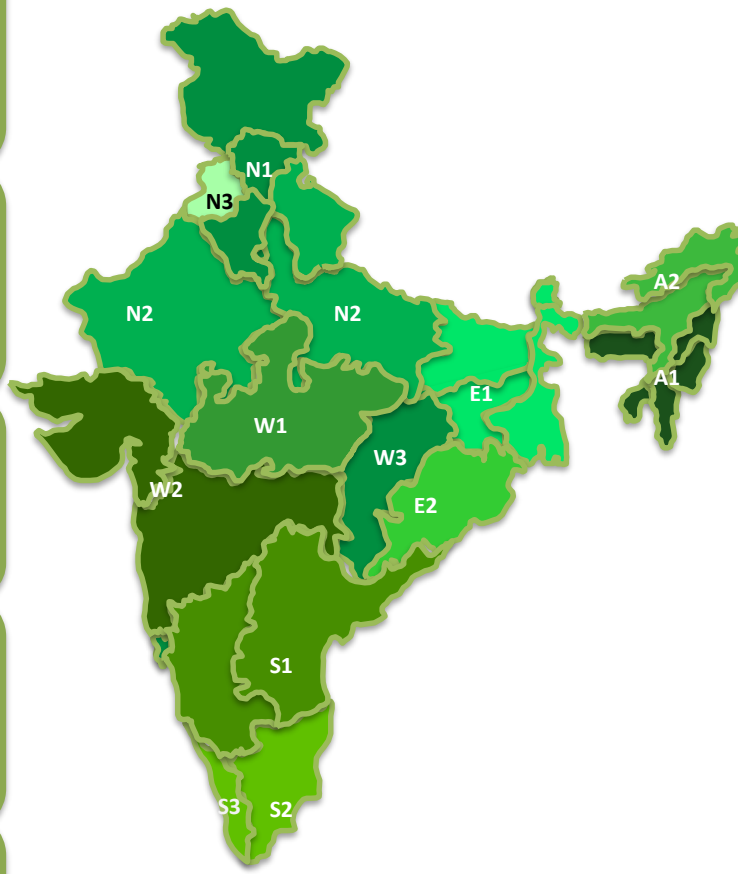
13 Bid Area defined

Congestion Management through market splitting and determining Area Clearing Price (ACP) specific to an area

Bid types: Portfolio Orders or Block Orders

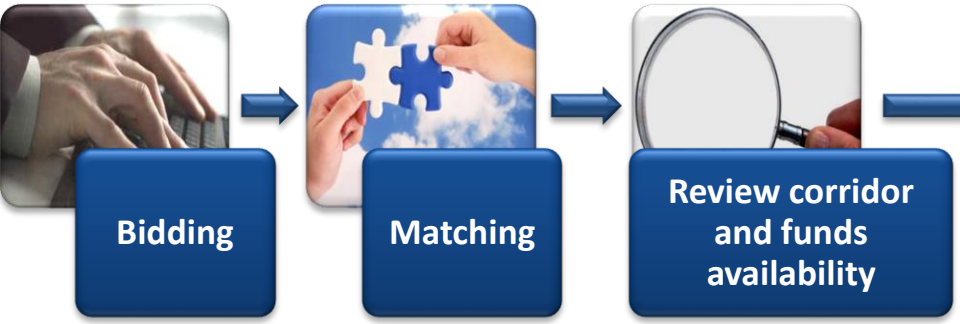
Minimum Bid=Re.1 for 0.1MWh

Minimum Price & Volume Step = 0.1 * 0.1 MWh



13 Bid Areas

DAM Trading Process



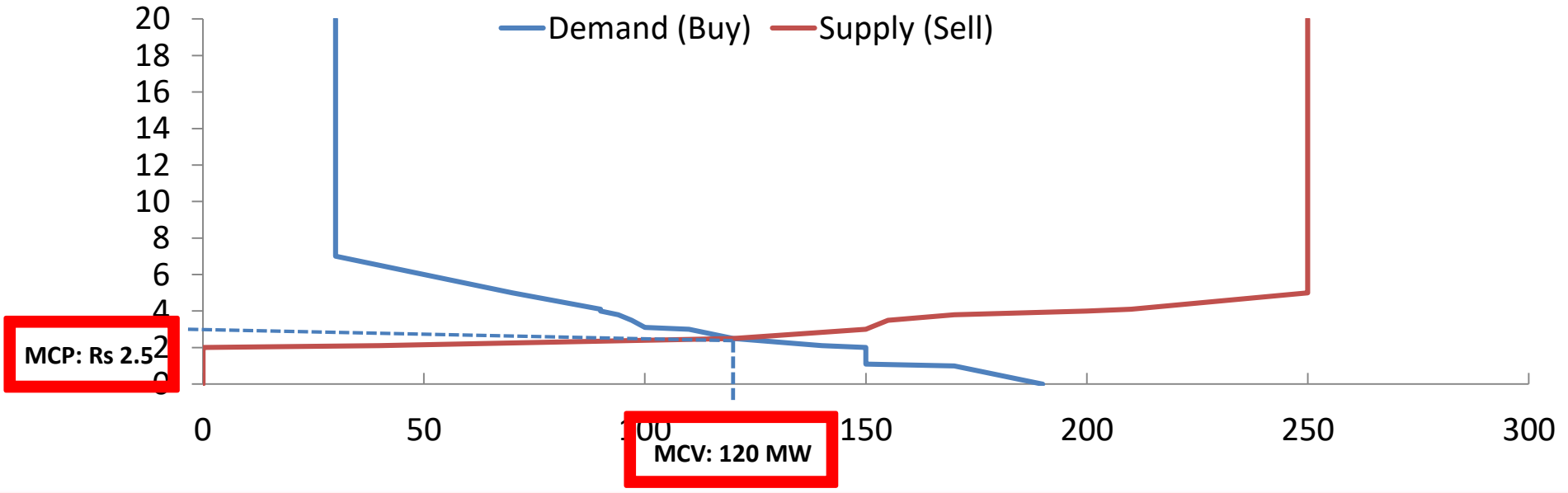
Bidding	Matching	Review corridor and funds availability	Result	Confirmation	Scheduling
10:00 am to 12:00 pm	12:00 pm to 1:00 pm	1:00 pm to 2:00 pm	3:00 pm	5:30 pm	6:00 pm
Bids for 15- min each or block bids can be placed	MCP &MCV calculated	Corridor availability from NLDC and funds verified from bank	Final ACV and ACP calculated. Market splitting if congestion	Collective transaction confirmation by NLDC and Pay In	Final Schedule sent to RLDC for incorporation

*Timeline is based on IST

Matching: Model Price Calculation Algorithm

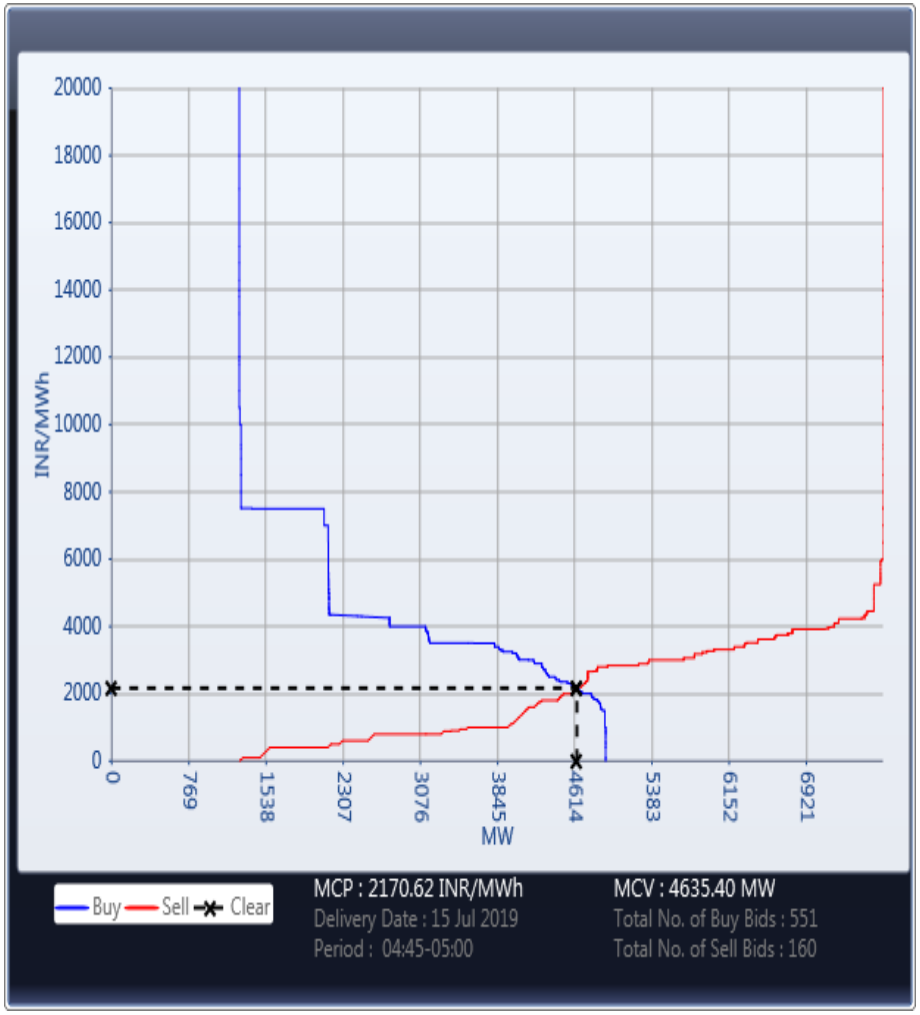
(Example for a sample 15-min- single bids)

Price Tick	0	1	1.1	2	2.1	2.5	3	3.1	3.5	3.8	4	4.1	5	7	9	12	14	17	19	20
Portfolio A	20	20	20	20	20	20	20	10	7	4	0	0	0	0	0	0	0	0	0	0
Portfolio B	60	60	60	60	50	40	40	40	40	40	40	40	20	20	20	20	20	20	20	20
Portfolio C	70	70	70	70	70	60	50	50	50	50	50	50	50	10	10	10	10	10	10	10
Portfolio D	40	20	0	0	-40	-60	-80	-81	-85	-100	-120	-120	-120	-120	-120	-120	-120	-120	-120	-120
Portfolio E	0	0	0	0	0	-40	-50	-50	-50	-50	-60	-60	-90	-90	-90	-90	-90	-90	-90	-90
Portfolio F	0	0	0	0	0	-20	-20	-20	-20	-20	-20	-30	-40	-40	-40	-40	-40	-40	-40	-40
Total Buy, MW	190	170	150	150	140	120	110	100	97	94	90	90	70	30	30	30	30	30	30	30
Total Sell, MW	0	0	0	0	-40	-120	150	-151	-155	-170	-200	-210	-250	-250	-250	-250	-250	-250	-250	-250
Net Transaction, MW	190	170	150	150	100	0	-40	-51	-58	-76	-110	-120	-180	-220	-220	-220	-220	-220	-220	-220

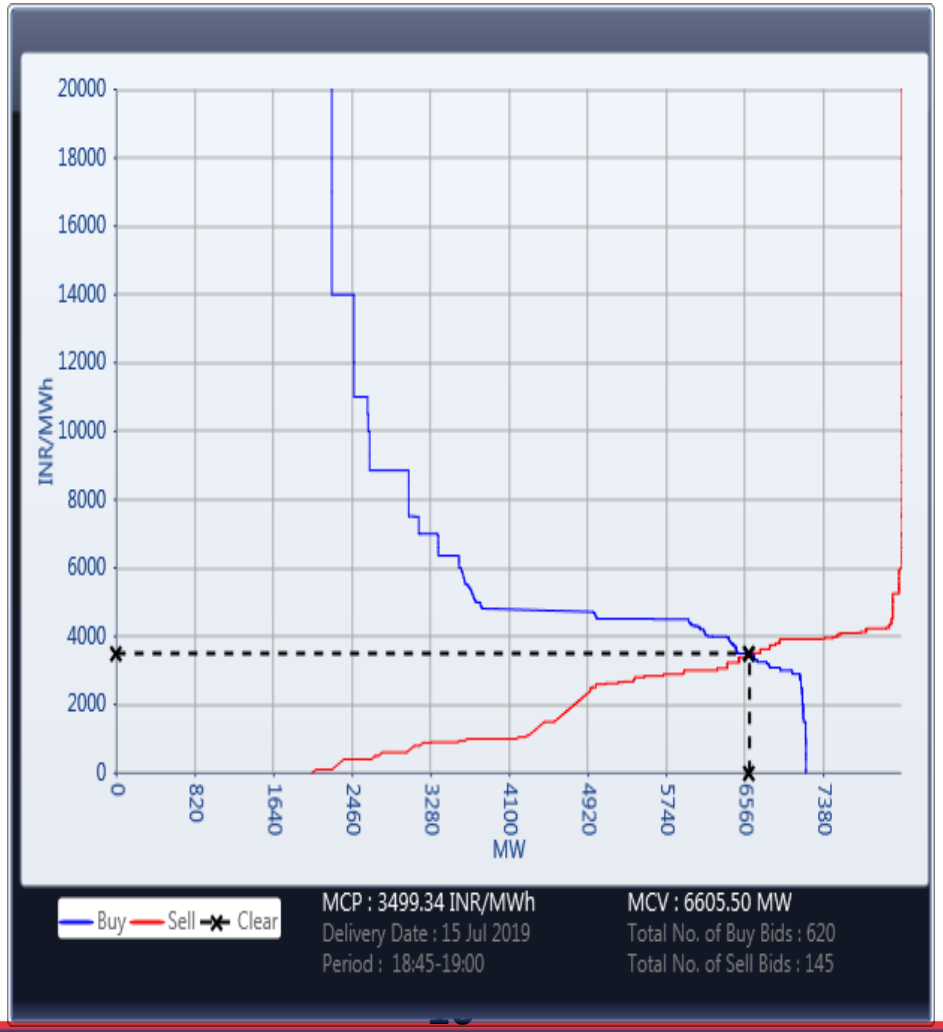


Aggregate D-S curve: 15th July 2019

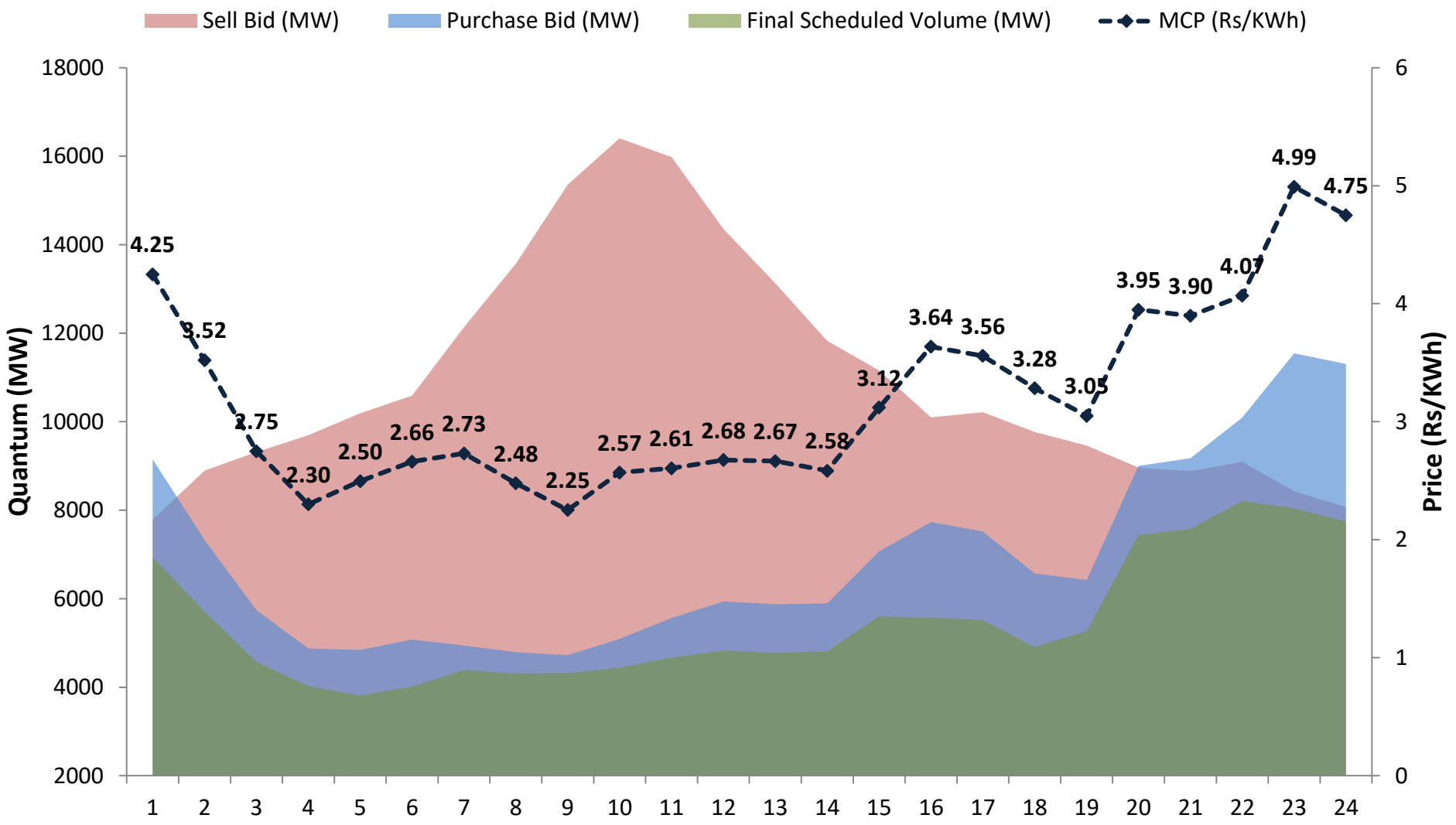
Off-Peak- 4:45Hrs-5:00Hrs



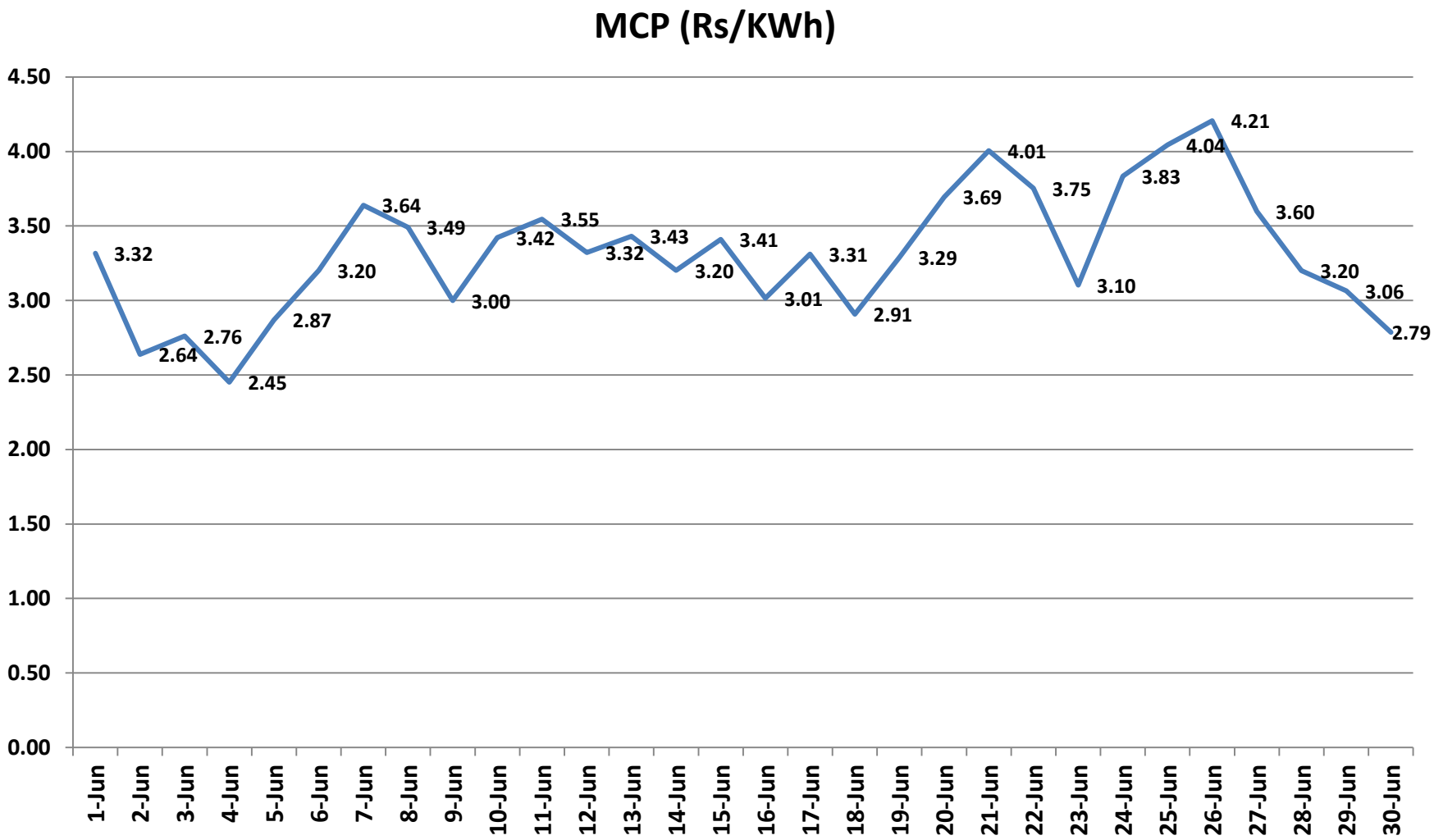
Peak- 18:45Hrs-19:00Hrs



DAM Market Snapshot
06 June 2019

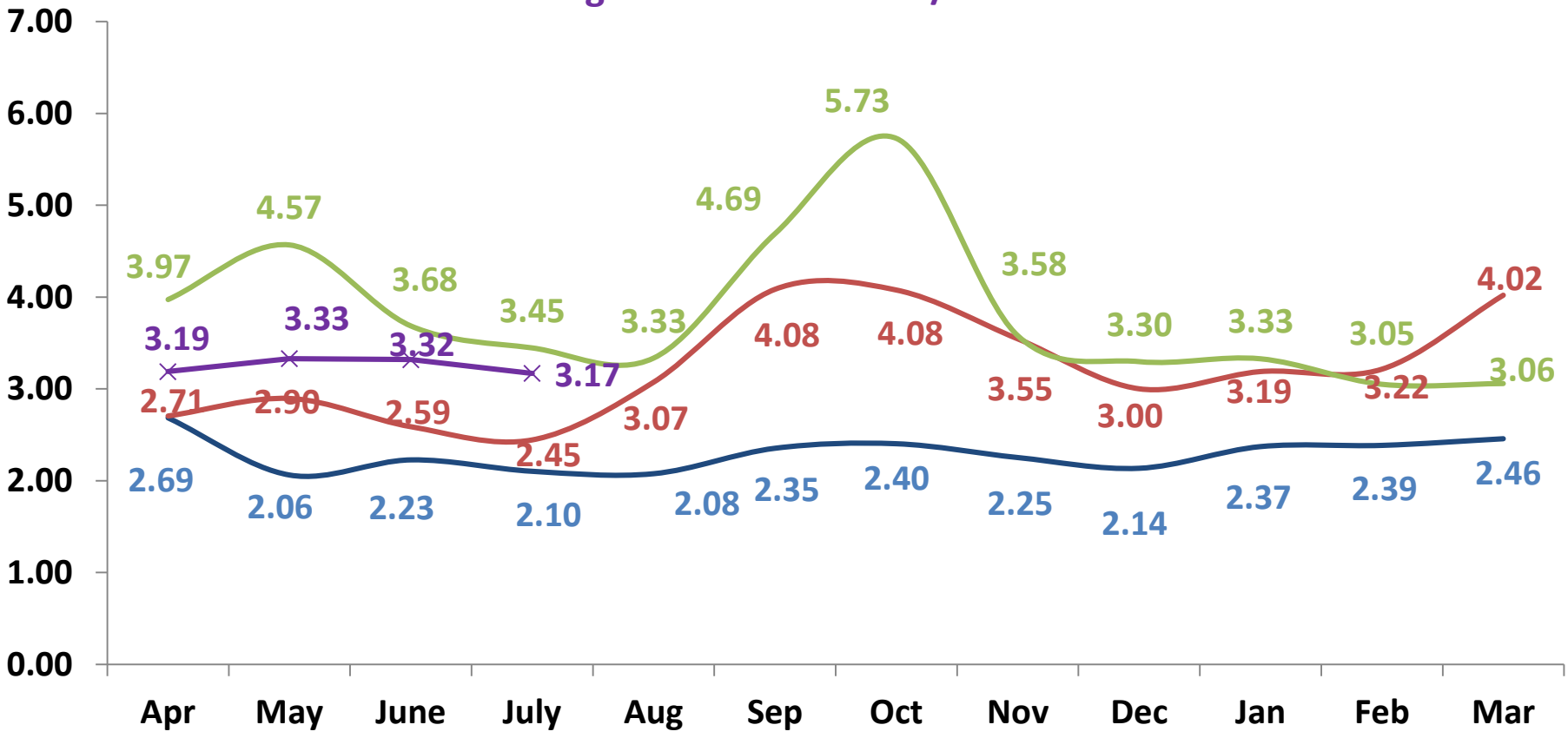


IEX Daily Price Trend for June



IEX Monthly Avg Price Trend

FY 16-17 Avg. RTC Price: Rs 2.29/kWh
FY 17-18 Avg. RTC Price: Rs 3.24/kWh
FY18-19 Avg. RTC Price: Rs 3.81/kWh
FY19-20 Avg. RTC Price: Rs 3.27/kWh



Offering trading option with high flexibility

Duration Flexibility

- Bidding for 15 min time block basis
- Bidding options:
  - Single time block I Round The clock I Custom Time block : Uniform & Non Uniform

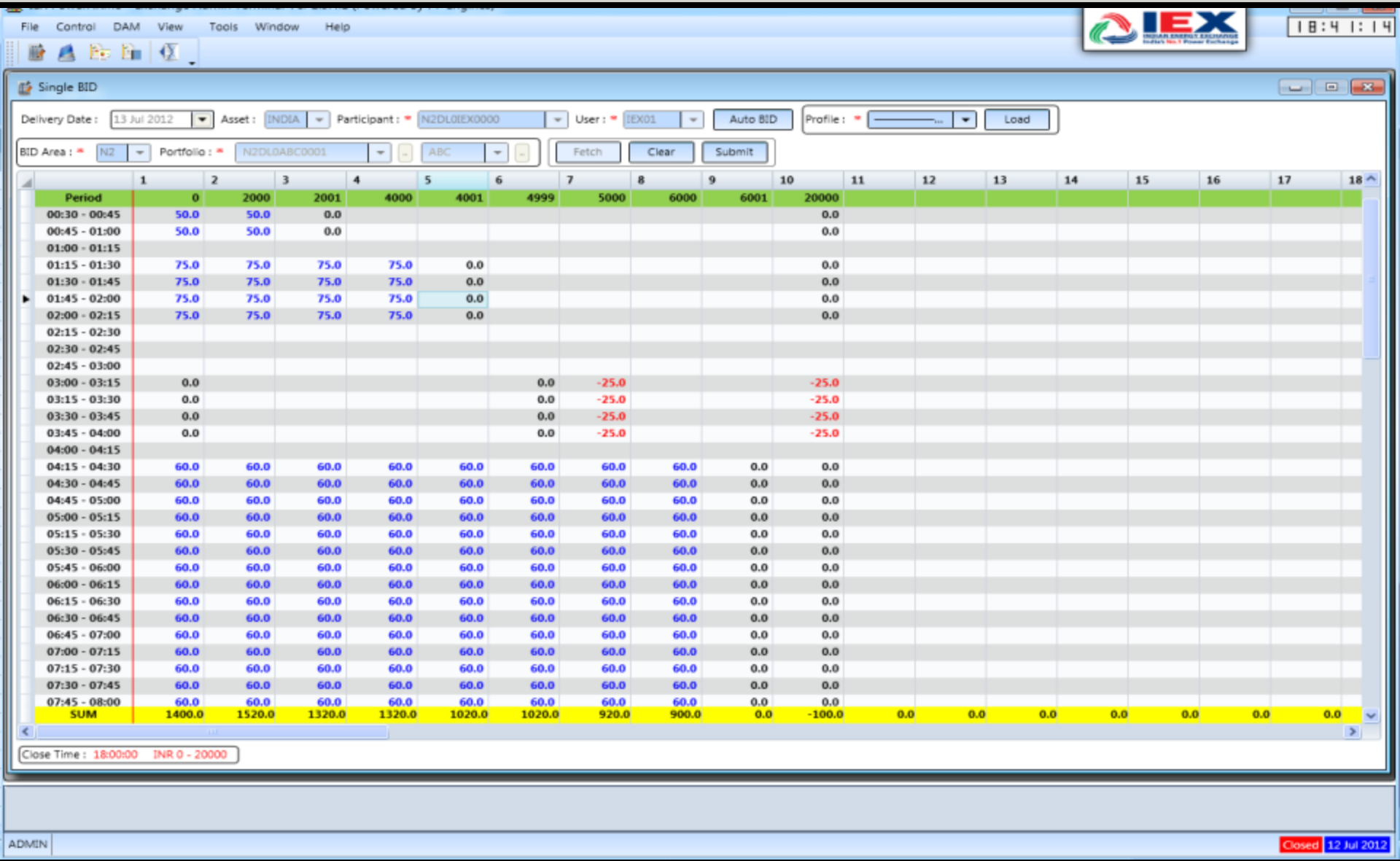
Volume Flexibility

- Bidding possible for any volume > 0.1 MW
- Bidding Options:
  - **Single Bid**
    - Participant can enter multiple Price-Quantity pair for any/all time blocks.
    - Partial selection possible
  - **Block Bid**
    - To avoid partial and non uniform clearing , participants can enter Block Bid
    - Any set of time blocks with uniform volume to be selected on “All or None” principle
    - Different Block bid can be linked as “Mother-Child”. (Child bid is selected only if Mother bid selected)
- Pump storage power plant can be operate on this model by creating separate block bid for Pumping & Generation.
- Few other hybrid bid options are under development like flexible Block Bid

Single Bid Concept

Time Block	Bid Volume (MW)	Buy Bid Price	Clearing Price	Result
1	100	Rs 4	Rs 1	
2	100	Rs 4	Rs 5	
3	100	Rs 4	Rs 3	
4	100	Rs 4	Rs 5	
Average		Rs 4	Rs 3.5	

DAM-Single Bid

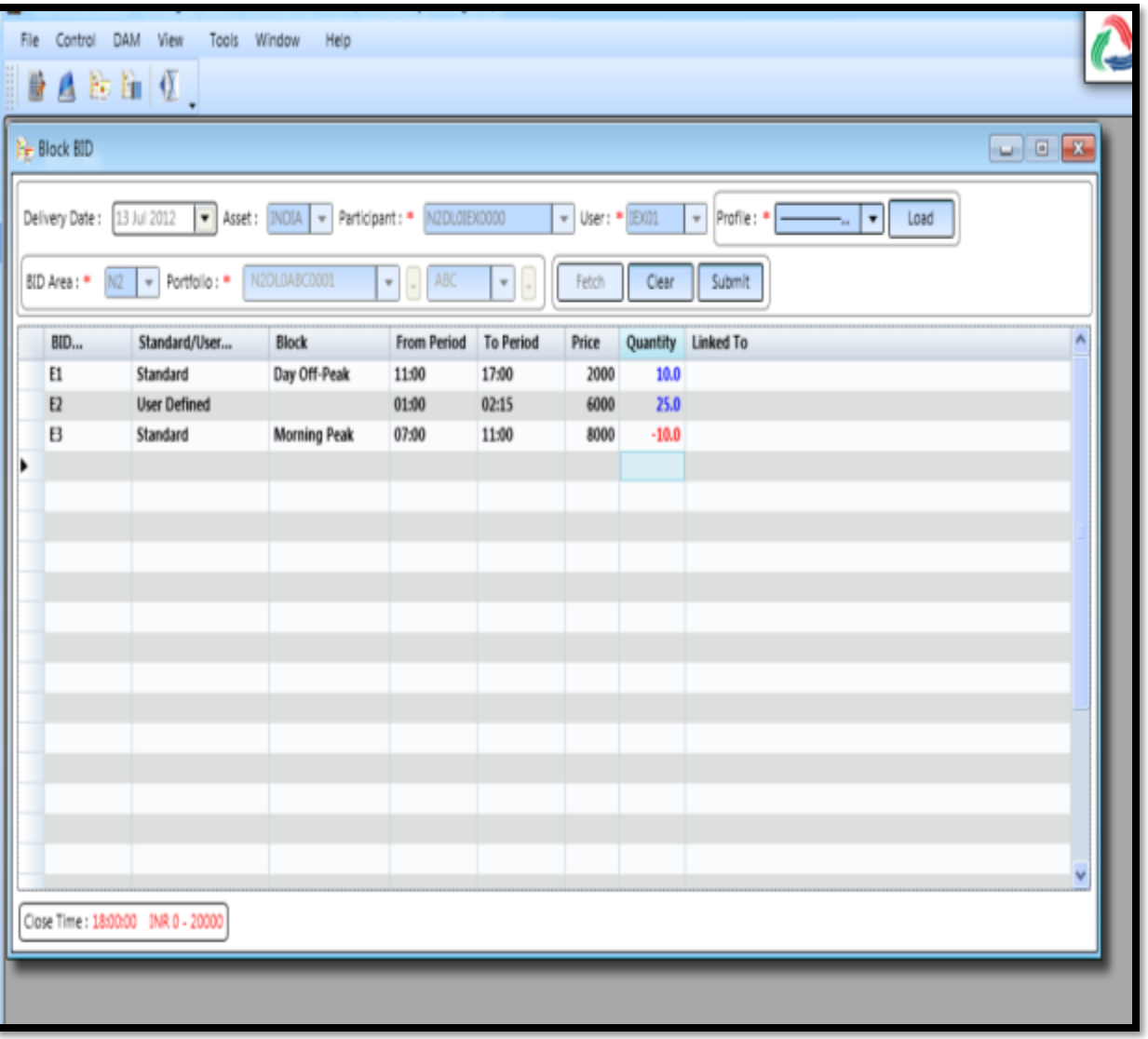


	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Period	0	2000	2001	4000	4001	4999	5000	6000	6001	20000								
00:30 - 00:45	50.0	50.0	0.0							0.0								
00:45 - 01:00	50.0	50.0	0.0							0.0								
01:00 - 01:15																		
01:15 - 01:30	75.0	75.0	75.0	75.0	0.0					0.0								
01:30 - 01:45	75.0	75.0	75.0	75.0	0.0					0.0								
01:45 - 02:00	75.0	75.0	75.0	75.0	0.0					0.0								
02:00 - 02:15	75.0	75.0	75.0	75.0	0.0					0.0								
02:15 - 02:30																		
02:30 - 02:45																		
02:45 - 03:00																		
03:00 - 03:15	0.0					0.0	-25.0			-25.0								
03:15 - 03:30	0.0					0.0	-25.0			-25.0								
03:30 - 03:45	0.0					0.0	-25.0			-25.0								
03:45 - 04:00	0.0					0.0	-25.0			-25.0								
04:00 - 04:15																		
04:15 - 04:30	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
04:30 - 04:45	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
04:45 - 05:00	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
05:00 - 05:15	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
05:15 - 05:30	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
05:30 - 05:45	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
05:45 - 06:00	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
06:00 - 06:15	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
06:15 - 06:30	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
06:30 - 06:45	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
06:45 - 07:00	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
07:00 - 07:15	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
07:15 - 07:30	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
07:30 - 07:45	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
07:45 - 08:00	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	0.0	0.0								
SUM	1400.0	1520.0	1320.0	1320.0	1020.0	1020.0	920.0	900.0	0.0	-100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	

Block Bid Concept

Time Block	Bid Volume (MW)	Buy Bid Price	Clearing Price	Result
1	100	Rs 4	Rs 1	
2			Rs 5	
3			Rs 3	
4			Rs 5	
Average		Rs 4	Rs 3.5	

DAM-Block Bid



Rules for bid linking :

•A bid (bid B) can only be linked to one other bid (bid A)

•Both bid A and bid B must be of same type, i.e. sale-sale or purchase-purchase.

•Bid A and bid B can span any set of hours independently of each other

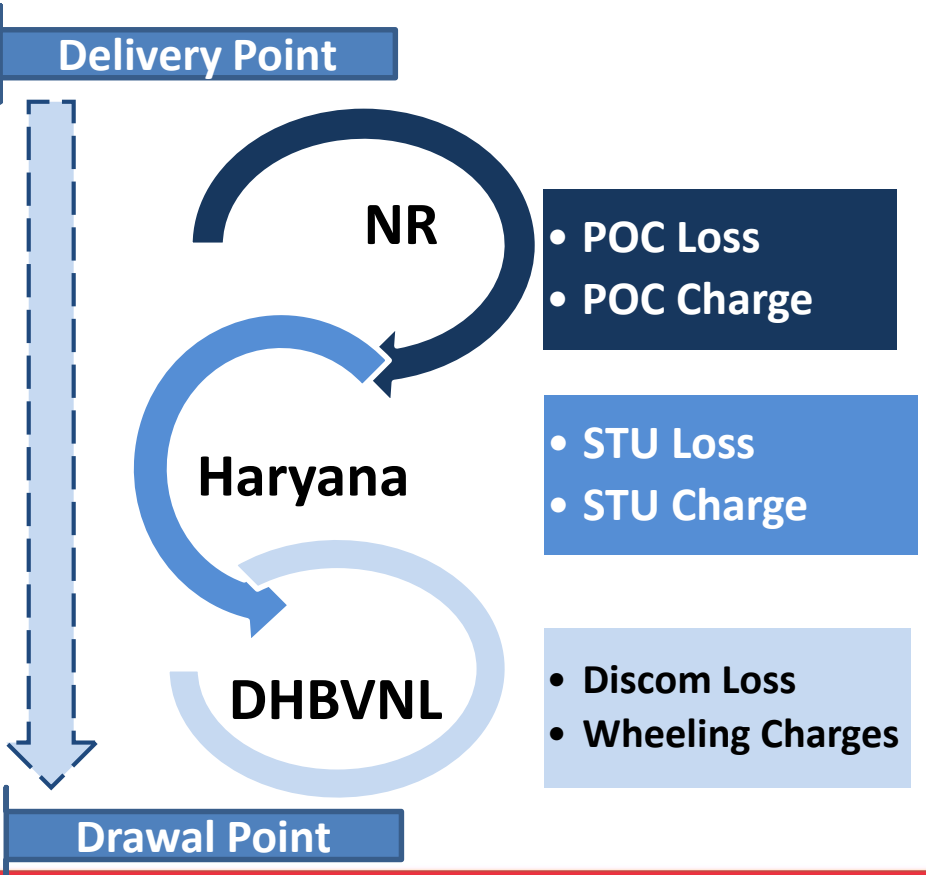
•Bid A and bid B can have any bid price independently of each other.

How to Use it ??

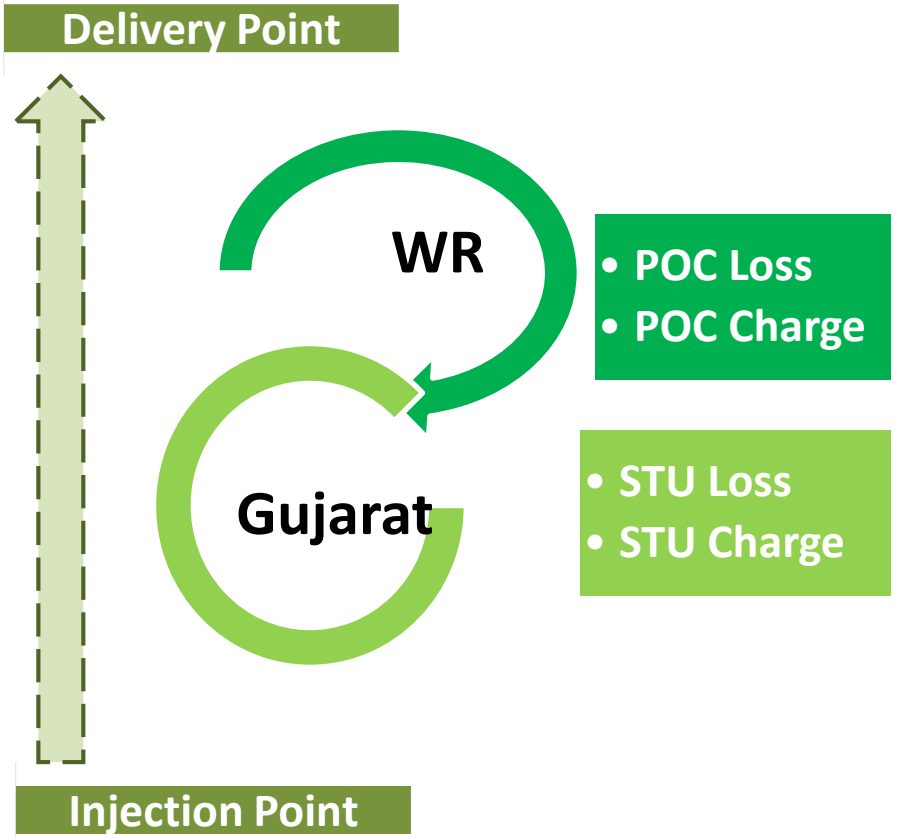
Charges payable

- Delivery point for Buyers & Sellers is their respective **Regional Periphery**
- **Buyer**: All losses and charges from delivery point till Drawal Point
- **Seller**: All losses and charges from Injection point till Delivery Point

Buyer Connected to Haryana Discom network



Seller Connected to Gujarat State network

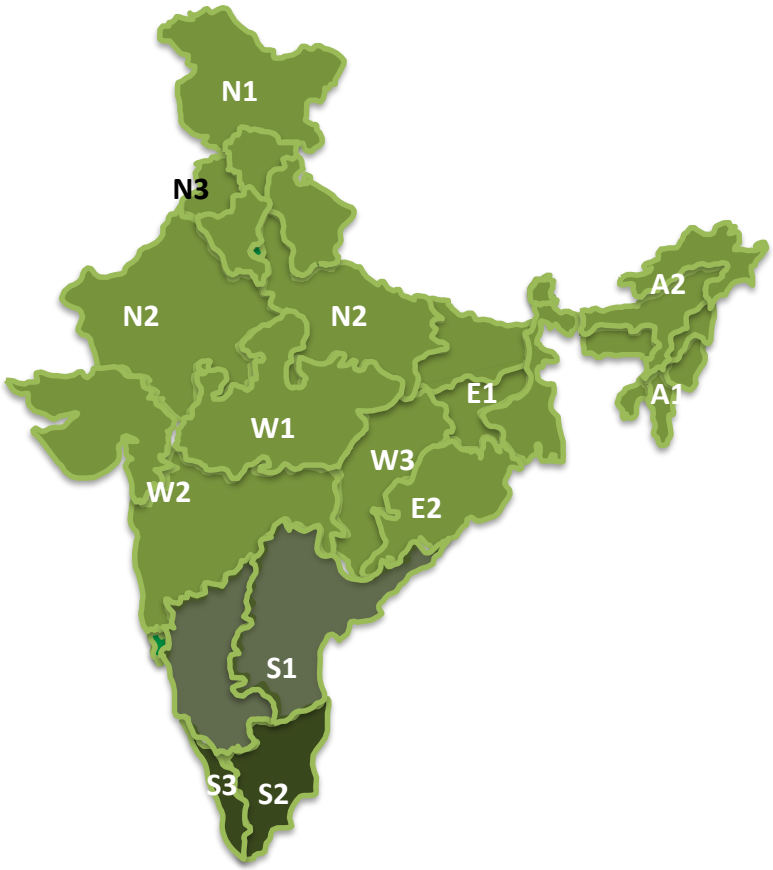


Concept of Market Splitting

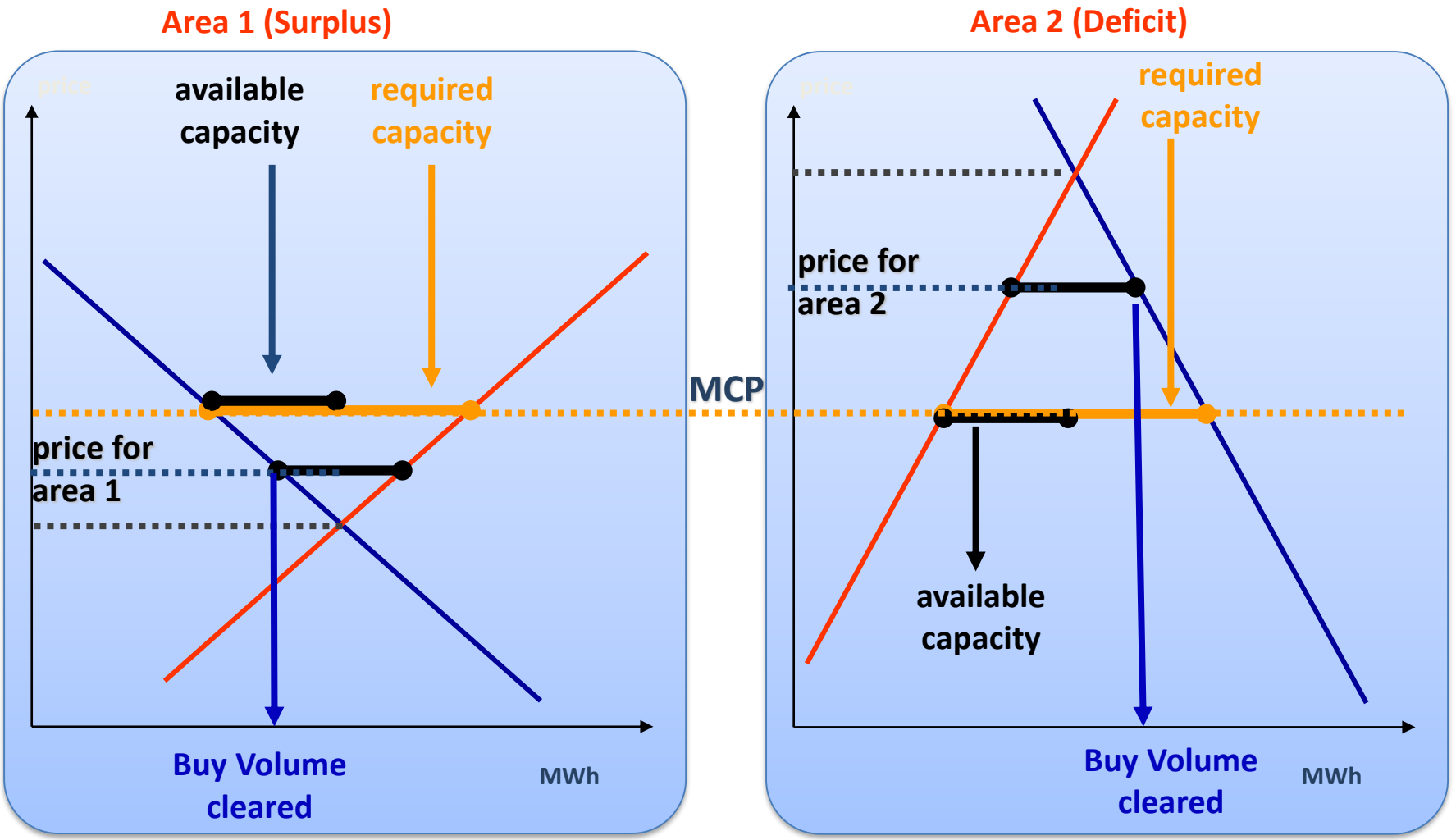
- Country is divided into 13 bid areas for the purpose of trading through Exchange

- In case of congestion **when the required flow exceeds transfer capability,** Exchange determines Area Clearing Price (ACP) specific to the bid area

- **The price is reduced in the surplus bid area (sale > purchase) and increased in the deficit area (purchase > sale)**

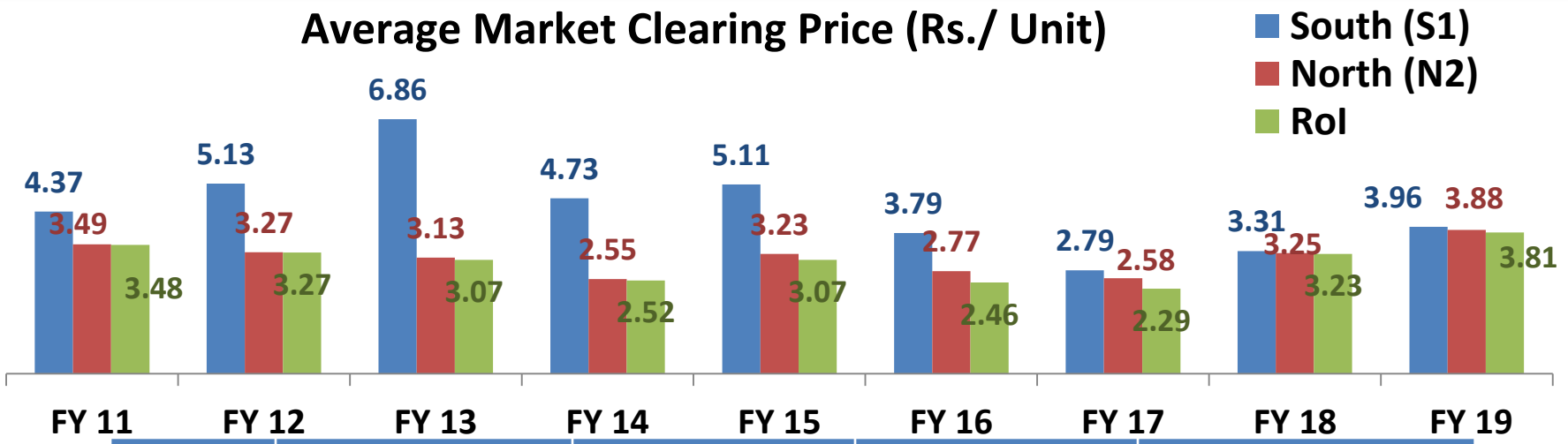


Congestion Management : Market Splitting



Courtesy Nordpool Consultancy

Lowered Congestion and Price convergence in Regions

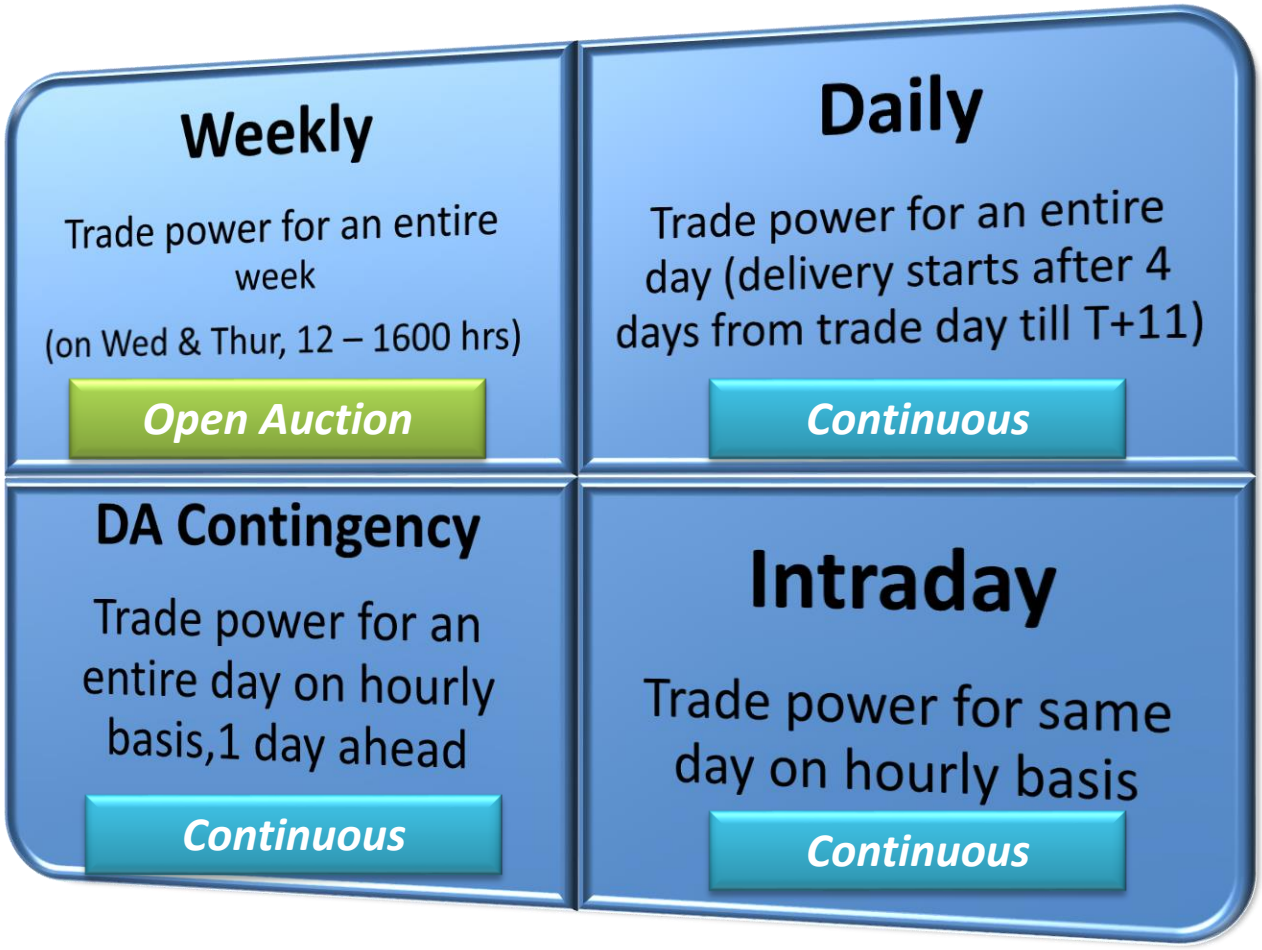


FY	Market Clearing Volume (MU)	Cleared volume (MU)	Curtailed Volume (MU)	Curtailment (%)
FY 14	34,230	28,925	5,305	15.5
FY15	31,227	28,141	3,086	9.9
FY16	36,210	34,067	2,143	5.9
FY17	41,310	39,830	1,480	3.6
FY18	45,121	44,925	196	0.4
FY19	50,600	50,136	464	0.9

- With transmission augmentation, congestion has reduced.
- Reduced congestion has increased reliability in sourcing power from exchanges

TERM AHEAD MARKET

TAM Market Segments



BID MATCHING

Open/Closed Auction

- Orders accumulated during call phase (no matching)
- Orders matched after call period
- Orders are used for calculation common price i.e. Equilibrium Price.
- All successful orders matched at Equilibrium Price.

Continuous Trading

- Price-time priority based continuous matching
- The highest Buy order & lowest Sell order gets the priority
- If the prices are same then priority is given to the time of the order received.

Contract Characteristics

	TERM AHEAD MARKET				
Contract Characteristic	**Day Ahead Market**	**Intraday Contracts**	**Day Ahead Contingency**	**Daily Contracts**	**Weekly Contracts**
Delivery	Next day	0400-2400 Hrs same day	For next day	From T+2 day to next T+9 days	For next week
Auction Type	**Closed Auction**	Continuous trading	Continuous trading	Continuous trading	Open Auction
Contracts	**15 min**	Hourly	Hourly	Block of Hours (Fixed)	Block of Hours (Fixed)
Trade Availability	All Days	All days	All Days; 1500-2300	All Days; 1200-1500	Wed & Thurs; 1200-1600
Financial Settlement	Pay-In- D-1; Pay Out – D+1	Pay in: T+1 Pay out: T+1	Pay in: T+1 Pay out: T+2	Pay-In- D-1; Pay Out – D+1	Pay-In- D-1; Pay Out – D+1

T = Trade

D = Delivery

Trading of Intra-day Contracts

Trading Hour

Trading Hours:20
(00:30-20:30)

0:30-1:30	1:30-2:30	2:30-3:30	3:30-4:30	4:30-5:30	5:30-6:30	6:30-7:30	7:30-8:30	8:30-9:30	9:30-10:30	10:30-11:30	11:30-12:30	12:30-13:30	13:30-14:30	14:30-15:30	15:30-16:30

16-:30-17:30	17:30-18:30	18:30-19:30	19:30-20:30

Delivery Hours:20
(04-24)

4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	18-19	19-20

20-21	21-22	22-23	23-24

Contracts available for delivery on the same day

Intra-day & DAC contracts with current trading system

Trading Date	Trading Time	Intra-Day contracts	Trading Time	DAC contracts
17-04-2019	00:30- 01:30	H5 to 24 (of 17-04)		
17-04-2019	01:30 – 02:30	H6 to 24 (of 17-04)		
17-04-2019	02:30 – 03:30	H7 to 24 (of 17-04)		
17-04-2019	03:30 – 04:30	H8 to 24 (of 17-04)		
17-04-2019	04:30 – 05:30	H9 to 24 (of 17-04)		
17-04-2019	05:30 – 06:30	H10 to 24 (of 17-04)		
17-04-2019	06:30 – 07:30	H11 to 24 (of 17-04)		
17-04-2019	07:30 – 08:30	H12 to 24 (of 17-04)		
17-04-2019	08:30 – 09:30	H13 to 24 (of 17-04)		
17-04-2019	09:30 – 10:30	H14 to 24 (of 17-04)		
17-04-2019	10 :30- 11:30	H15 to 24 (of 17-04)		
17-04-2019	11:30 – 12:30	H16 to 24 (of 17-04)		
17-04-2019	12 :30- 13:30	H17 to 24 (of 17-04)		
17-04-2019	13 :30- 14:30	H18 to 24 (of 17-04)		
17-04-2019	14 :30- 15:30	H19 to 24 (of 17-04)	15:00 to 21:30 (of 17-04)	H1 (of 18-04)
17-04-2019	15 :30- 16:30	H20 to 24 (of 17-04)	15:00 to 22:30 (of 17-04)	H2 (of 18-04)
17-04-2019	16 :30- 17:30	H21 to 24 (of 17-04)	15:00 to 23:00 (of 17-04)	H3 to 24 (of 18-04)
17-04-2019	17 :30- 18:30	H22 to 24 (of 17-04)		
17-04-2019	18 :30- 19:30	H23 to 24 (of 17-04)		
17-04-2019	19 :30- 20:30	H24 to 24 (of 17-04)		

Trading of Weekly & Daily Contracts

Daily

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
	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				

TWS Screen

Pending Buy Order

Buy 10 MW @ Rs 4500/MWh

Pending Sell Order

Sell 15 MW @ RS 5500/MWh

Trading Engine

Buy 10 MW @ RS 4500/MWh

Sell 15 MW @ RS 5500/MWh

Buy 10 MW @ Rs 4500/MWh

Sell 15 MW @ Rs 5500/MWh

TWS Screen

Pending Buy Order

Buy 10 MW @ RS 5000/MWh

Buy 10 MW @ RS 4500/MWh

Pending Sell Order

Sell 15 MW @ Rs 5500/MWh

Trading Engine

Buy 10 MW @ RS 5000/MWh

Buy 10 MW @ 5000/MWh

TWS Screen

Pending Buy Order

Buy 10 MW @ RS 4500/MWH

Buy 10 MW @ 4500

Pending Sell Order

Sell 5 MW @ Rs 5000/MWh

Trading Engine

Sell 15 MW @ Rs 5000/MWh

Trade 10 MW @ RS 5000/MWh

Bid Modified

Sell 15 MW @ RS 5000/MWh

CLEARING AND SETTLEMENT

Clearing and Settlement (C&S) process:-

- C&S department acts as an internal clearing house to help with the receivables and payables of each trade on the Exchange.

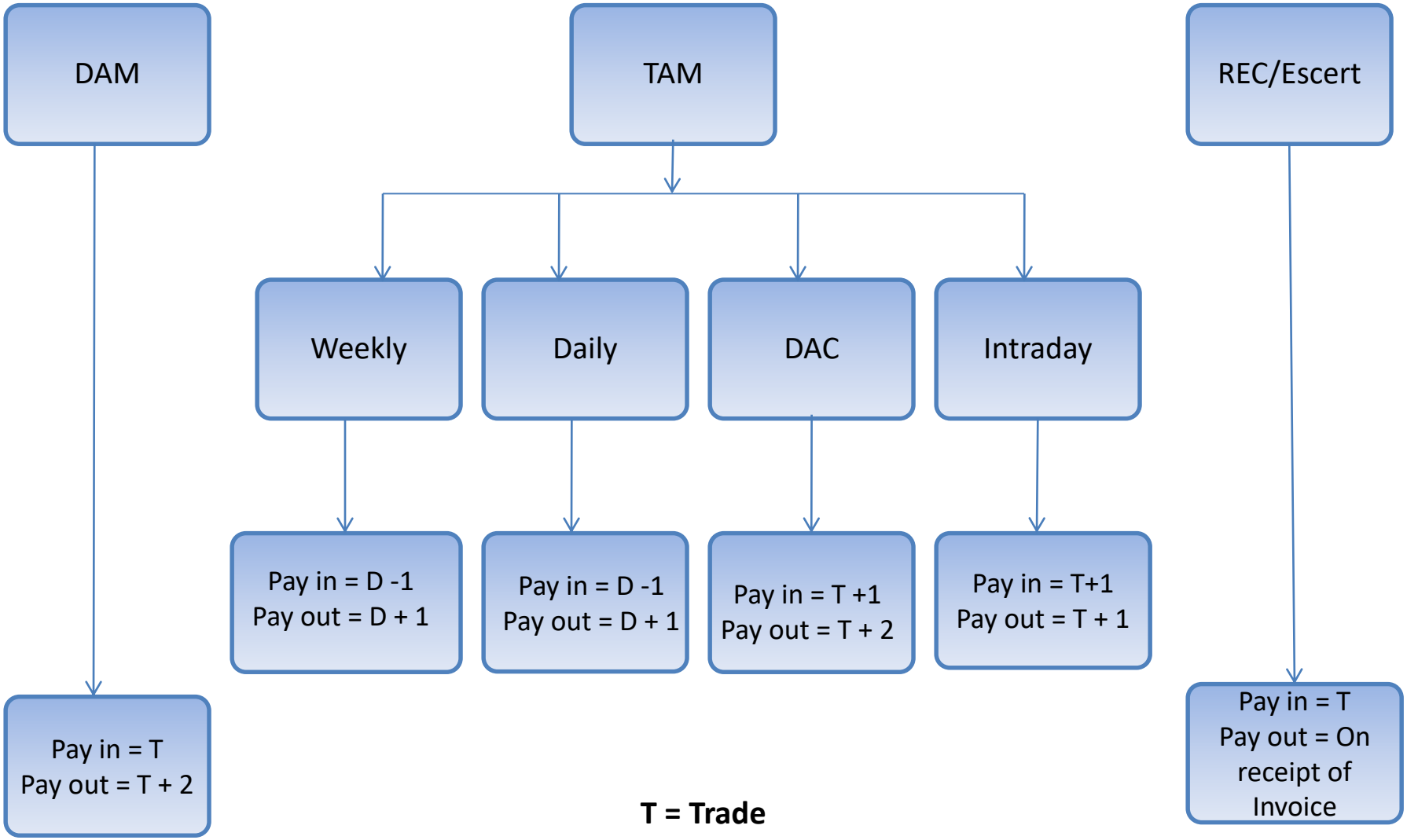
- C&S department provides member exposure, collaterals management on a day to day basis to enable smooth trading on the Exchange.

- IEX adopted best practices while formulating prudent Margining systems. Members risk is monitored constantly. Some key risk management measures are:

  - ✓ Margins and Pay in are collected as per the settlement cycle to maintain the efficacy of risk management.
  - ✓ Margins are maintained by the Members on a gross basis (purchase) across clients of the exchange.
  - ✓ There is no offsetting of positions of different Clients of a Member in the same market.

Payment and Settlement

Time Lines - Pay in / Pay out



T = Trade

D = Delivery

Risk Management:

Trader Member
• On T day (T stands for trade) at 09:30 hrs: Pre-trade Margin Check. - Equal to the initial margins or average of last 7 days' trading value, whichever is more. • T day at 13:30 hrs: Preliminary Obligation Margin Check - Preliminary Obligation =< Funds Available (incl initial margin), Block funds • T day at 15:30 hrs. : Pay-in • At T+2 11:00 hrs. Pay-out

- Each Member need to open a Settlement Account in a Clearing to settle its daily obligation , Margin and exchange related annual fees.

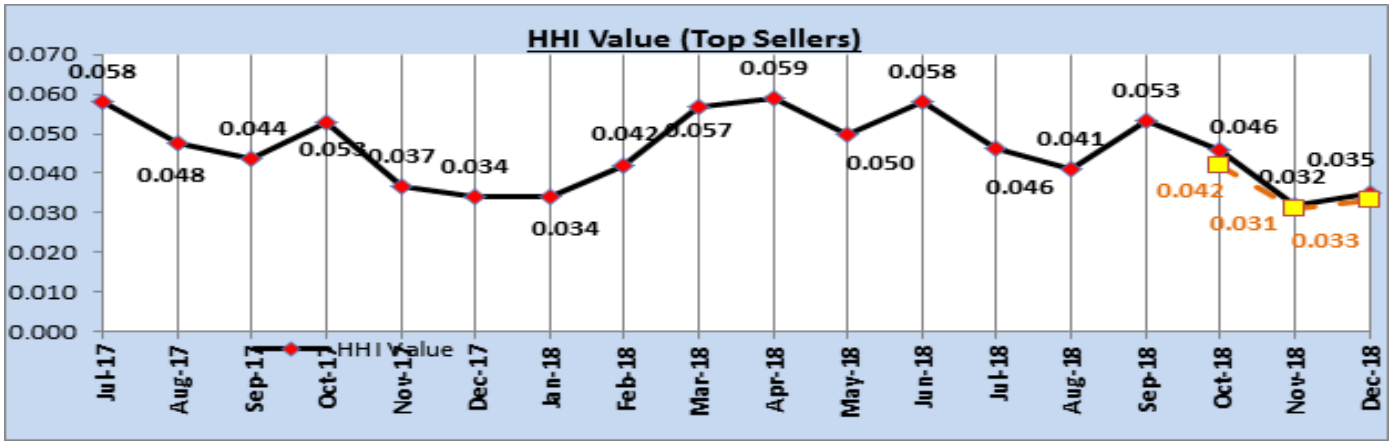
Financial Risk:-Exposure to Member-Risk Mitigation through Margin Process

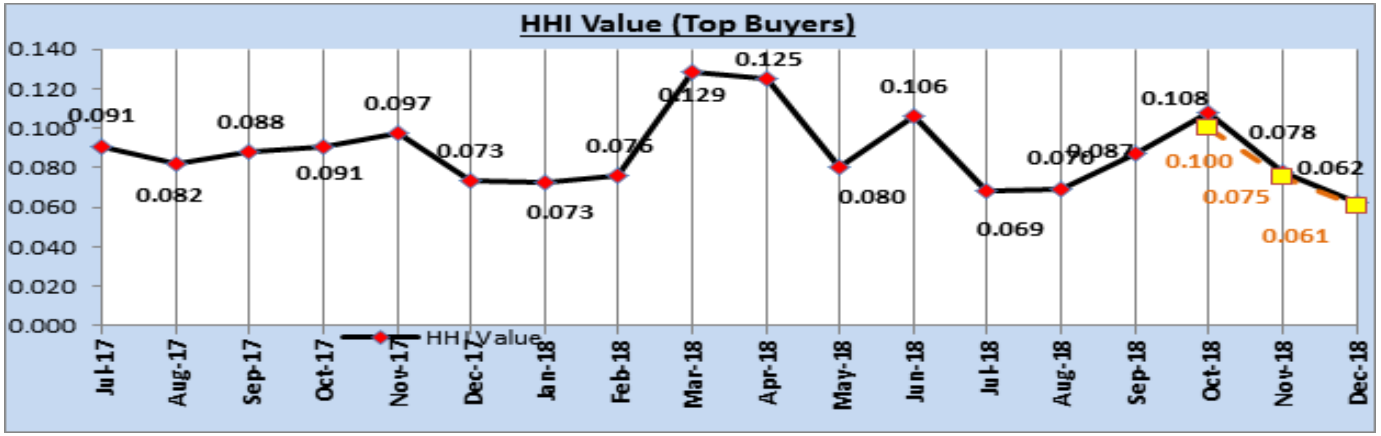
	Proprietary/Trading Licensee Members		Professional Members (client settlement a/c)	
	Initial Margin	**Basis/Additional Margin**	**Initial Margin**	**Basis/Additional Margin**
Day-Ahead Market	Margin equal to Last 7 Days Average of Buy turnover		As per Bank Balance less Hair Cut Factor	
TAM-Intraday	105% of Trade Value	-	105% of Trade Value	-
TAM-DAC	105% of Trade Value	-	105% of Trade Value	-
TAM-Daily	5% of Trade Value	50% of Trade Value	5% of Trade Value	50% of Trade Value
TAM-Weekly	5% of Trade Value	4 days Trade Value	5% of Trade Value	4 days Trade Value
REC	100% of Trade Value	-	100% of Trade Value	-

Funds Management

- Pay in / Pay out & Margins Processing transactions done through electronic interface between exchange & banks.
- All third party payments to NLDC/RLDCs and SLDCs are done electronically after taking confirmation from respective LDC with regard to their bank account details.
- Daily reconciliation of Member's/NTL clients funds obligation.
- Weekly reconciliation of charges with SLDC.
- Monthly reconciliation of charges with NLDC.
- Maker and Checker Process for any transaction.

5. Increased competition- HHI for IEX transactions





- HHI below 0.01 (or 100) indicates a highly competitive index.
- **HHI below 0.15 (or 1,500) indicates an un-concentrated index.**
- HHI index between 0.15 to 0.25 (or 1,500 to 2,500) indicates moderate concentration.
- HHI index above 0.25 (above 2,500) indicates high concentration.

CROSS BORDER ELECTRICTY TRADE

INTERNATIONAL SCENARIO & SAARC STATUS

Cross Border trade through Exchange

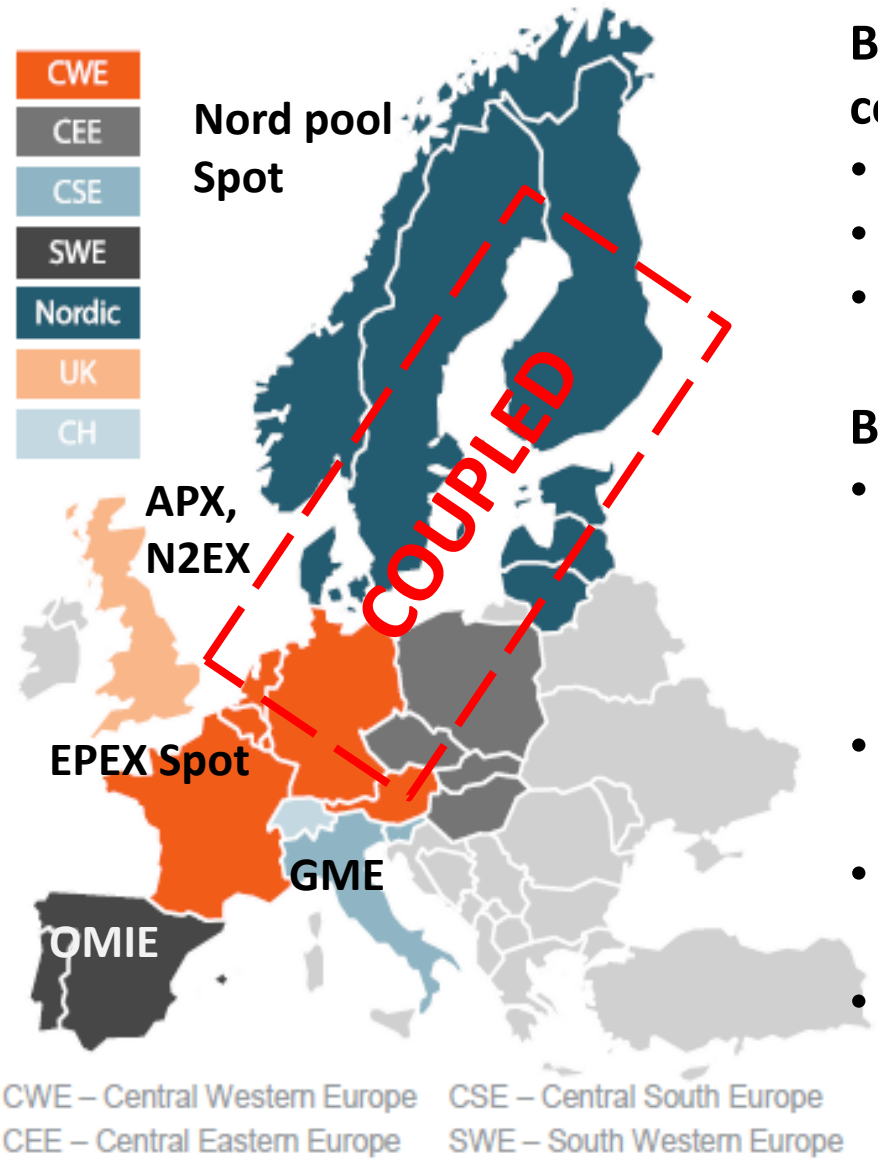
- Globally, countries have harnessed the resources by integration of power markets to harness greater system reliability, optimization of investments and optimum utilization of resources across border.

- Most **countries achieved efficient utilization of cross border transmission capacity and linking of the electricity markets of the neighboring companies through the Day Ahead Markets.**

- **European Union (EU) established a single electricity market through Day Ahead Market across 28 countries. Similarly, South African Power pool (SAPP) integrated 12 countries to form a common market offering Day-ahead contracts.**

- Cross Border transactions is expected to be much less compared to the surplus power in DAM. Therefore allowing cross border transaction cannot have any adverse impact on Indian markets.

Cross Border Integration of European Market



By 2015: North-West & South-West Europe coupled

- 19 Countries
- 75 % of Europe's energy
- 3000 BUs Consumption PA

Benefits:

- Price differences between each spot market are minimised, with convergence at times when there is sufficient capacity
- Capacity usage is optimized
- Perfect Market arbitrage
- Integrated market, higher security of supply through market integration

Evolution of Market Coupling in EU

- Market Coupling is linking separate day-ahead markets using cross-border transmission capacities. **It is conceptually similar to market-splitting being used internally for Day-ahead markets in India.**

2006

Trilateral market Coupling

(**France, Belgium Netherlands**)

2010

CWE **Pentalateral** Market Coupling

(**Germany, Austria** Joined)

2011

BritNed coupling

(**UK Joined**)

2014

North West Europe (NWE) coupled

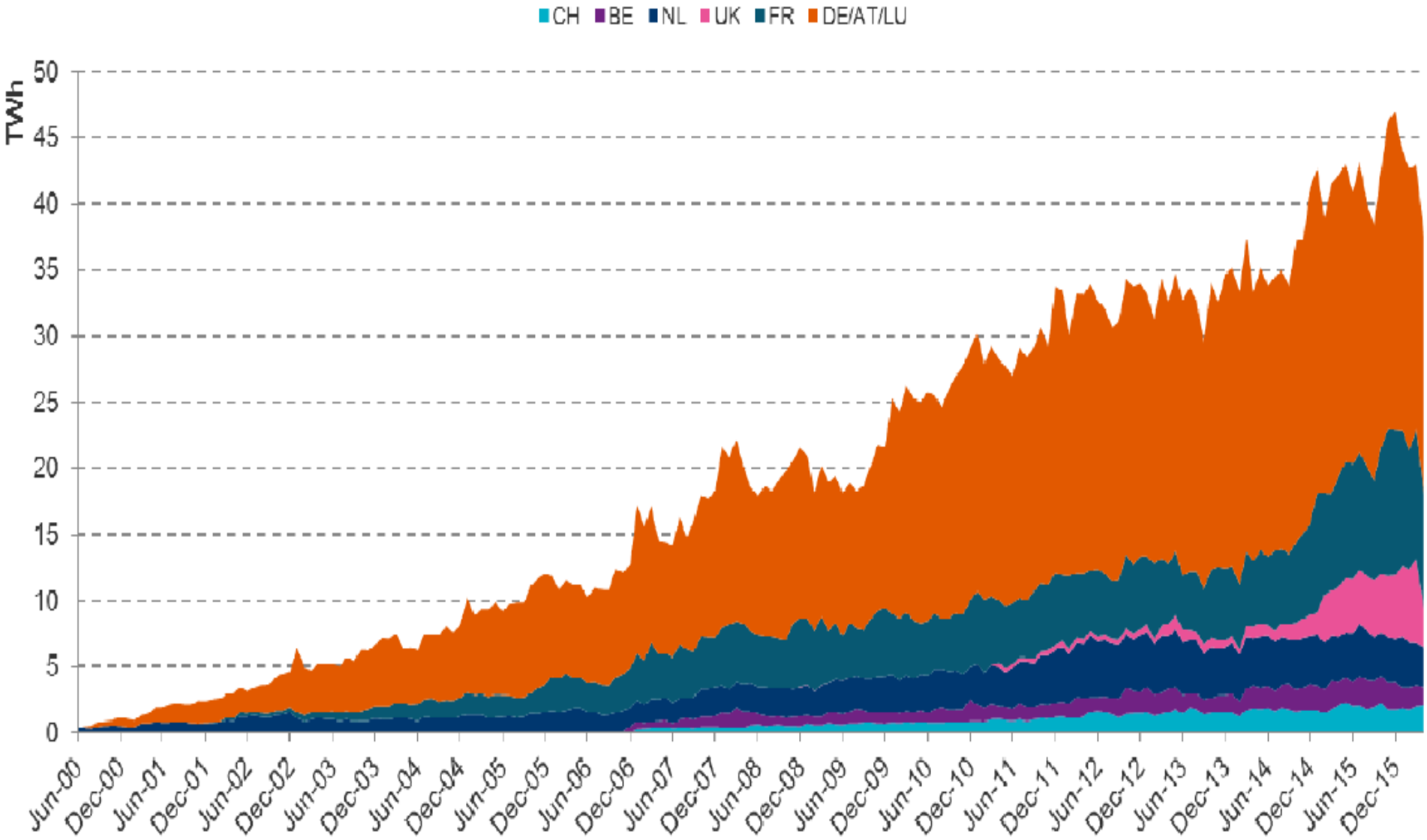
- Italy, Slovenia, Iberia joins NWE

2015

NWE, SWE, CEE Coupled

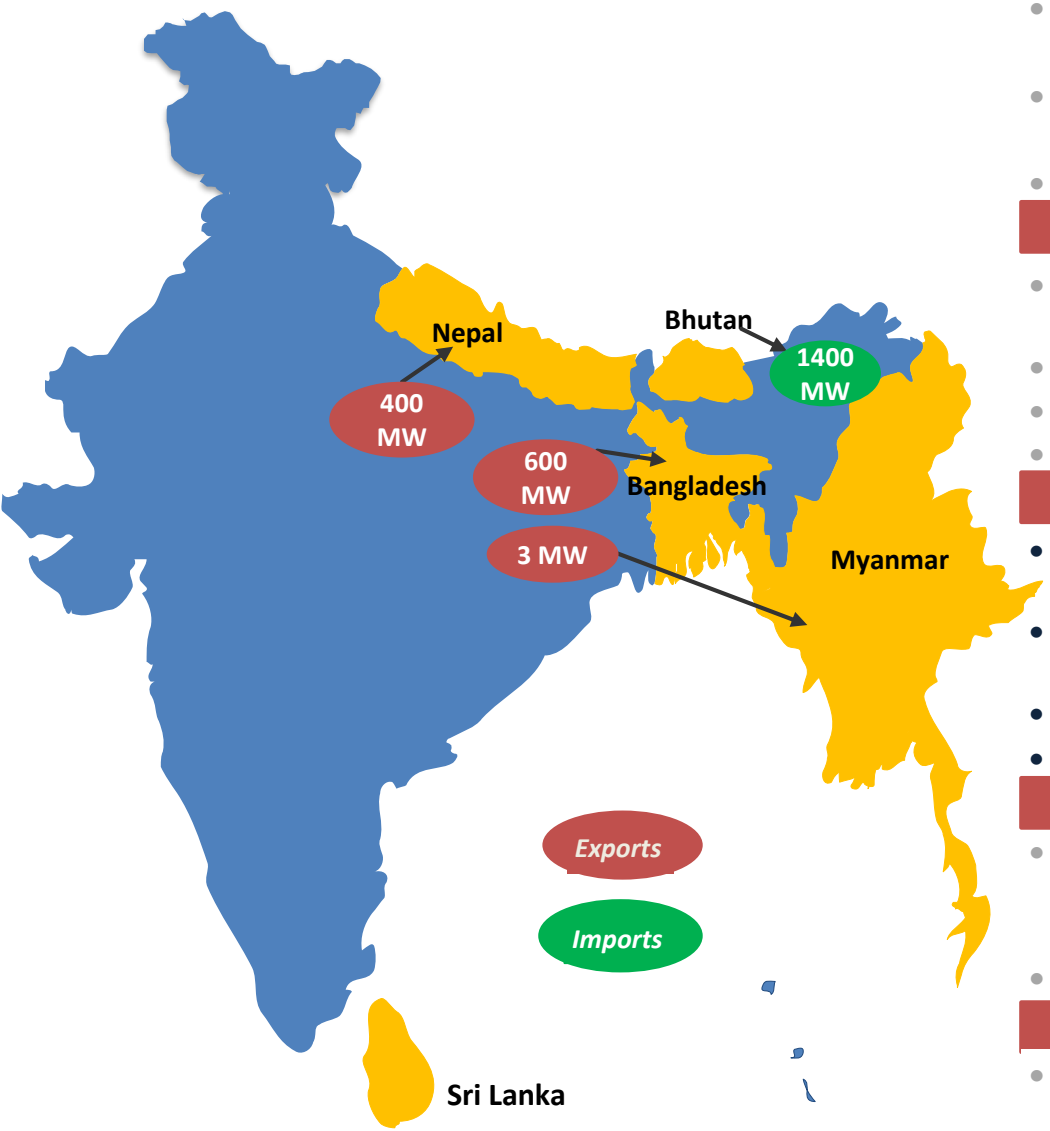
- Spain, Portugal
- Czech, Slovakia, Hungary Join

Growth in Day Ahead Trade Volumes in EU



CH: Switzerland , BE: Belgium, NL: Netherlands, DE: Germany, AT: Austria, LU: Luxembourg

Today: India trades ~2500 MW / ~13BUs with its neighboring countries in S Asia (Nepal, Bangladesh, Bhutan)



Bhutan

- Power surplus: Primarily hydro power; India purchases all surplus as per the **2006 Inter-Governmental Treaty**
- **Total imports of ~1500 MW or 5.6 BUs**; existing **1500 MW transmission capacity**
- **Seasonal generation**, concentrated in **May-Sept.** period

Bangladesh

- Power deficit: Peak demand of ~13 GW and capacity of ~12 GW however, effective capacity of ~9GW (lack of gas)
- **India exports 600 MW or 5.3 BUs**, to meet B'desh's deficit
- **600 MW** transmission capacity**; expected to double** in 5 years
- **Power deficit situation to continue for next 10 years**

Nepal

- Power Deficit: Instances of blackouts during dry seasons; expected to be surplus during monsoon in 5 years
- India financed hydro projects currently stuck owing to land-acquisition challenges
- **India exports 400MW** or 1.8 BUs
- Transmission capacity to be **expanded to 1000 MW** (400 MW now)

Myanmar

- Power surplus: Internal demand is low due to **poor grid connectivity within Myanmar** – only 35% households connected to their main grid
- **India exports 3 MW** or 0.03 BUs; no inter-regional transmission

Sri Lanka

- Power sufficient, though costs are high due to expensive oil imports
- **No power trade currently** given **lack of transmission capacity**;
- 500 MW transmission capacity to come up by ~2030

Enabling Steps for Cross Border Trade through Exchange

Guidelines issued by Ministry of Power ✓

CERC to notify Regulations for Cross Border Trade ✓

CEA notified draft CBR (Conduct of Business Rules) ✓

IEX to file for changes in contract specs in line with CERC regulations and CEA rules — In process

Guidelines on Cross Border Trade through Exchanges in India

- **Guidelines issued by Ministry of Power:** allows cross border trade through power exchange

- **CERC notified Cross Border Trade of Electricity Regulations, 2019 on 8th March 2019.**

- **Trade Through Indian Power Exchanges:**
  - Participating Entity of neighbouring Country can trade on Power Exchange only through Indian trading licensee.
  - For such trading, the trading licensee is required to take approval from Designated authority for specific quantum.
  - There is no restriction on the market i.e. DAM/TAM in which such transactions can be executed.
  - There is no restriction on IMPORTS into India through Power Exchange.
  - There is certain restriction on Indian exporters –
    - Only Imported Coal, Hydro, Gas, RE plants allowed to export

CERC Regulation

Salient Features

- **Designated authority** in India will grant **approval for export or import of electricity to/from India**.
- CBT shall be allowed through **mutual agreements** under the overall framework of agreements signed between India and the neighbouring country(ies).
- Tripartite agreements will also be allowed under the framework of bilateral agreements

➢ ***Tariff Determination***

- For import/export: Either determined through competitive bidding or mutual agreement or government to government agreements.
- For import from Hydro Plant: CERC may determine tariff based on request of the entity of neighbouring country through its government.

➢ ***Trade Through Indian Power Exchanges:***

- Participating Entity of neighbouring Country can trade on Power Exchange only through Indian trading licensee.
- For such trading, the trading licensee is required to take approval from Designated authority for specific quantum.
- There is no restriction on the market i.e. DAM/TAM in which such transactions can be executed.
- There is no restrictions on import or export of power through Power Exchange

➢ ***Transmission charges:***

- PoC injection charges or withdrawal charges for delivery of electricity at the pooling station within India shall be governed as per provisions of Sharing Regulations.

CERC Regulation

- ***Cross Border Transmission Link (CBTL) :***
  - The CBTL to planned jointly by Transmission Planning Agencies of the two countries
  - Not form a part of the basic ISTS network for the determination of PoC charges under the Sharing Regulations.
  - A generating station in neighbouring country may develop and operate the dedicated transmission system from the generating station to the pooling station within India at its own cost.
- ***Connectivity, Long Term Access, Medium Term Open Access and Short Term Open Access:***
  - long-term access or medium-term open access shall be made to CTU
  - short-term open access through NLDC under Regulations with approval of DA.
- ***Scheduling:***
  - Scheduling shall be carried out for each 15-minute time block.
  - Transmission System losses declared on weekly basis borne in kind by the buying/selling, as the case may be, as per the quantum
  - The respective party will inform their requisitions to the Settlement Nodal Agency.
  - SNA will co-ordinate with System Operators of respective neighbouring countries for scheduling of cross border transactions and revisions during the day of operation
- ***Transmission Losses:***
  - Withdrawal PoC losses as applicable shall be applied at the interface.
  - Injection PoC losses of respective injection grid shall be applied at the interface.
  - Net schedule after applying injection PoC loss of the concerned injection zone and withdrawal PoC loss

Draft conduct of Business Rules for Cross Border Trade of Electricity (1/2)

- Designated Authority (DA), **CEA** has proposed draft procedures for facilitating Cross Border trade of electricity on **26.04.2019**.
- Salient features of the proposed Rules are as under:
- **Objective**:
  - 1. *To grant approval to eligible entities to participate in Import/Export (Cross Border) of Electricity*
  - *2. Approval of transmission links with the neighbouring country*

– **Approval of DA to participate in Import/Export (Cross Border) of Electricity**:

➢ Approval of DA not required where the import/export is taking place under the Inter Government Agreement signed by India and neighbouring country for specific project.

➢ **Trading in Indian Power Exchange (PX):**

- Indian Trader trading in Day Ahead Market (DAM) in PX on behalf of Entity of neighbouring country **require approval of DA for specific quantum and period**.
- To sell in other products (i.e. other than DAM) of Indian PX, requires to obtain approval from the DA as per Procedure for '**Export of electricity by Indian Entities'**.
- For other than DAM, PX to ensure that the buyer from neighbouring country is able to buy only from approved exporters of India.
- Approval will be given for quantum of electricity (in MW) and time period.
- Applicant to furnish PPA/LoI with the entity of neighbouring country for trade in Indian PX
- The application should also have consent of respective government of the neighbouring country for allowing trade of power.

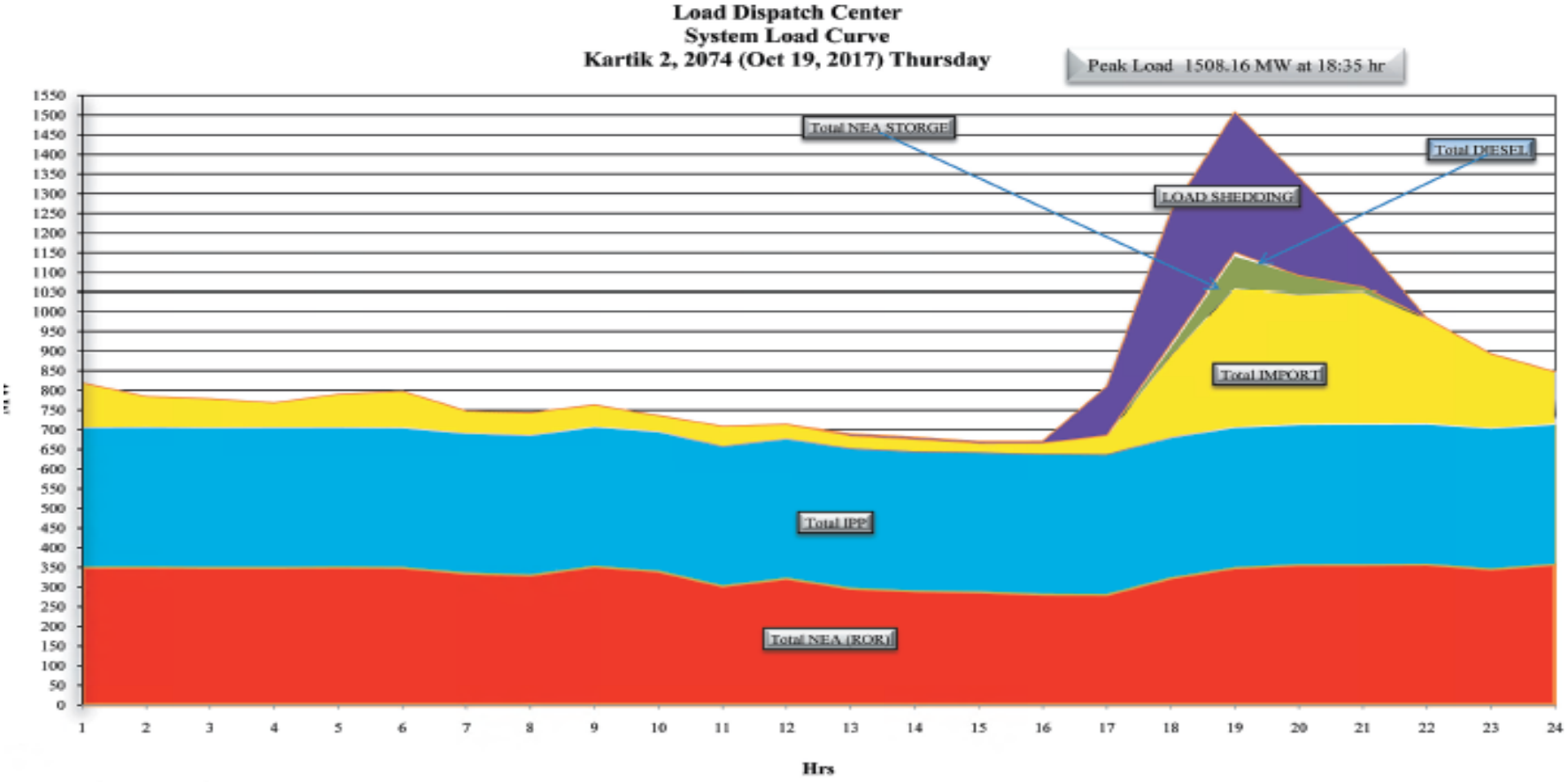
Draft conduct of Business Rules for Cross Border Trade of Electricity (2/2)

- **Import of electricity by Indian Entities:**
  - Allowed from projects with permission to export power to India from the respective Government of the neighbouring country.
  - Allowed from the generation projects located in neighbouring countries directly or through Government or Company, licensed for trading
  - The Applicant shall submit a copy of PPA/LOI from generator of neighbouring country, for import of such power.
- **Export of electricity by Indian Entities:**
  - Generating Companies/ Distribution Companies of India may export directly or through trading licensee(s) of India.
  - Export of electricity generated from coal utilizing imported coal or spot e-auction coal or coal obtained from commercial mining is allowed.
  - The Applicant to submit a copy of PPA)/LOI from entity of neighbouring country, for export of such power, except for those who intend to sell in other products of Indian PX (i.e. other than Day Ahead Market), where establishment of one-to-one transaction is possible.
- The trading licensees of India can apply for STOA to NLDC and MTOA/LTA to CTU for facilitating transfer of power from one neighbouring country to other neighbouring country through Indian Grid, provided it has approval from the DA (or Government of India) for such quantum of power during the period.
- The last date of comments is 15.5.2019

WAY FORWARD FOR NEPAL

Daily Load Curve – Peak and Base Load variation

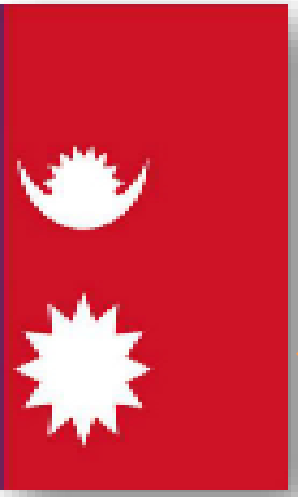
System Load Curve of Peak Load Day



FINANCE DIRECTORATE | FISCAL YEAR 2017/18

Source :NEA Annual Report 2017-18

India-Nepal Transactions Potential



- Exports during wet season
- Significant hydro power export possible

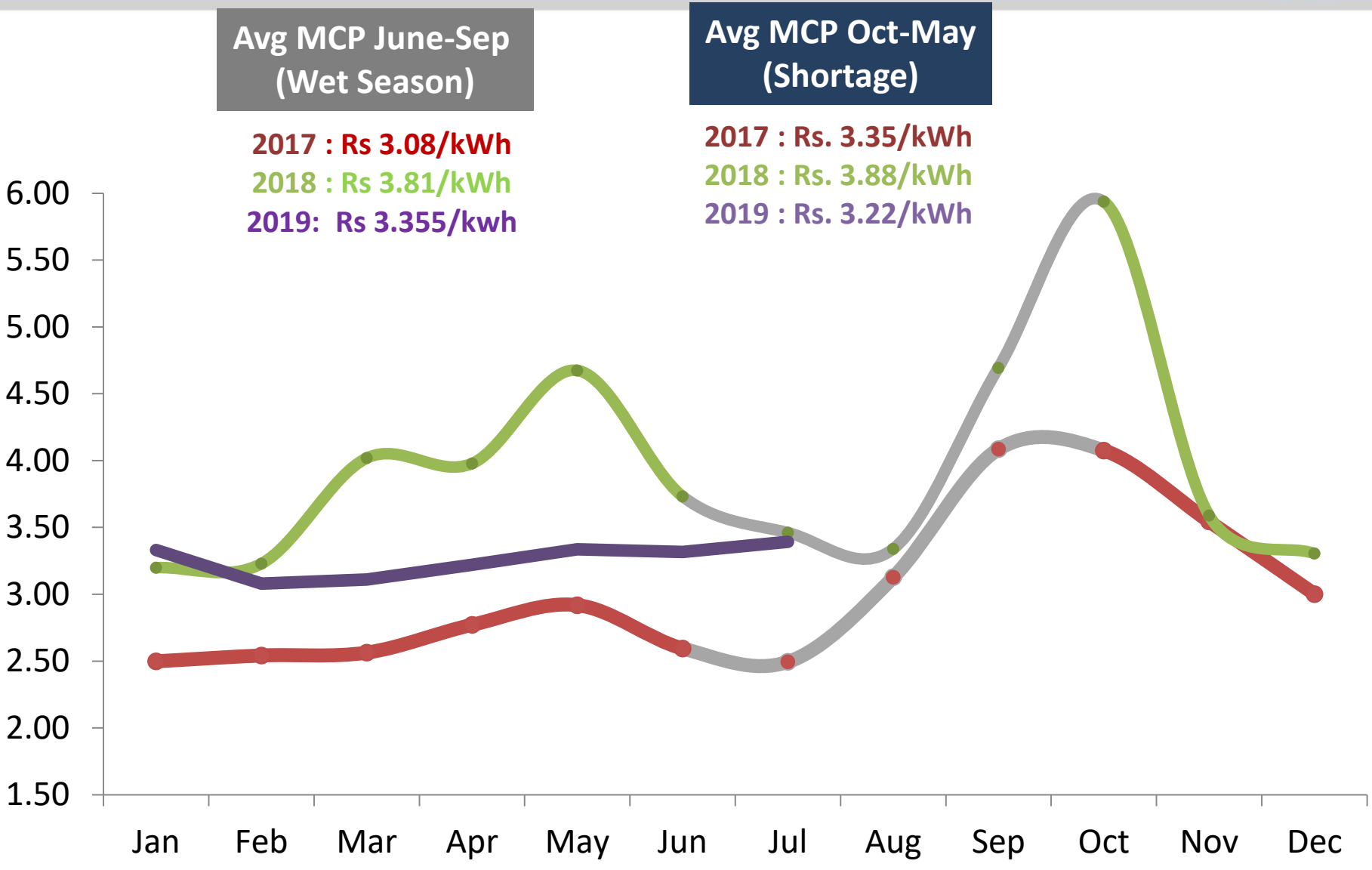
- Thermal power support for load following
- Dry season support

Nepal Import Details

	Quantum	IR Link
Bihar	250-300 MW	Bihar-Nepal (Bihar connections)
DB Power	50 MW	East-Nepal (Dhalkebar-M'pur line)
GMR	25 MW	
Sembcorp Gayatri Power Ltd	120 MW	
Baglihar Hydroelectric Power Project	25 MW	North-Nepal (Tanakpur)
Tanakpur HEP	70 MUs	

- Presently, Bihar is supplying power to Nepal under consultation Power Exchange Committee

IEX Monthly Average Market Clearing Price (Rs./kWh)



INDIA NEPAL CONNECTIVITY

Existing

- 13 cross border interconnections at 11kV, 33kV and 132 kV level through which Nepal draws power upto 240MW.
- ✓ 132 kV Tanakpur line
- ✓ Muzaffarpur(India) – Dhalkebar(Nepal) 400kV D/c line (being operated at 132 kV. total up to 160 MW. Expected at rated voltage of 400 kV by December 2019 (power upto 600 MW can be exported)
- ✓ 132 kV Katiya – Kusaha 2nd circuit and 132 kV Raxaul – Parwanipur S/C Lines. (additional 100 MW can be exported)

Upcoming

- Joint Technical Team (JTT) of India and Nepal has prepared an integrated Master Plan for power evacuation from about 280 hydro projects in Nepal to India totaling to about 45GW installed capacity. Total eleven high capacity cross-border links have been identified to be implemented in phased manner till 2035.
- New Butwal (Nepal) – New Gorakhpur (India) 400kV D/c (Quad) line is proposed to be implemented. (Feasibility report under preparation)

15,800 MW by 2036-40

✓ *Exchange Transaction feasible*

Nepal Portfolio Management through Exchange

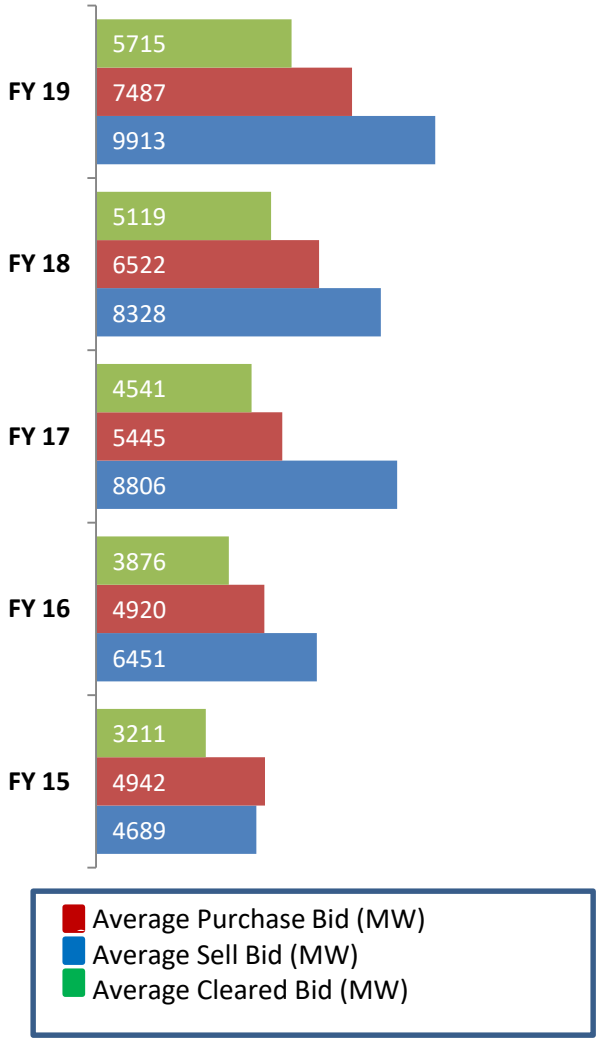
Meeting Shortages

- **Buy Residual Requirement** : when transmission margins are available and demand exits
- **Economise when possible:** Can buy when it's cheaper on IEX and replace costlier power through Bilateral trade to the extent of Contract conditions (~20% in case of 80% take-or-pay contracts)
- **Leverage Value of Stored Water:** Can leverage Storage , similar to Hydro rich state like HP etc., save water for generation in peak hours/ seasons etc.
- **Cheaper Power :** Exchange Prices are lowest during Nepal's peak season (Oct-Feb)

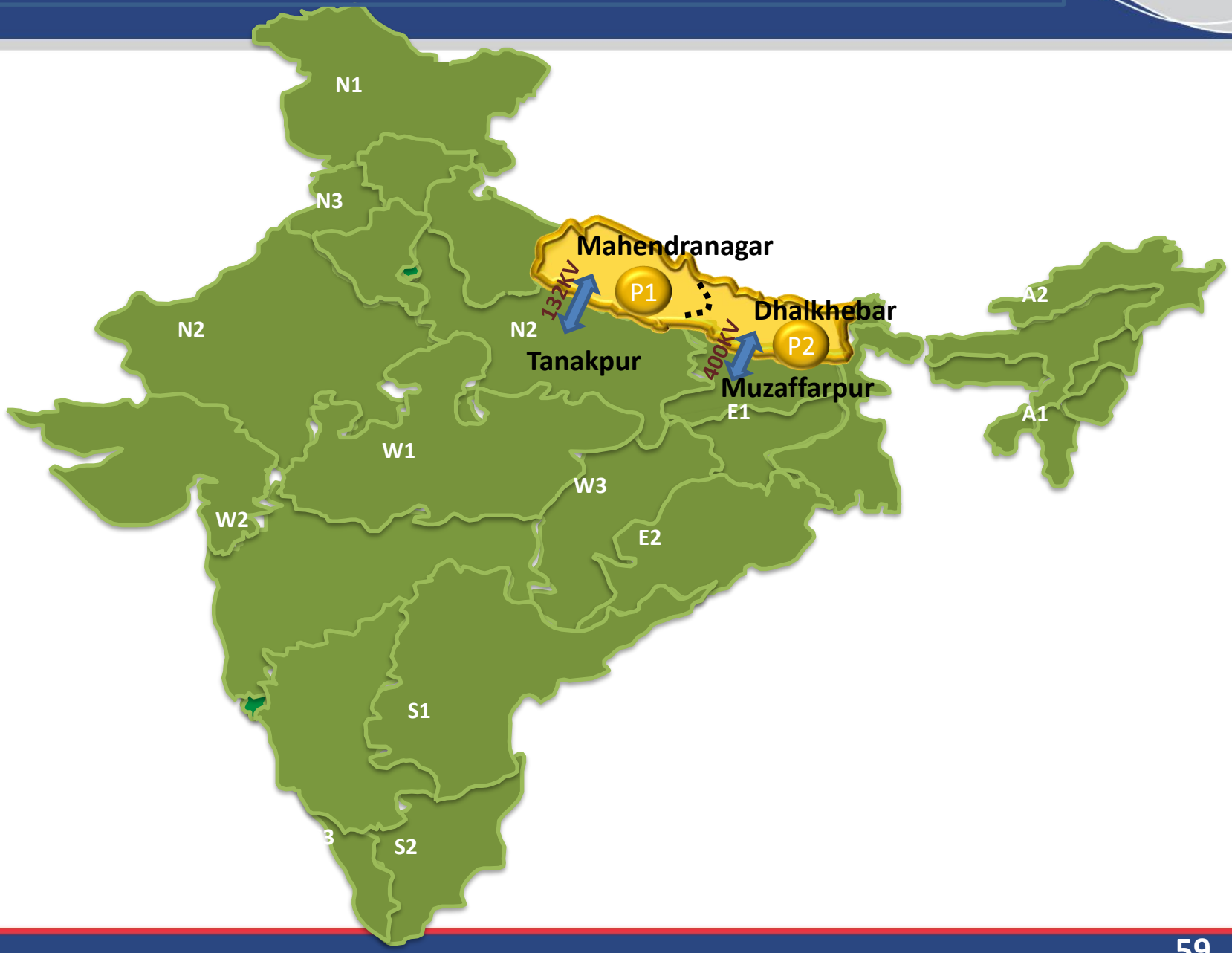
Selling Surplus

- Nepal Going forward will be surplus is wet season
- IEX will offer a very liquid platform to sell the surplus at competitive prices
- Nepal should implement concept of "Value of water" and try to commercially mange manage reservoirs

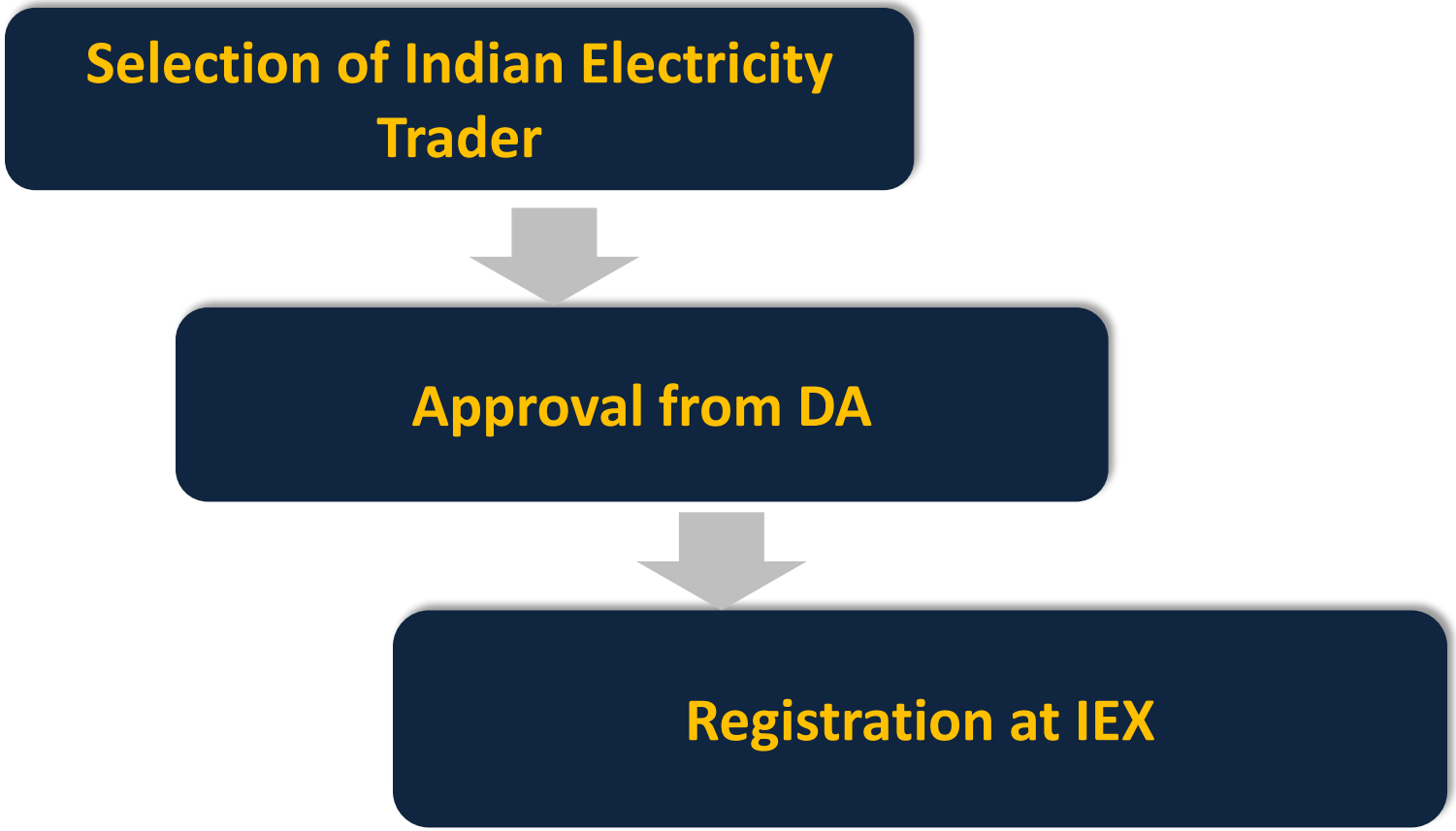
High Liquidity



New Bid Areas & Existing interconnection



Registration Procedure



Thank You

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INDIA-NEPAL: MAJOR INTERCONNECTIONS

S. No	Connection Point	Present Import (MW)
1	Kusaha-Kataiya (132kV)	Around 200
2	Gandak - Ramnagar (132kV)	25
3	Tanakpur - Mahendranagar (132kV)	30
4	Kataiya (Bihar) - Rajbiraj (Nepal)(33kV)	7
5	Sitamari (Bihar)- Jaleshwor (Nepal) (33kV)	10
6	Raxaul (Bihar)- Birganj (Nepal) (33kV)	10
7	Jaynagar (Bihar) – Siraha (Nepal) (33kV)	7
8	Nanpara – Nepalgunj (33kV)	10

Load Forecast: Nepal

Fiscal Years	Energy (MU)	Peak Load (MW)
2017-18	7,489	1,644
2018-19	8,391	1,842
2019-20	10,138	2,225
2020-21	12,017	2,638
2021-22	13,952	3,062
2022-23	15,332	3,365
2023-24	16,869	3,703
2024-25	18,579	4,078
2025-26	20,585	4,519
2026-27	22,826	5,011
2027-28	25,332	5,561
2028-29	28,111	6,171
2029-30	31,196	6,848

Source :NEA Annual Report 2017-18