

Discussion Paper on
Shortening the scheduling Timeline for Real Time Markets in India



Central Electricity Regulatory Commission

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Disclaimer

The issues presented in this discussion paper do not represent the views of the Central Electricity Regulatory Commission, its Chairman, or Individual Members, and are not binding on the Commission. The views are essentially of the staff of CERC and are circulated with the primary aim of initiating discussions on various aspects of redesigning the real-time electricity market and soliciting input from stakeholders in this regard.

Shortening the scheduling Timeline for Real Time Markets in India

1. INTRODUCTION

- 1.1. India stands at a pivotal position in its energy transition journey. As of 28th February, 2026, the country's total installed generation capacity reached 524 GW, and India crossed 50% of its cumulative installed capacity from non-fossil fuel sources in June 2025, five years ahead of its 2030 NDC target under the Paris Agreement. The policies and regulations shaping this shift from fossil fuels to cleaner energy sources will determine the pace and direction of what comes next. The energy transition has significantly reshaped the generation landscape by accelerating the deployment of renewable energy technologies.
- 1.2. The share of solar & wind power as of January 2026 has reached 140.60 GW & 54.65 GW respectively, and as the RE penetration increases, the grid operation challenge rises due to the intermittent and variable nature of wind & solar. The instances of RE curtailment are also rising, largely due to system security concerns arising from high-frequency fluctuations. It is important that RE curtailment is reduced and that grid fluctuations arising from variations in energy demand and supply are minimised.
- 1.3. Pertinently, the Real Time Market (RTM) was introduced in India in June 2020 to facilitate load-generation balancing closer to real-time. It has provided an avenue for balancing the demand-supply position through an organised market mechanism in near real time. In the Indian Power System, the Real Time Market (RTM) was introduced as a half-hourly market for collective transactions of real-time contracts through Power Exchange(s). The Real Time Market enables the DISCOMs and the GENCOs to adjust their positions in real time by procuring additional power when demand spikes unexpectedly or selling surplus when generation exceeds forecast, improving overall portfolio efficiency and reducing financial stress from imbalance penalties. A physical requirement of a power system is that demand and supply must always be in balance. System operation and power market operations are deeply aligned.

- 1.4. Gate closure refers to the time at which the bidding for a specific delivery period closes, and no further bidding or modification of already placed bids can take place for the said delivery period. The Gate closure for the Real Time Market (RTM) currently occurs 60 minutes before the start of the delivery time block. A number of activities take place between gate closure and delivery. This extended timeline is due to multiple sequential activities undertaken by Power Exchanges, NLDC, SLDCs, and generators, which include market clearing, congestion checks, unit commitment and dispatch, and ancillary services procurement.
- 1.5. The Commission, while introducing the Real Time Market, had mentioned that with a requisite level of automation, the timeline for the Real Time Market and the 'Revision of Schedule' can be shortened further.
- 1.6. The main objective of this discussion paper is to propose a reduction in the timeline between 'Revision of Schedule' and delivery, and compress the real-time market timeline, in order to match the electricity demand & supply more accurately, minimise the forecasting errors in the real-time market and reduce RE Curtailment.

2. EXISTING FRAMEWORK

- 2.1. In the Indian power market, power procurement can be planned for long duration (20-25 years), medium (1 -5 years), and short-term (more than one day to one year) timelines. Power Purchase Agreements (PPAs) are long-term contracts lasting up to 25 years. Around 88-90% of Discoms' electricity procurement portfolio consists of long-term contracts, with medium- and short-term contracts accounting for the balance (approx. 13% as of FY 2025-26). The majority of contracts in India are physical, and the beneficiaries (Discoms) schedule them on a day-ahead basis. They define the amount of power needed to be procured from a generating station (seller) with which they have a contract one day in advance. The generating stations disclose their DC (Declared Capacity) one day ahead of the actual power supply.
- 2.2. The current framework of scheduling under the Indian Electricity Grid Code (IEGC) provides the beneficiaries (Discoms) the flexibility to revise their schedule 7th/8th time

blocks before the delivery time block. The relevant provision in the Indian Electricity Grid Code (IEGC) is reproduced below for ready reference:

“Regulation 49 Procedure for Scheduling and Despatch for Inter-State Transactions:

.....

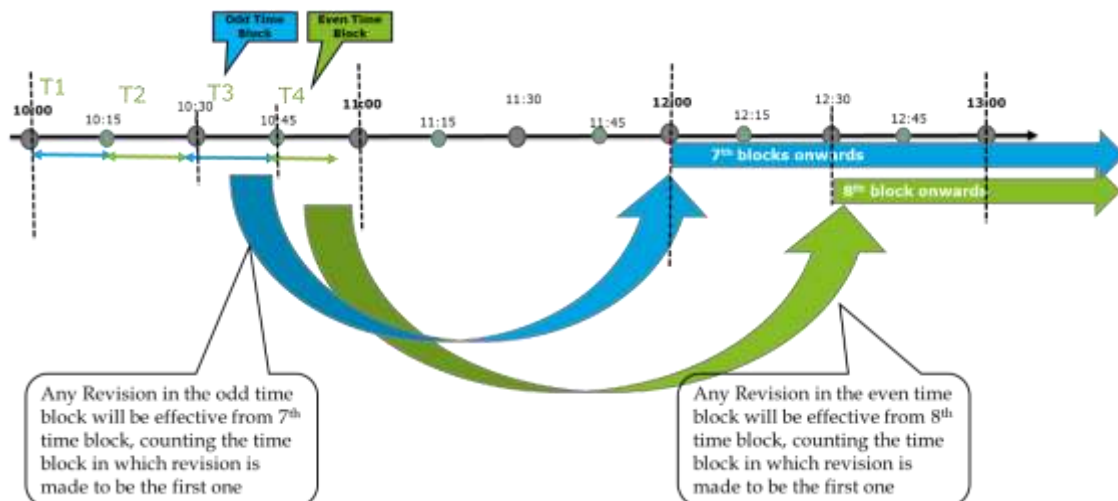
(4) Revision of Schedule on Request of buyers which are GNA grantee:

....

(c) Based on the request for revision in schedule made as per sub-clauses (a) and (b) of this clause, any revision in schedule made in odd time blocks shall become effective from 7th time block and any revision in schedule made in even time blocks shall become effective from 8th time block, counting the time block in which the request for revision has been received by the RLDCs to be the first one ”

- 2.3. As per the above provision, any revision in the schedule made in odd time blocks shall become effective from the 7th time block onwards, and any revision in the schedule made in even time blocks shall become effective from the 8th time block onwards, counting the time block in which the request for revision has been received to be the first one.
- 2.4. As per the above provision, once the real-time market commences for any specific half-hour delivery period, the revision in the schedule for that half-hour (two-time blocks) shall not be permitted. In other words, the ‘Revision of Schedule’ is nothing but the product in the electricity market continuum, which could be exercised by the beneficiaries until the Real Time Market (RTM) for a specified half-hour commences. The current timelines for the revision of the Schedule are depicted in the following Figure 1:

Figure-1: Revision of Schedule as per IEGC



- 2.5. Any requirement for power after the end of the right to revision of the schedule should be met through the Real-Time Market at the real-time price. Real Time Market is an organised market platform that enables buyers and sellers to meet their energy requirements in real time. The RTM provides the market participants with the opportunity to correct their real-time position (of buy and sell) through an organised market platform. The price and quantum of electricity trading are determined through a double-sided, closed-auction bidding process. Buyers and sellers can place buy/sell bids for each 15-minute time block in the half-hourly real-time market. Under the Real Time Market, Power exchanges conduct 48 RTM sessions per day.
- 2.6. In the RTM, electricity is traded in 15-minute blocks, and bidding closes 75 min before delivery. If a state/discom suddenly has a power shortage or surplus beyond its PPAs at any given moment, it can quickly purchase or sell electricity on the exchange in real time.
- 2.7. The Real Time Market provides for the concept of “Gate Closure”, with an appropriate timeline in consonance with the half-hourly market. ‘Gate Closure’ implies the point of time after which no trade or revision of the schedule is allowed. This is considered necessary to achieve the desired firmness in schedules during market hours. After the RTM gate closes, the system operator assumes responsibility for balancing the system.
- 2.8. Accordingly, the timelines for the Real Time Markets as specified in the IEGC, are as follows:

Regulation 49 (1)

(q) Procedure for scheduling of transaction in Real-time market (RTM):

(i) All the entities participating in the real-time market including TRAS may place their bids and offers on the Power Exchange(s) for purchase and sale of power

(ii) The window for trade in real-time market for day (D) shall open from 22.45 hrs to 23.00 hrs of (D-1) for the delivery of power for the first two time-blocks of 1st hour of day (D) i.e., 00.00 hrs to 00.30 hrs, and will be repeated every half an hour thereafter.

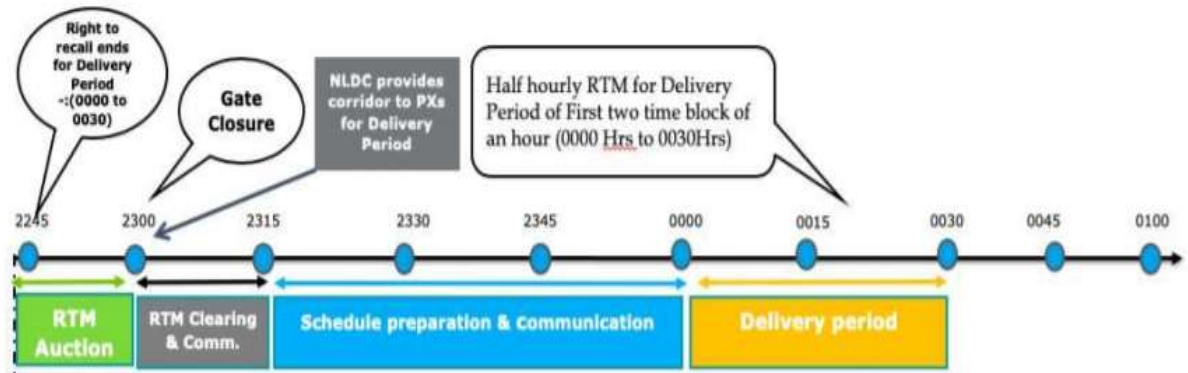
(iii) NLDC shall indicate to the Power Exchange(s) the available margin on each of the transmission corridors before the gate closure.

(iv) The power exchanges shall clear the real-time bids from 23.00 hrs till 23.15 hrs of 'D-1' day based on the available transmission corridor and the buy and sell bids for the real time market (RTM) for the specified duration and intimate the cleared bids to NLDC by 23.15 hrs, for scheduling.

(r) NLDC shall finalise schedules under RTM, SCED and Ancillary Services by 23.30 hrs. of 'D-1' day and RLDC shall publish the final schedules for dispatch by 23.35 hrs. of 'D-1' day.

2.9. A simple illustration of timeline for Real Time Market is shown below:

Figure 2. Time line for Real Time Market (RTM) – Current



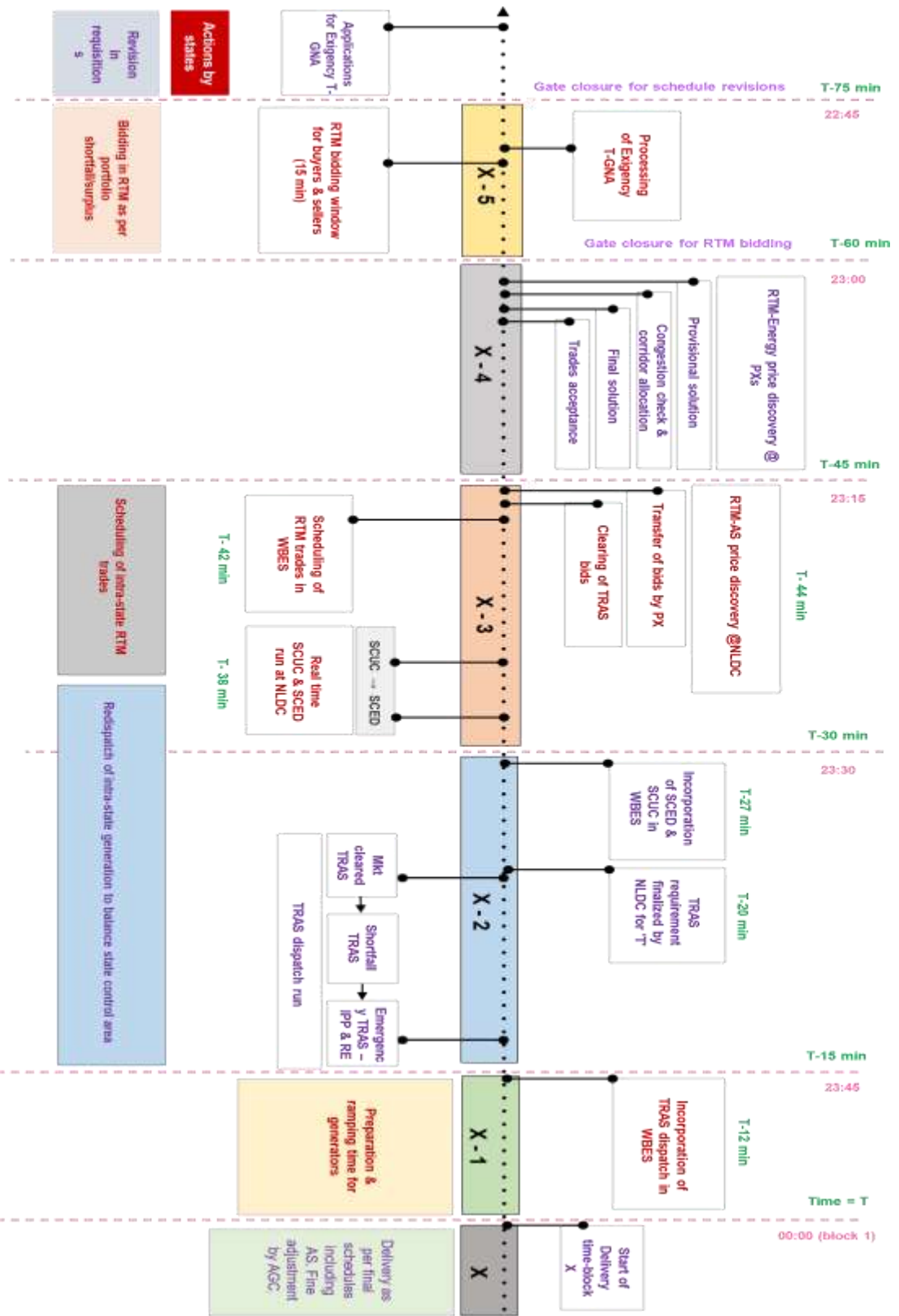
RTM Auction Start Time	RTM Auction End Time	RTM Clearing Interval and publication in the website	Communication of Schedule to NLDC/RLDCs/SLDCs	Final Schedule Preparation	Preparation time for despatch	Delivery Period
Illustration - A						
22:45 Hrs (of the previous day)	23:00 Hrs (of the previous day)	23:00 Hrs – 23:15 Hrs (of the previous day)	23:15 Hrs – 23:30 Hrs (of the previous day)	23:30 Hrs – 23:45 Hrs (of the previous day)	23:45 Hrs – 24:00 Hrs (of the previous day)	00:00:00 – 00:30:00
23:15 Hrs (of the previous day)	23:30 Hrs (of the previous day)	23:30 Hrs – 23:45 Hrs (of the previous day)	23:45 Hrs – 00:00 Hrs (of the previous day)	00:00 Hrs – 00:15 Hrs	00:15 Hrs – 00:30 Hrs	00:30:00 – 01:00:00
Illustration - B						
07:45 Hrs	08:00 Hrs	08:00 Hrs – 08:15 Hrs	08:15 Hrs – 08:30 Hrs	08:30 Hrs – 08:45 Hrs	08:45 Hrs – 09:00 Hrs	09:00:00 – 09:30:00
Illustration - C						
20:45Hrs	21:00Hrs	21:00 Hrs – 21:15 Hrs	21:15 Hrs – 21:30 Hrs	21:30 Hrs – 21:45 Hrs	21:45 Hrs – 22:00 Hrs	22:00:00 – 22:30:00

2.10. A number of activities take place between gate closure and delivery. These activities are summarised in Table 1 (considering block X as the delivery block):

Table-1: Timeline for Scheduling from end of ‘Revision in Schedule’ till the ‘delivery time block-X’

BLOCK	TIMELINE	PHASE	ACTIVITIES
Block X-5	(T-75) to (T-60)	Bidding window for RTM	•Processing of DC and schedule revision requests received up to gate closure and preparation of injection and drawal schedules. •Processing of exigency T-GNA applications. •Bidding by market participants in Power Exchange platform for RTM and RTM-AS segments – to be finalized by T-60.
Block X-4	(T-60) to (T-45)	RTM clearing	•Matching of buy/sell bids by power exchanges to obtain provisional/unconstrained solution and its transmission to NLDC. •Verification of combined trade volumes against corridor-wise ATC margins and exchange-wise margin allocation. •Fetching of ATC margins by power exchanges, running constrained solution and transmission of final results to NLDC. •Verification of traded volumes against margins and trade acceptance.
Block X-3	(T-45) to (T-30)	SCUC and SCED optimization	•Scheduling of RTM trades in regional entity schedules •Discovery of MCV and MCP for RTM-AS market by NLDC •Real-time SCUC run followed by SCED run
Block X-2	(T-30) to (T-15)	TRAS dispatch	•Scheduling of SCED and SCUC instructions in regional entity schedules •Finalization of TRAS dispatch requirement for block X •Sequential TRAS dispatch – Market followed by Shortfall, then Emergency, considering generator and system constraints
Block X-1	(T-15) to (T)	Preparation time	TRAS dispatch incorporated in schedule
Block X	(T) to (T+15)	Delivery Block	Power is Delivered

Figure:3- Real time scheduling Timeline- Present



3. NEED FOR CHANGE

3.1. Currently, the real-time scheduling process takes about 75 minutes from the end of the ‘Revision of Schedule’ to the start of the delivery time block. This timeline was specified when the RTM market was introduced in 2020 due to operational constraints highlighted by the System Operator. Multiple sequential activities are undertaken by Power Exchanges, NLDC, SLDCs, and generators after the end of ‘Revision in Schedule’ until the actual delivery of power. These include RTM auction, RTM market clearing, congestion checks, unit commitment & dispatch, ancillary services procurement, etc. As the grid evolves with higher variable Renewable Energy (VRE) penetration, the dependence on RTM and ancillary markets increases. Therefore, a need is felt to reduce turnaround time and improve the efficiency of balancing closer to the time of delivery.

3.2. The Commission, while introducing the RTM, had highlighted the need for shortening the time between RTM auction and delivery of power for managing the real-time variations, including renewable generation in the system. The Commission had also suggested that, with the required automation in place, it would further bring the RTM closer to the actual delivery time. The relevant excerpt from the Statement of Reasons for ‘Framework for Real Time Market for Electricity’ is reproduced below for reference:

“ 2.3 The Commission is in consonance with the need for reducing the time between RTM auction and delivery of power, but is constrained by the operational difficulties highlighted by the system operator and other stakeholders. Automation is a pre-requisite to shortening the time between RTM auction and delivery of power. The process of implementation of National Open Access Registry (NOAR) has already been initiated and once the automation is in place, the Commission would definitely like to bring Real Time Market further close to actual time of delivery.”

3.3. The Real Time Market has been in place now for more than five years, and except for some exceptions in the initial month of implementation, no RTM sessions have been aborted by NLDC. The required automation, such as the National Open Access Registry (NOAR) and other technological advancements, is in place to enable regular, timely exchange between power exchanges and system operators. The consistent increase in the volume of the RTM

market also demonstrates stakeholders' confidence and the success in adhering to the RTM timelines.

- 3.4. Further, the stakeholders on many occasions have highlighted that as there is a time gap of more than 1 hr between gate closure and actual dispatch of electricity, the demand forecasting becomes difficult, resulting in a mismatch of demand and supply in the grid, and attracts a penalty as per the provisions under the deviation settlement mechanism (DSM). Discoms have highlighted that electricity demand is dynamic and varies with factors such as weather, public holidays/social events, festivals, and power supply disruptions. For RE generators, it becomes difficult to maintain grid stability and avoid DSM changes, and RE curtailment persists due to grid constraints. Therefore, there is a strong need to reform, reduce turnaround time, and improve overall efficiency.
- 3.5. Recently, in the context of the Petition No. 9/SM/2025 on determining the value of X for DSM, several stakeholders requested the Commission to shorten the time period for the right to revision. The relevant extract from the order on the said petition is as follows:

“ Shifting Revision of Schedule to a lesser Time-block

27. Stakeholders (*Avaada, NGEL, Sembcorp, Sprng, Tata Power, Torrent, WIPPA, Mr Shanti Prasad*) requested that intraday schedule revisions from the 3rd or 4th time block be permitted instead of the currently proposed 7th or 8th, to better align generation with actual weather and grid conditions. Developers such as *MRPL, SAEL, Tata Power, Ayana, and NSEFI* expressed concern that the 8-time-block window is detrimental for wind and solar (WS) generators, as it restricts their ability to reschedule in response to sudden weather shifts, especially where on-ground radar or weather stations are unavailable.

28. Further, **InWEA** recommended allowing wind generators to revise their schedule within a 15-minute window from a weather event, subject to telemetry or satellite validation.

29. **Greenko** emphasised the need to permit real-time revisions to minimise DSM penalties and enhance responsiveness to rapid weather fluctuations. Juniper suggested corresponding amendments in the Grid Code and Power Market Regulations to reduce the gate closure period to no more than three time blocks ahead of delivery, aligning with international best practices.

30. **Serentica** emphasised a market-based mechanism for managing real-time imbalances, which will align with the operational characteristics of RE to reduce punitive impacts. **Evren** and **NSEFI** suggested enabling ex-post settlement of deviations through market mechanisms, as practised in advanced electricity markets.

31. **Juniper, Evren** and **NSEFI** proposed allowing RE generators to buy back power in the Real-Time Market (RTM) to manage deviations, and submitted that the current 4-block gate closure (delivery in 6th) is too rigid. They suggested a phased reduction to 2 blocks or less, which would improve responsiveness and deviation management.”

3.6. The Commission took note of the above suggestions and observed in the order on the aforesaid petition (No.9/SM/2025) as follows:

“ 69. The Commission has also considered the submissions regarding the reduction of the time block for schedule revision and the gate closure period. While such suggestions aim to provide greater flexibility in responding to sudden weather changes, the Commission notes that the gate-closure mechanism is intrinsically linked to system security, dispatch coordination, and power market operations. Any modification would have system-wide implications on real-time balancing, reserve deployment and market settlement processes. Such changes, therefore, require comprehensive technical evaluation in consultation with system operators and market participants, and the Commission is actively engaged in discussion with Grid-India on this aspect.”

3.7. Subsequently, interactions have been held with Grid India to explore the possibility of shortening the RTM timelines. Based on the interaction, the Commission staff has prepared a proposal with revised timelines for the Revision of the Schedule and RTM, as explained in the following paragraphs.

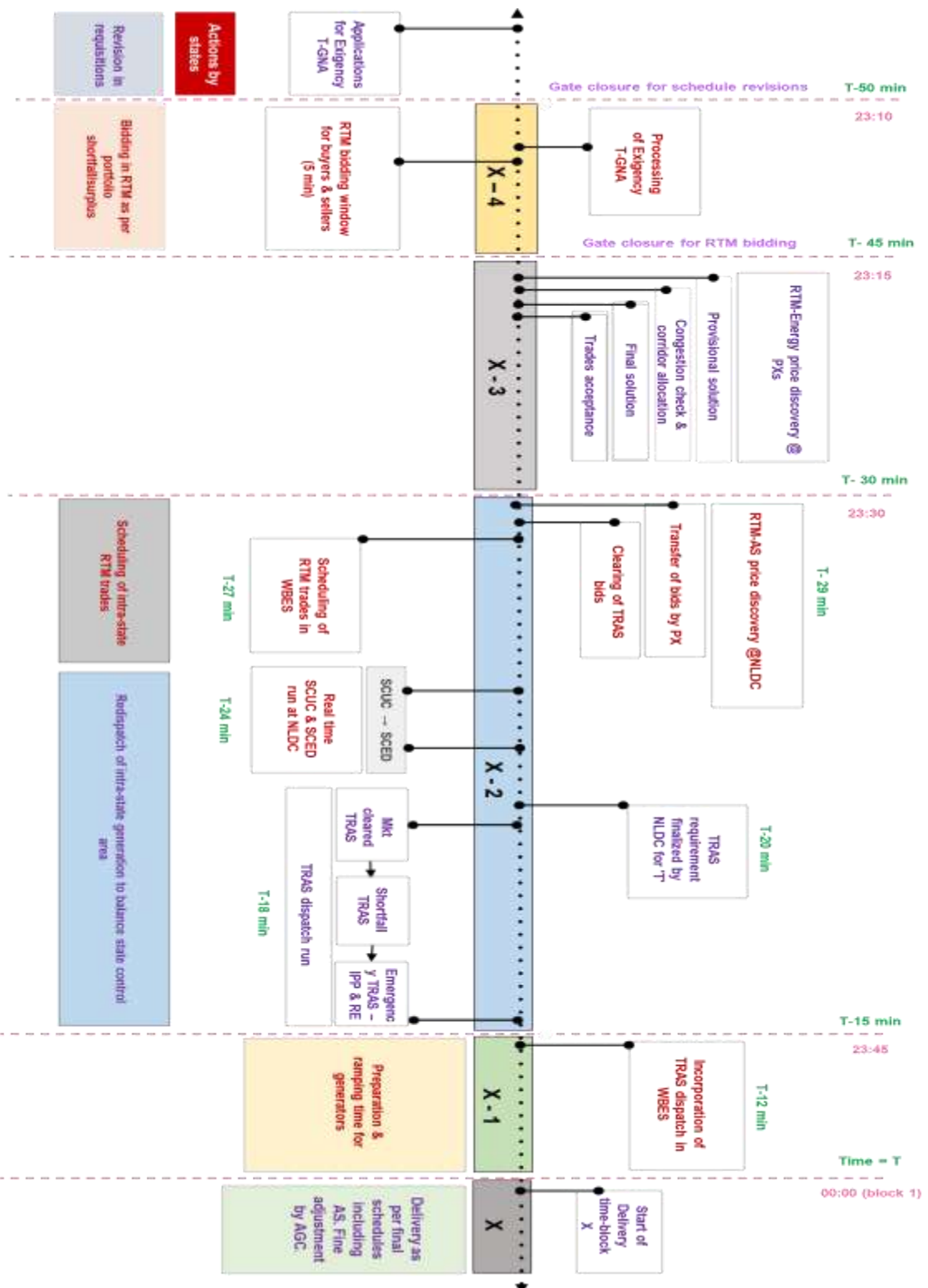
4. PROPOSED FRAMEWORK

4.1. It is proposed to reduce the timeline between the end of ‘Revision of Schedule ‘and actual delivery of power from the existing 75 minutes to 50 minutes. The time between the Gate Closure for RTM and the commencement of delivery of power is proposed to be reduced by 15 minutes. In the existing framework, the system operator has 45 minutes after the RTM clearing time block to perform various activities before power delivery commences. This

includes price discovery for RTM AS bids, running real-time Security Constrained Unit Commitment (SCUC) and Security Constrained Economic Dispatch (SCED), incorporating the RTM schedule and AS Schedule in WBES, dispatch run for AS, etc. Most of these activities need to be performed sequentially, as the output of one serves as the input to the subsequent activity. However, it is felt that the existing 45-minute gap between RTM clearing and the commencement of power delivery can be reduced by 15 minutes. With the successful implementation of NOAR and the required automation in place for running SCUC, SCED, and AS clearing, Grid-India is performing these activities effectively with minimal manual intervention. Accordingly, it seems feasible to complete these activities within 30 minutes by merging the activities as explained in the following paragraphs.

- 4.2. Further, the existing framework provides a 15-minute window for bidding in the RTM market. It has been noted that the actual time needed for entities to bid in the RTM is much shorter when automated. Operational experience shows that the five-minute window is sufficient to place bids in the RTM. Accordingly, it is proposed to reduce the RTM bidding window from the existing 15 minutes to 5 minutes.
- 4.3. The existing framework for bilateral transactions provides regional entities with the flexibility to revise their schedule before the 7th to 8th time block of the actual commencement of the delivery time block under the 'Revision of schedule' provision specified in the IEGC. This was necessary to incorporate the RTM framework into the existing scheduling framework. But with the proposed changes to the RTM timeline as above, the schedule revision period can also be shortened. Accordingly, it is proposed that the revision period end 50 minutes before the start of the delivery time block, rather than the current 75 minutes. Thereafter, the RTM bidding window would open.
- 4.4. Together, both the above measures would enable the reduction in scheduling timeline by 25 minutes, bringing provision for end of revision in schedule to 50 minutes before start of delivery time block as depicted in Table and **Figure 4** below:

Fig-4: - Real time scheduling Timeline- Proposed



5. The proposed revision in timeline is explained further as follows (Reference Table2):

Table-2: Revised Timeline for Scheduling from the end of ‘Revision in Schedule’ till the ‘delivery time block-X’

BLOCK	TIMELINE	PHASE	ACTIVITIES
Block X-4	(T-50) to (T-45)	Bidding window for RTM	•Processing of DC and schedule revision requests received up to gate closure and preparation of injection and drawal schedules. •Processing of exigency T-GNA applications. •Bidding by market participants in Power Exchange platform for RTM and RTM-AS segments – to be finalized by T-60.
Block X-3	(T-45) to (T-30)	RTM clearing	•Matching of buy/sell bids by power exchanges to obtain provisional/unconstrained solution and its transmission to NLDC. •Verification of combined trade volumes against corridor-wise ATC margins and exchange-wise margin allocation. •Fetching of ATC margins by power exchanges, running constrained solution and transmission of final results to NLDC. •Verification of traded volumes against margins and trade acceptance.
Block X-2	(T-30) to (T-15)	SCUC and SCED optimization	•Scheduling of RTM trades in regional entity schedules •Discovery of MCV and MCP for RTM-AS market by NLDC •Real-time SCUC run followed by SCED run •Scheduling of SCED and SCUC instructions in regional entity schedules •Finalization of TRAS dispatch requirement for block X •Sequential TRAS dispatch – Market followed by Shortfall, then Emergency, considering generator and system constraints
Block X-1	(T-15) to (T)	Preparation time	TRAS dispatch incorporated in schedule
Block X	(T) to (T+15)	Delivery Block	Power is Delivered

5.1. The procedure for scheduling of transactions in the Real-time market (RTM) (*considering block X as the delivery block*) is proposed as follows :

i) Block X-4 (T-50 to T-45)- bidding window for RTM

All the entities participating in the real-time market may place their bids and offers on the Power Exchange(s) for the purchase and sale of power. Under the proposed RTM timeline, all entities would be given 5 minutes for bidding, as it is felt that with automation, bidding operations can be performed more quickly and precisely, and a 5-minute window would be sufficient to complete the tasks. The window for trade shall open from 23.10 hrs to 23.15 hrs of (D-1, considering D as the delivery day), for the delivery of power for the first two time-blocks of 1st hour of day (D), i.e., 00.00 hrs to 00.30 hrs, and will be repeated thereafter.

ii) Block X-3 (T-45 to T-30) – RTM clearing

The power exchanges shall be given 15-minute time to clear the real-time bids from 23.15 hrs till 23.30 hrs of ‘D-1’ day based on the available transmission corridor and market splitting in case of congestion checks and the buy and sell bids for the real time market (RTM) for the specified duration and intimate the cleared bids to NLDC by 23.30 hrs, for scheduling.

iii) Block X-2 (T-30 to T-15)- AS price discovery & TRAS dispatch run

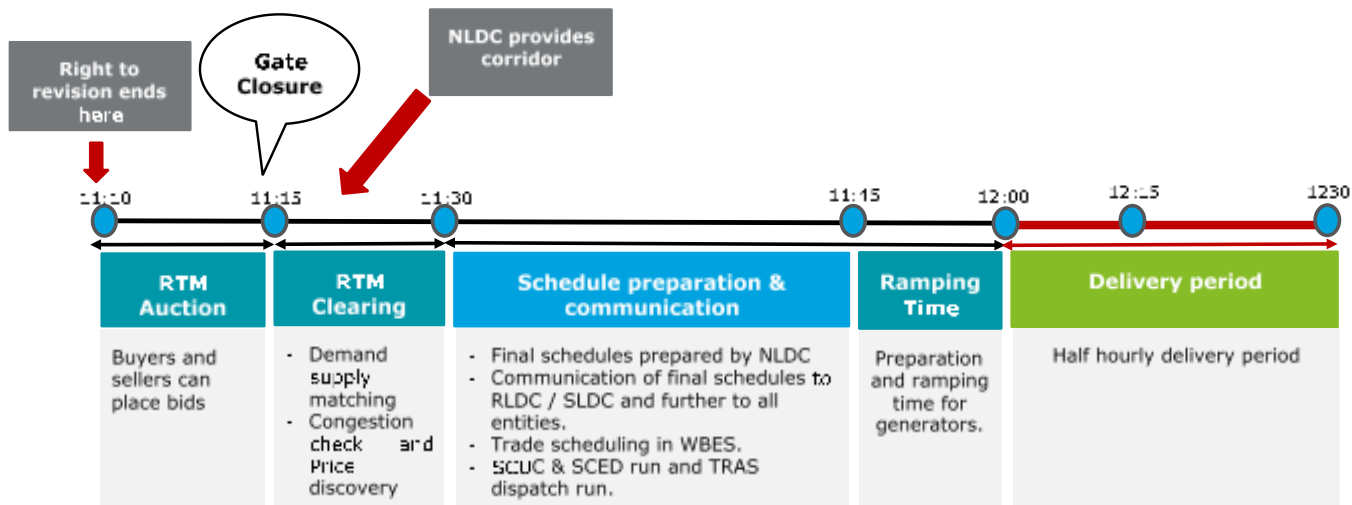
Further, from 23:30-23:45, RTM-AS discovery at NLDC, transfer of bids by power exchanges, scheduling of RTM trades in WBES, and finalisation of the TRAS requirement by NLDC must be completed within the stipulated 15-minute timeline.

iv) Block X-1 (T-15to T)- Preparation Time

From 23:45, another 15 min will be utilised for the incorporation of TRAS dispatch in WBES and preparing & ramping up of generators. And from 00:00hrs of D, final delivery of power will be processed for 2-time blocks of 15 minutes each.

A sample illustration for the timeline for the Real Time Market is shown below in **Fig 5**:

Figure-5: proposed timeline of RTM



5.2. Table 3 depicts the timeline of activities to be conducted within 50 minutes for each bidding cycle, and the same would repeat for all the cycles accordingly, and power would be dispatched for each 15-minute delivery schedule.

Table-3: Proposed timeline for RTM scheduling

RTM auction start time	RTM auction end time	RTM clearing interval	Schedule prep and Communication	Delivery period (MCP and MCV will be discovered for each 15-minute block)
23:10 Hrs (of the previous day)	23:15 Hrs (of the previous day)	23:15-23:30 Hrs (of the previous day)	23:30-24:00 Hrs	00:00-00:30
23:40 Hrs (of the previous day)	23:45 Hrs (of the previous day)	23:45-00:00 Hrs	00:00-00:30 Hrs	00:30-01:00
...				
22:40 Hrs	22:45 Hrs	22:45-23:00 Hrs	23:00-23:30 Hrs	23:30-00:00

- 5.3. The present discussion paper proposes to shorten the schedule revision timeline from 75 minutes to 50 minutes, and to reduce the time between the last organised market of electricity and the actual delivery of power. It is expected that this will enable better forecasting/scheduling of intermittent sources such as wind and solar, and would be beneficial for managing discoms' portfolios to avoid DSM charges in the long run.
- 5.4. Accordingly, comments are being sought on the discussion paper from the stakeholders before proceeding with the required regulatory framework in this regard.
