



## Webinar on

# Enhancing Participation in Real Time Electricity Market

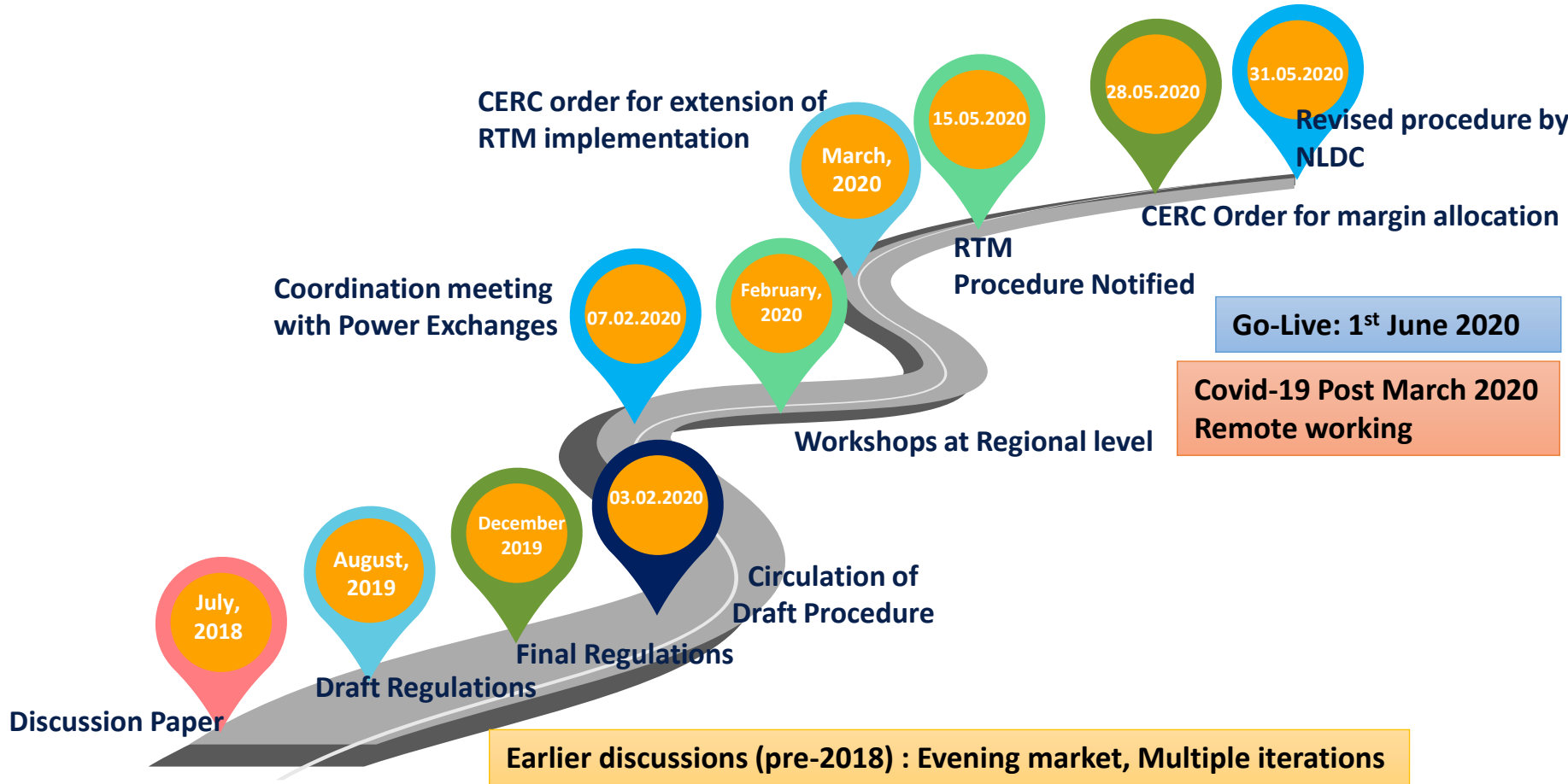
## Real Time Market (RTM) in India System Operators Perspective

**S C Saxena**

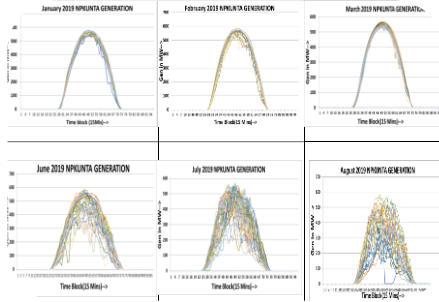
**Sr. General Manager (Market Operation)**

**National Load Despatch Center (NLDC), POSOCO**

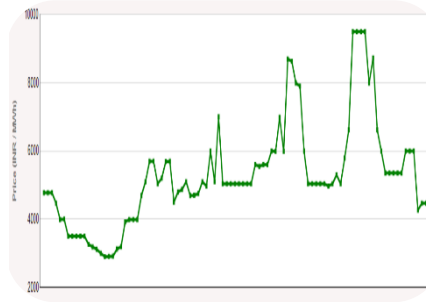
# Evolution of Real Time Market in India



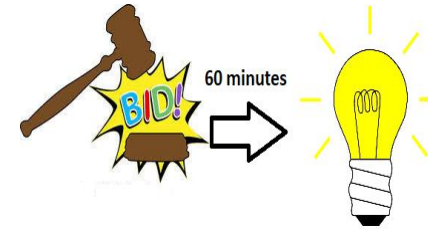
# Objectives



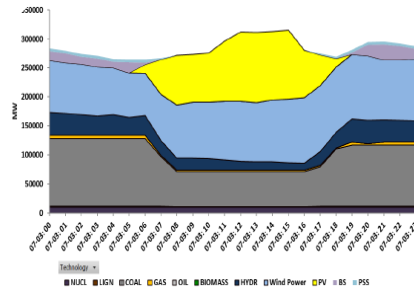
**Balancing avenue mitigating variability**



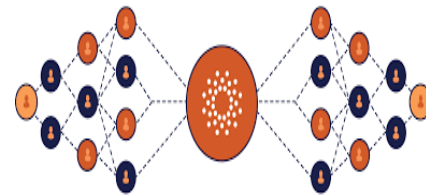
**Managing price volatility**



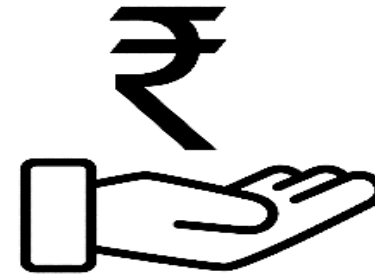
**Fast market and defined processes (gate closure)**



**Better portfolio management**



**Access to larger generator reserves pool**



**Additional revenue opportunity**

# Salient Features

- Half hourly market
- 15-minutes bidding window
- 15-minutes clearing window
- 48 times bidding and clearing every day.

## Duration



- 30 minutes (two time-blocks of 15 minutes each)
- Financially and physically binding

## Delivery



- Double sided closed auction
- Uniform pricing
- Price and Volume discovered for every 15 minutes

## Price Discovery



- End of the right to revision of schedule or declared capability for specific half hour
- RTM window closes
- 1 hour time between gate closure and delivery

## Gate Closure



- National Load Despatch Centre (NLDC), POSOCO
- Ensure grid security and reliability through ATC/TTC declaration.

## Nodal Agency

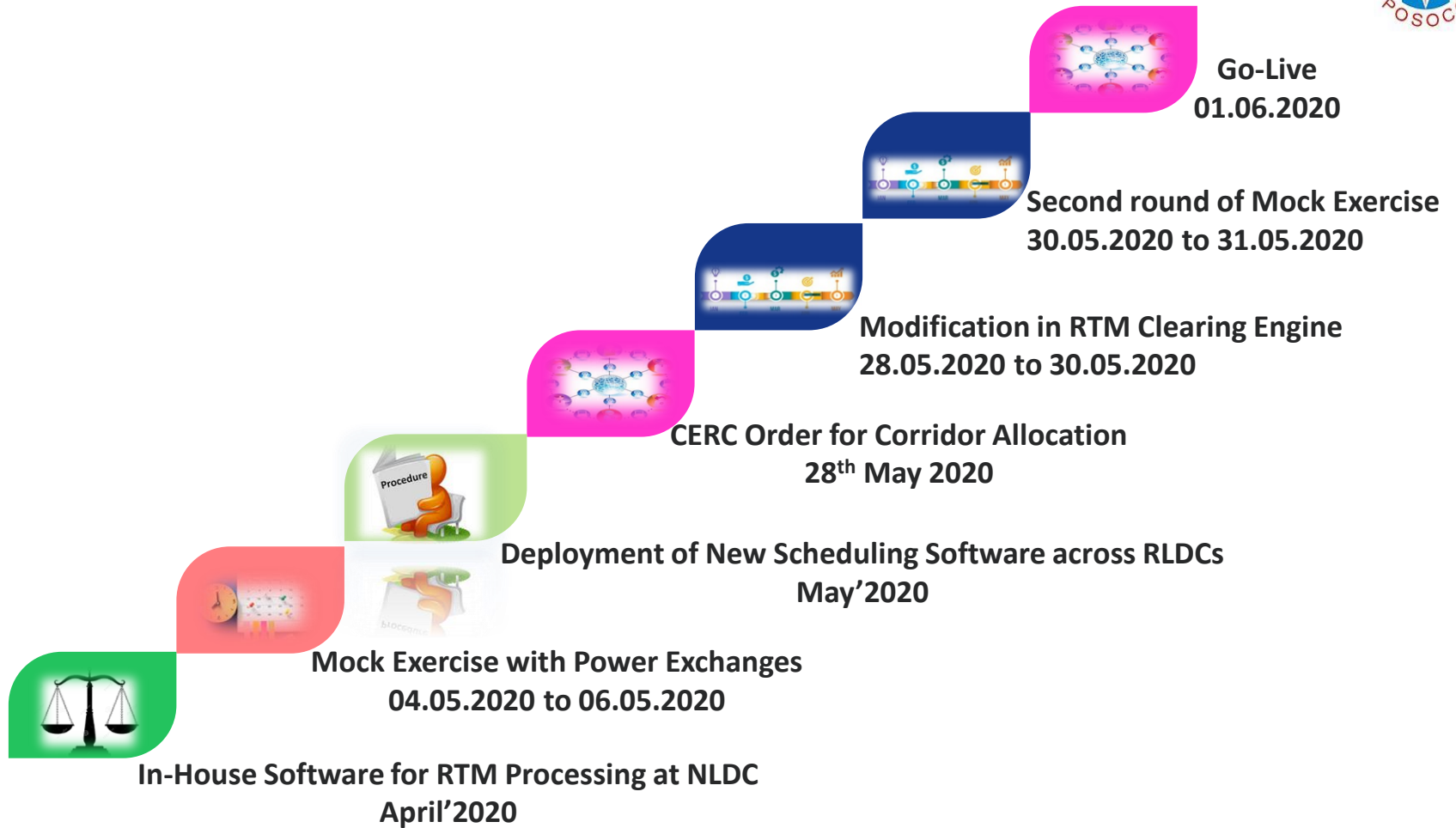


- Cleared volume communicated 45 minutes prior to delivery
- Incorporation in the schedules by RLDCs and SLDCs
- Information to respective generators and discoms.

## Communication



# Software Development for RTM Implementation



# Multiple Power Exchanges

## - Methodology for Corridor Allocation in RTM



### SoR to Framework for RTM

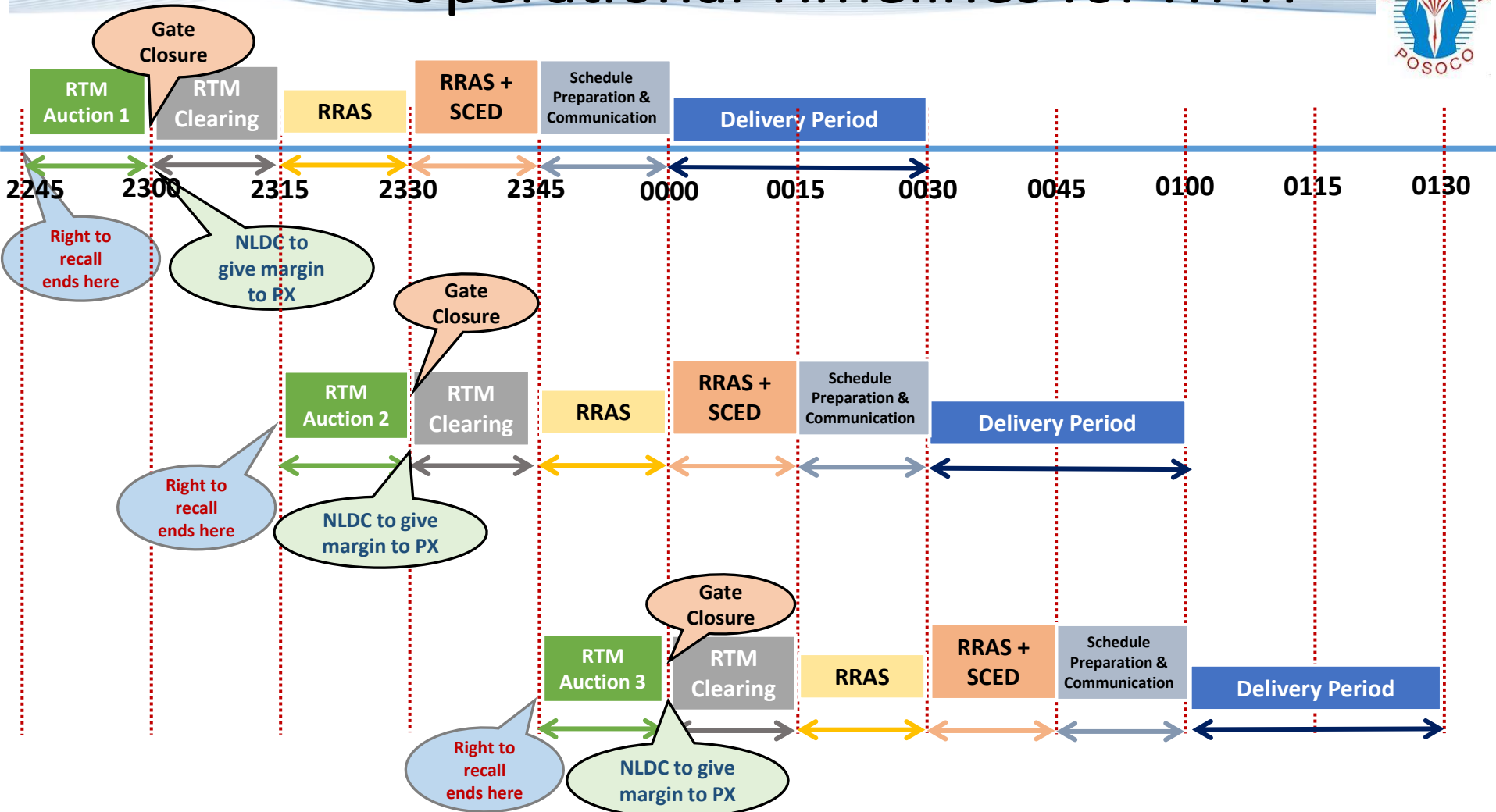
- Upfront allocation of margin in the ratio of DAM Volume
- Submission of final trade result by Power Exchanges

### CERC Order dated 28.05.2020

- Iterative process
- PXs to submit Provisional Solution
- Checking for congestion by nodal agency
- No congestion
  - Provisional solution accepted as final
- Congestion
  - Margin allocation in the ratio of provisional volume

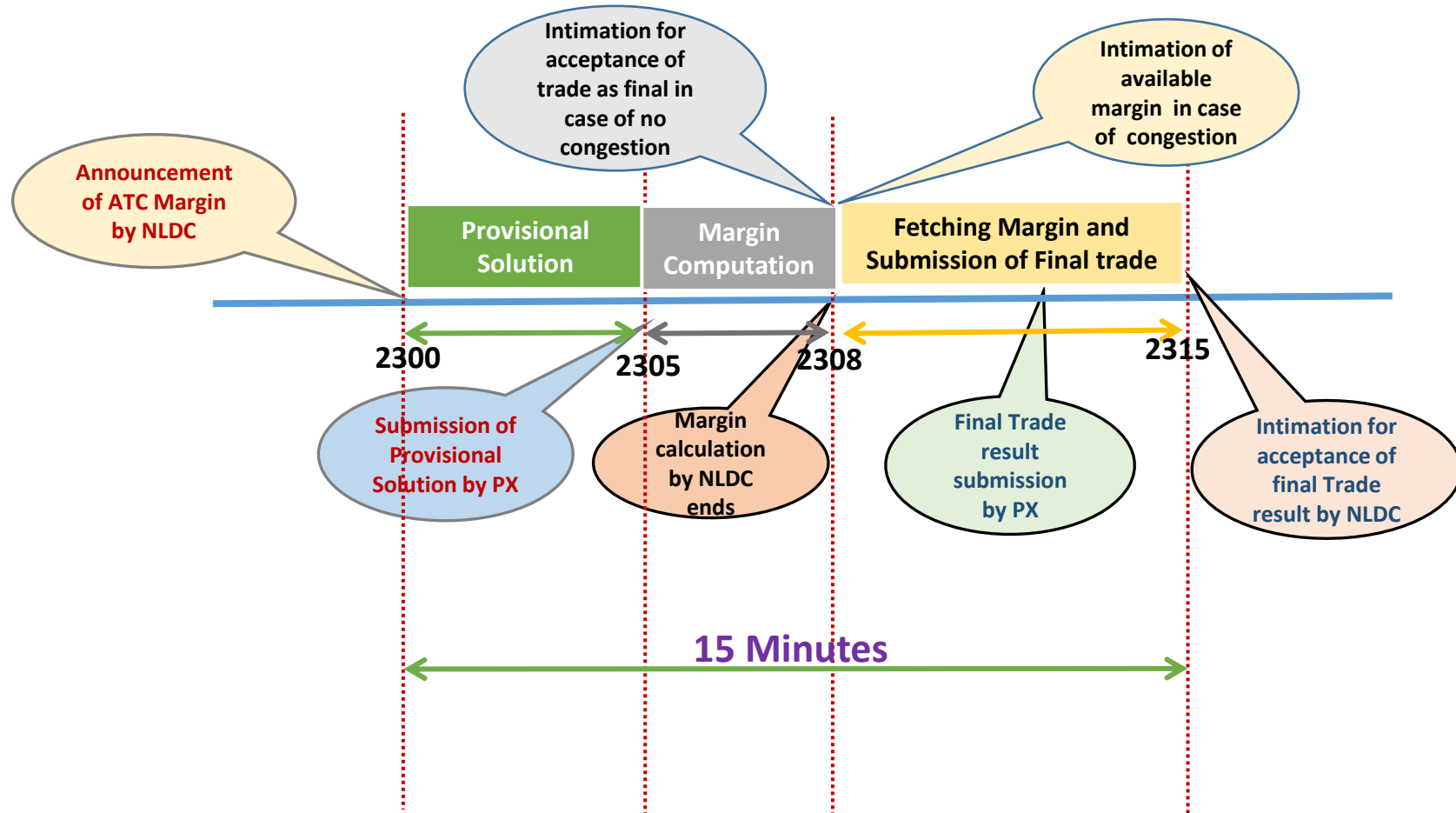


# Operational Timelines for RTM





# Timelines for RTM Clearing





# Software Architecture and Design



- In House
- Fully Automated
- RTM Core Engine
  - REST API,
  - Node.JS
  - Oracle; Mongo DB
- RTM Dashboard
  - REACT.JS
  - Node.JS
  - Mongo DB
- Secure data exchange
- Test Environment

## RTM Dashboard at NLDC

Real Time Market

RTM MCV (10:8:21)  
Delivery Date - 2020-06-12  
IEX MCV (Mwh) - 7882.125  
PXI MCV (Mwh) - 0  
Trade - 10:15-10:30  
Trade Clearance - 10:30-10:45

Activity Log By IEX/PXI/WBES

2020-06-12 10:08:01.111 Response sent: No congestion. Provisional solution accepted as final.  
2020-06-12 10:08:01.065 NLDC received request for ATC margin for runnum 23 from iex  
2020-06-12 10:07:56.051 ATC margin request for runnum 23 from iex denied: Request not received within allowed timeline  
2020-06-12 10:07:56.044 NLDC received request for ATC margin for runnum 23 from iex  
2020-06-12 10:07:54.034 ATC margin request for runnum 23 from iex denied: Request not received within allowed timeline

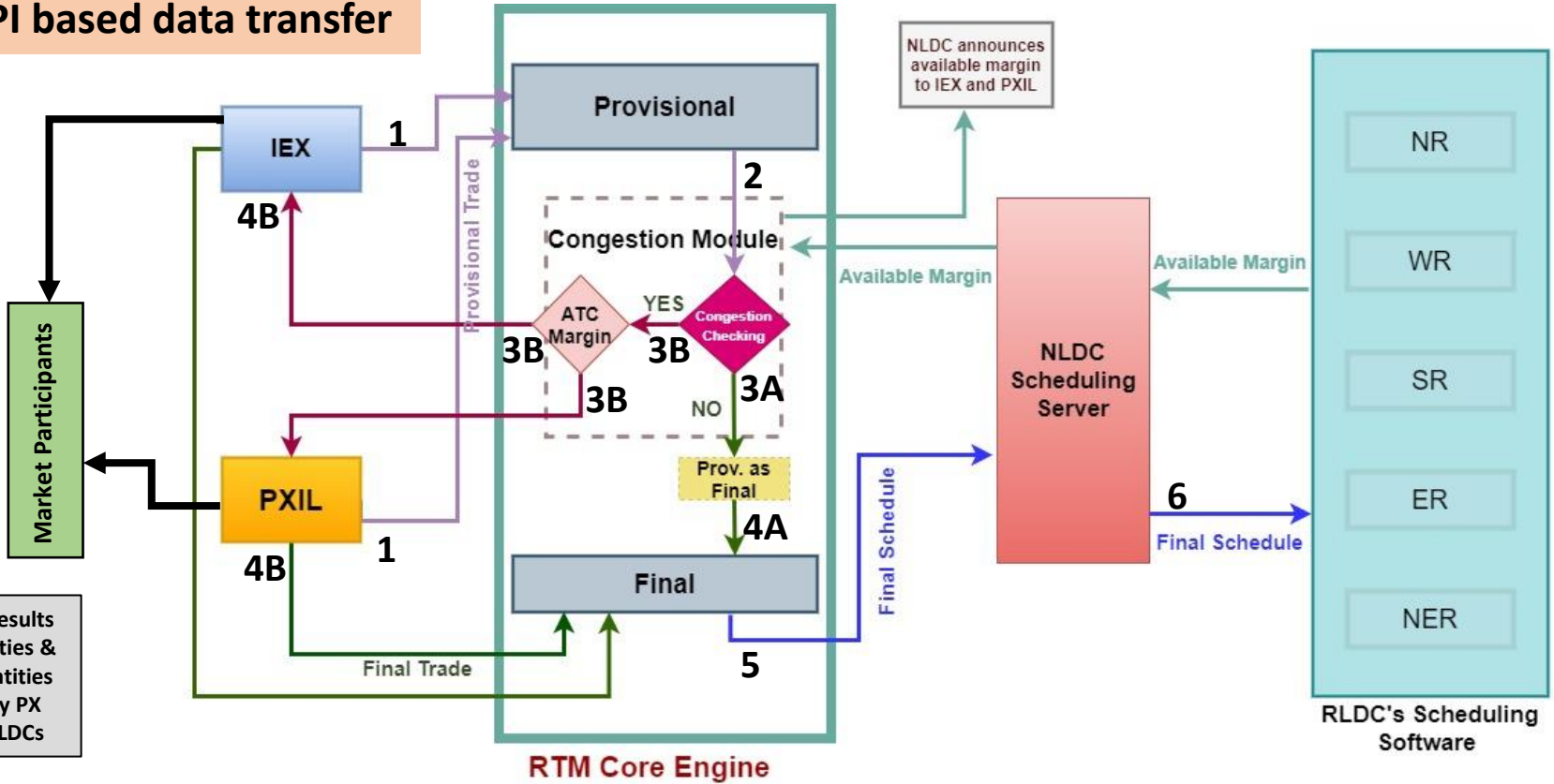
DETAILS OF THE END TO END LAST FOUR RTM RUNS

RUNUM	Time Block	Time	Provisional				Margin			Final			
			IEX	IEX Vol	PXI	PXI Vol	Congestion	IEX	PXI	IEX	IEX Vol	PXI	PXI Vol
23	45,46	11:00-11:30	✓	460.988	✓	0	✗	✗	✗	✓	460.988	✓	0
22	43,44	10:30-11:00	✓	511.035	✓	0	✗	✗	✗	✓	511.035	✓	0
21	41,42	10:00-10:30	✓	511.737	✓	0	✗	✗	✗	✓	511.737	✓	0
20	39,40	09:30-10:00	✓	534.9	✓	0	✗	✗	✗	✓	534.9	✓	0

- Synchronization of WBES at all RLDCs
- Interfacing of WBES and RTM

# Information Exchange

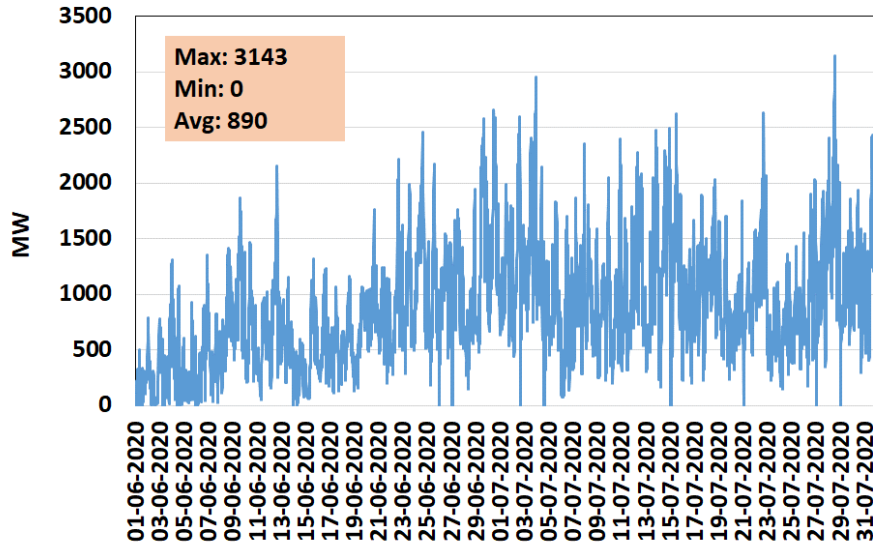
## API based data transfer



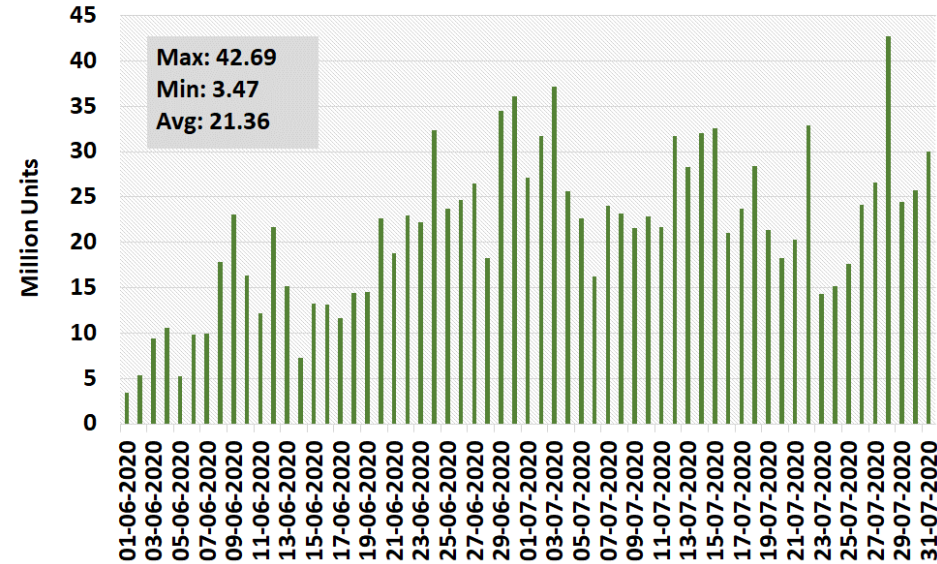
# Total Market Clearing Volume in RTM



Total Block Wise Final Scheduled Volume (MW)



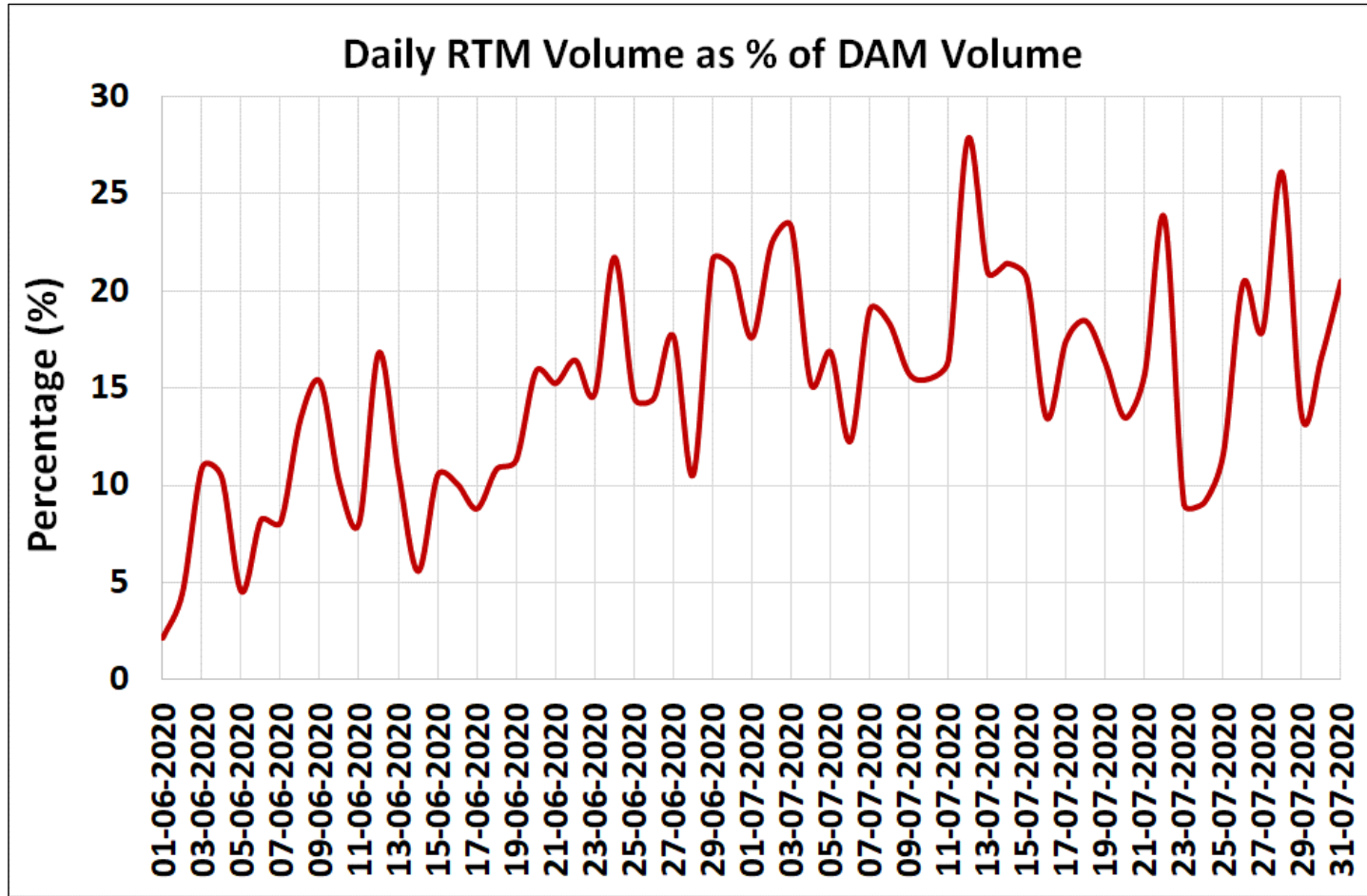
Total RTM Volume on daily basis (MU)



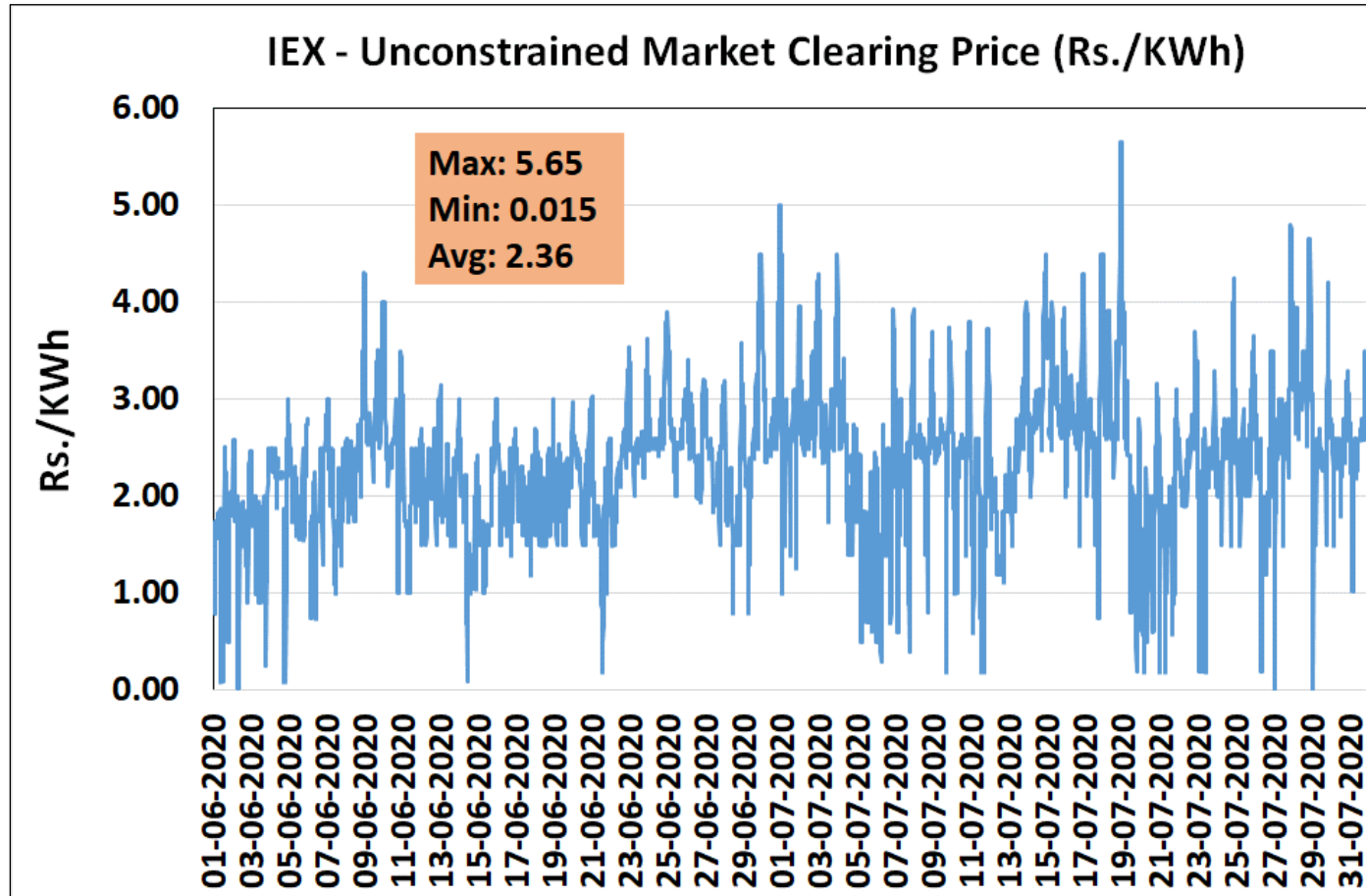
Maximum during 1st June to 31<sup>st</sup> July 2020 > 3000 MW

Average during 1st June to 31<sup>st</sup> July 2020 > 20 MU per day

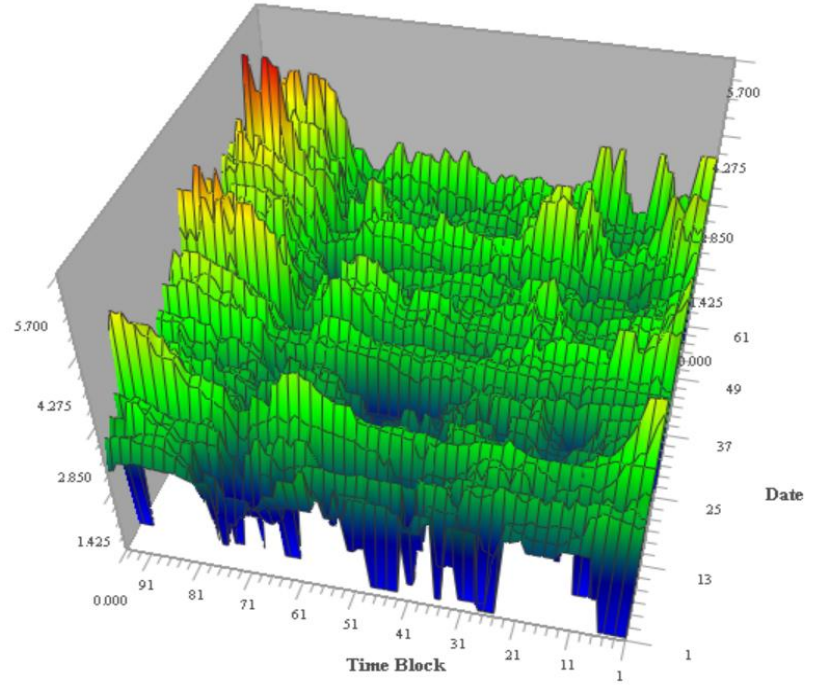
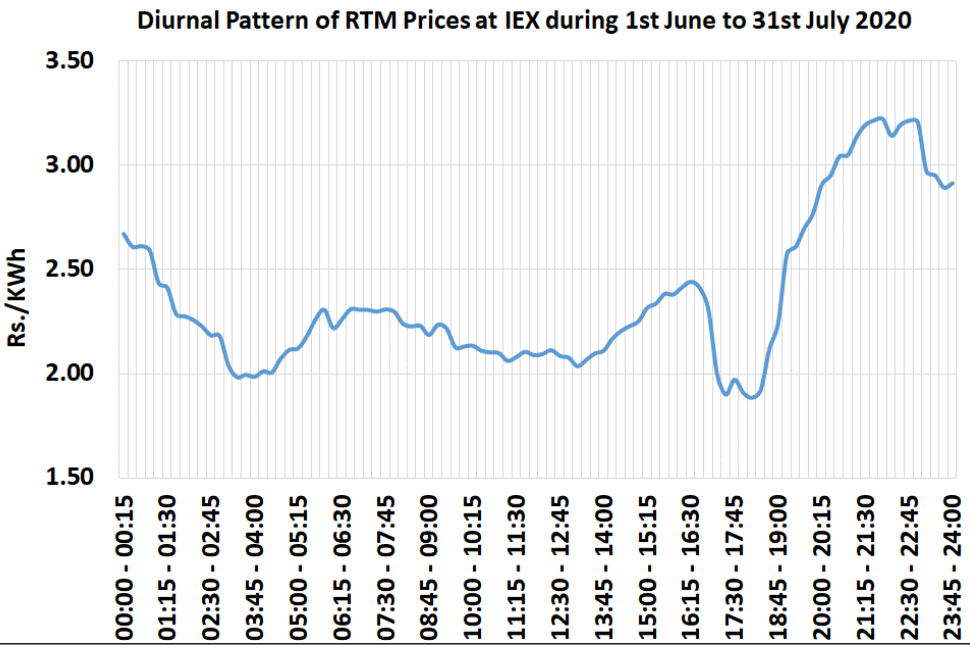
# Volumes in RTM and DAM



# Unconstrained Market Clearing Price

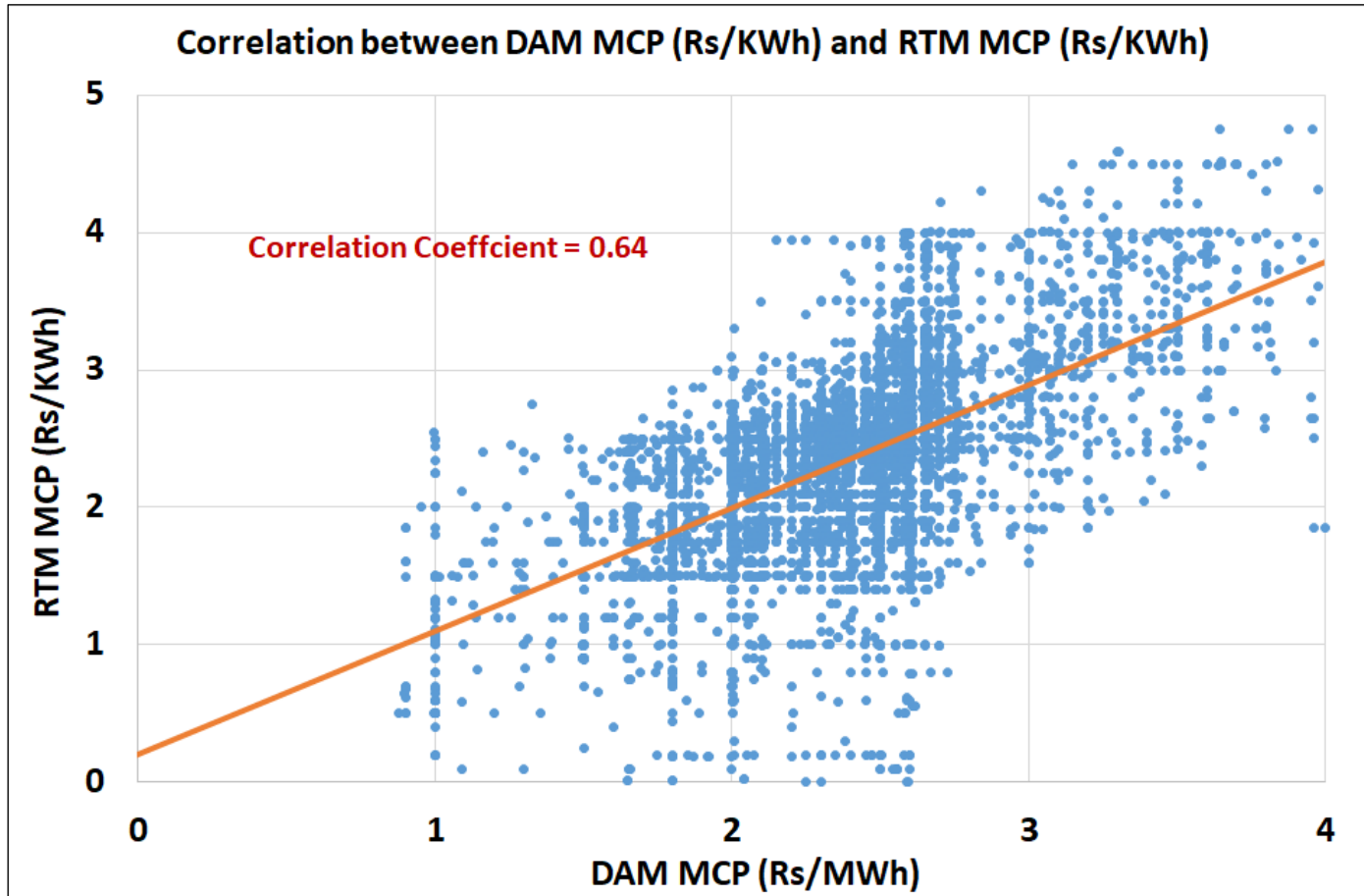


# Diurnal pattern of Market Clearing Prices in RTM



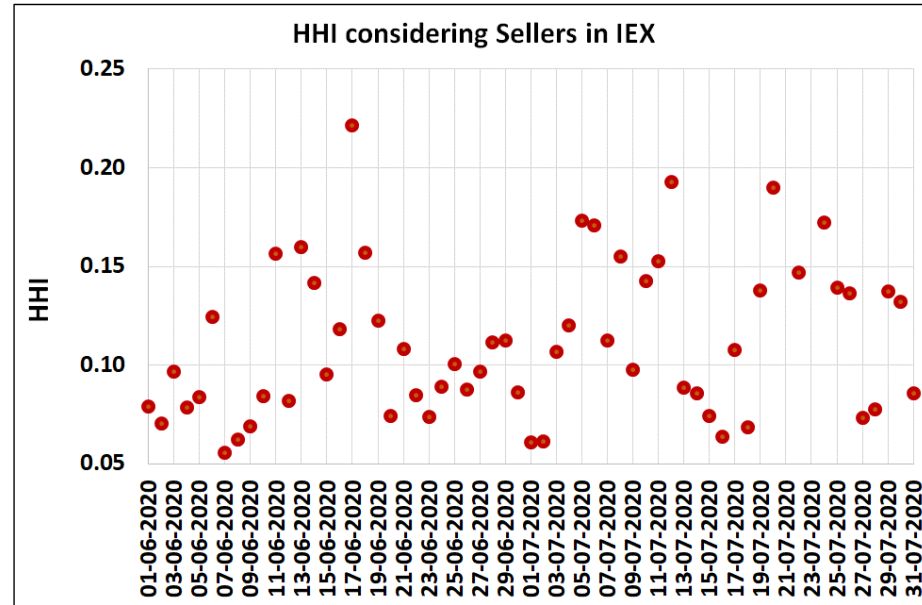
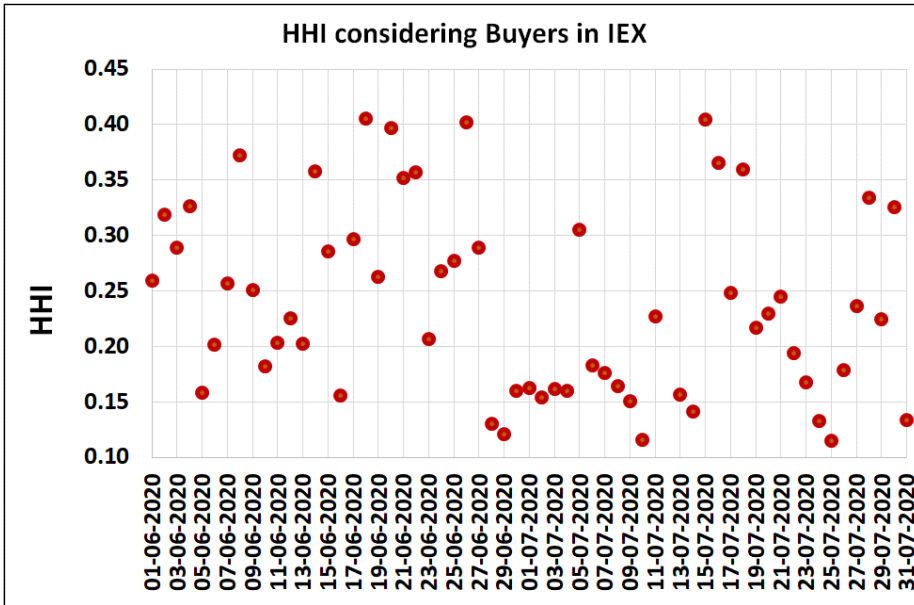


# Correlation between DAM and RTM





# Market Concentration in RTM



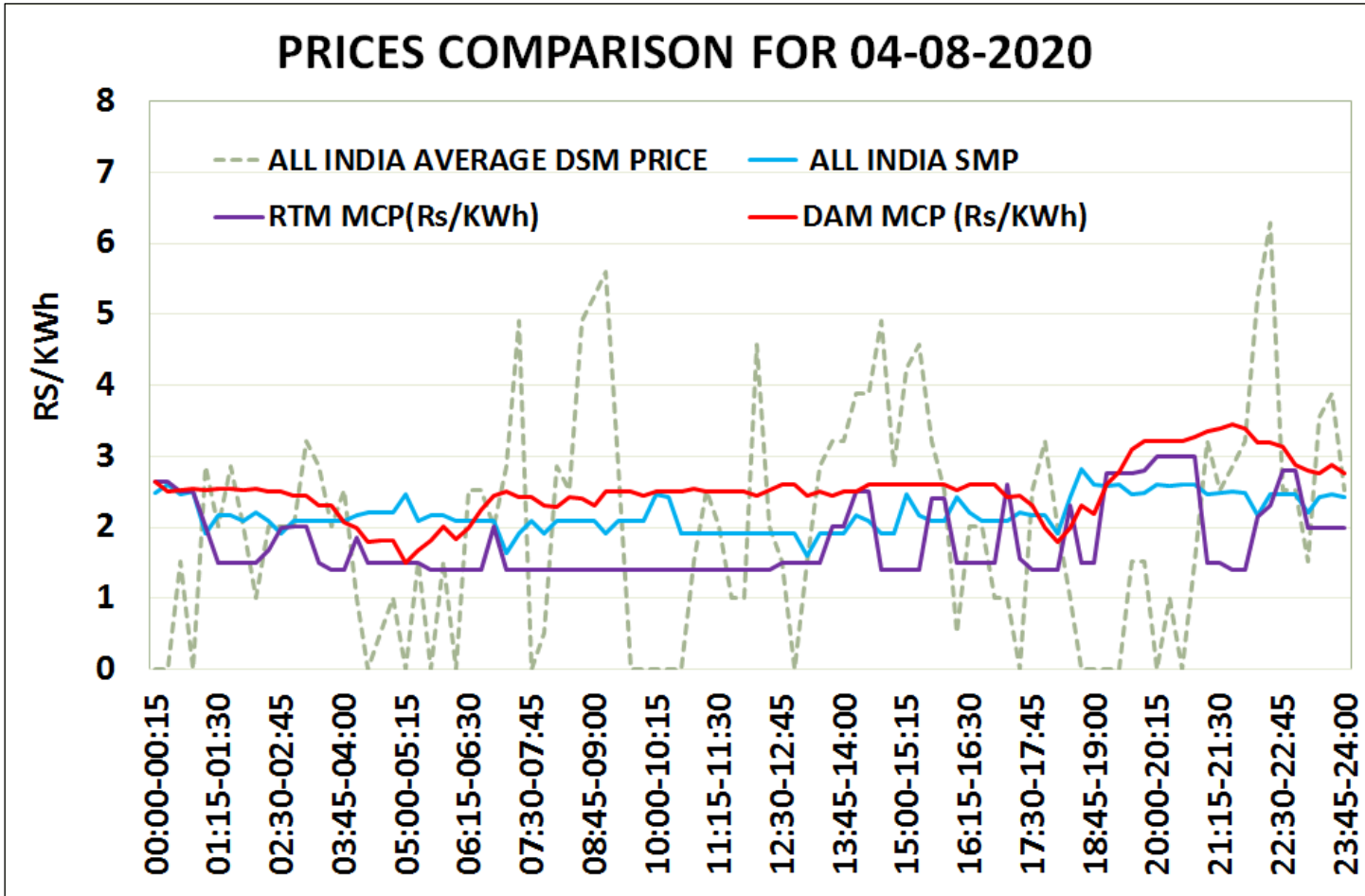
*Interpreting Herfindahl-Hirschman Index (HHI):*

*< 0.15 – No concentration*

*0.15 – 0.25 – Moderate concentration*

*> 0.25 – High concentration*

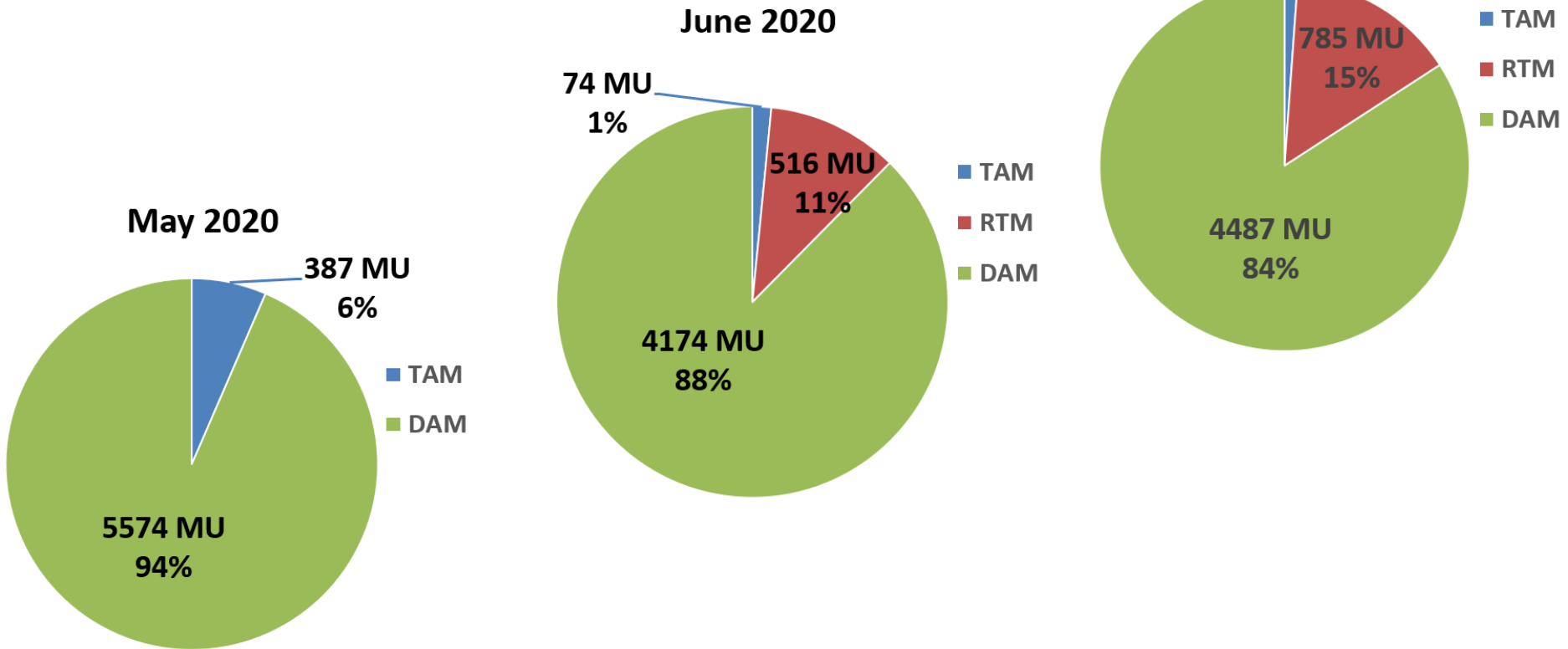
# Interplay of Multiple Prices on a typical day



# Interplay with other market segments



Volume of electricity transacted in different market segments at IEX



# Win-Win for all



# Challenges



24x7 continuous  
48 number of  
sessions with small  
response time

Dedicated  
manpower for  
software,  
hardware and  
communications  
setup pan-India



Constant 24X7  
interactions with  
generators and  
DISCOMs pan-  
India

Robust, resilient  
system automation  
and integration at  
NLDC / RLDCs /  
SLDCs / Power  
Exchanges





Thank You