eProcurement System Government of India

Published Corrigendum Details

Date : 23-Jun-2022 12:53 PM

🖨 Print

Organisation Chain :	Power System Operation Corporation Limited||Corporate Head Quarters /NLDCNew Delhi-POSOCO
Tender ID :	2022_POSOC_695882_1
Tender Ref No :	CC/CnM/TnI/ WBES/22-23
Tender Title :	Development, Implementation, Warranty and Comprehensive AMC of 04 years for Web Based Energy Scheduling Software WBES for Power System Operation Corporation Ltd
Corrigendum Type :	Technical Bid

Corrigendum Document Details

Corr.No.	Corrigendum Title	Corrigendum Description	Published Date	Document Name	Doc Size (in KB)
1	Addendum 1	Technical Specification Volume-I and II missed during uploading of bid are attached here	23-Jun-2022 12:53 PM	TechnicalSpecification.pdf	2576.95

Development of

WEB BASED ENERGY SCHEDULING

(WBES)

Contents

1. Preface

This document aims to provide an overview for development of Web Based Energy Scheduling (WBES) application, which shall be robust, flexible, compatible and seamlessly integrate with any other applications like NOAR, SCED, RRAS, RLDCs SCADA, SLDCs and Generators etc. The application shall encompass all the functions of the existing WBES at each of the RLDCs / NLDC and the some of the expected futuristic features, its services shall be versatile to include future needs and perform flawlessly in on-premises infrastructure. The application shall have an enterprise level approach which are highly flexible, scalable, secured, modular, economical, high performance, reliable and support replication.

2. The proposed Application in Centralized Architecture

Electricity Act 2003, mandate that RLDCs and NLDC shall be responsible for Scheduling and dispatch of electricity. The 'Web Based Energy Scheduling' (WBES) application provides a 24x7 platform for Market Operation in real time for optimum and efficient scheduling. It complies and enforces all principle and guideline of Scheduling system and practice as per the CERC regulations and as specified in the Grid Code. It keeps track of all the bilateral transactions and keeps accounts of scheduled energy between different stake holders

The present WBES application was installed and commissioned at each of 5 RLDCs in a decentralized and stand-alone mode, with exchange of Inter-regional data, so as to optimize the scheduling at the regional level. However, following issues were observer with time.

a) *The Reform in Electricity Market*: The existing WBES application was re-coded every-time, whenever there is a change in scheduling process or introduction of new market portfolios like Golden share allocation across inter-regional link, IEGC 5th Amendment, URS relocation, centralized dispatch of RRAS, Pilot SCED for cost optimization at all India level, integrating with Real time Market (RTM) etc.

b) *The Software issues*: The application was built under monolithic architecture and its code has become too complex and unmanageable, due to regular changes. The application misbehaves and give an erroneous value due to any change in the application, impacting the account for DSM and REA. The difficulty in data extraction for exigency report, analysis and visualization, especially during real time operation is also impacting day to day requirements.

c) *The infrastructure issues*: WBES applications at each RLDCs are facing constraints such as degradation of performance, hardware issues, lack of disaster recovery (DR) facility, and difficulty in maintaining the mesh communication network across 5 RLDC/NLDC, and these

constraints are partly due to new functional requirements that are being continuously being incorporated in the existing system.

d) *Asynchronous mode of operation leading to erroneous data & calculation*: The system is too much dependent on healthiness of communication Network for 24x7 operation. There are multiple networks to and fro communication among RLDCs and NLDC. Any delay or failure of data exchange, firewall issues, Network failure among the RLDCs and NLDC due to various reasons leads to errors and mismatch like

- Wrong information of URS, RRAS, SCED, Ramp, Generator Net Schedule, International Schedules (If applicable) to NLDC.
- Wrong schedule across RLDCs for the interregional contracts
- Failure of RTM etc.
- Wrong schedule for constituents and Generators
- Wrong ATC Margin
- Wrong Curtailment on IR schedule
- Failure in REMC schedule integration

e) *Duplication of effort in maintaining similar hardware and software*: Hardware (Servers, Storage etc) and Software (Database, Operating System, Virtualization system etc) required for running WBES is procured and maintained at each RLDC separately. This setup requires regular maintenance of the system to keep them running 24x7. The present architecture fails to optimally utilise the resources deployed and though adequate resource is engaged in the activity Pan-POSOCO, sufficient redundancy and fail-proof arrangements are not maintained individually. Also, cumulative cost of maintaining all the systems separately is very high.

f) *Requirement of cross-RLDC reconciliation and preparation of implemented schedule*: There are large mismatches of data due to various reasons across RLDCs. Hence in the current architecture workload on implemented schedule personnel is very high in matching the data across RLDCs. Non-Uniform Scheduling Process: The scheduling process need to be shall pan-India as defined by the CERC. However, the scheduling processes changed as per the conveniences of local RPC, without taking other RPC / RLDC / NLDC in confidence.

g) *Different protocol for communication*: The Communication among RLDCs and NLDC is via Web API or SCED/RTM and sftp for RRAS. Further for NTPC it is via .xml file, for state it is via .xml/.csv / Web API.

h) *Loss of crucial time*: The schedule needs to be created twice in each time block, to create the regional Generator schedule and then Match the IR schedule, to accurately generate the ATC

Margin for SCED and RTM. The Generators / Beneficiaries get minimum time before the start of the new Time Block.

i) *Responsibility:* The non-performance of any region WBES will lead to the failure of central modules like RRAS, SCED and RTM of that region. There is no single person/team who is responsible for the healthiness of the entire scheduling system in POSOCO.

The existing WBES support contract has also expired / at verge of expiry at individual RLDC. Additionally, there is requirement for bi-directional schedule integration with all the stake holder for real time requisition submission and utilities schedule.

The shortfall in the existing WBES system has led to a conclusion that the **new application shall be developed in Centralised Architecture,** wherein the WBES shall encompasses the functionality of all RLDCs and NLDC and integration with external applications through a Web API, thereby eliminating the vulnerability of communication and failure of internal applications at any RLDCs/NLDC. Each RLDCs and its utilities would communicate through a single application with common database, thereby preventing the issues of data integrity, data-duplication, data-reconciliation across RLDCs and easy for regular change and patch update in the application, with minimum platform for Hardware.

3. Report Structure

This report is divided in two volumes viz.

a) **Volume I**: Functional features and requirements of the Web Based Energy Scheduling (WBES) Application. Annexure includes flow charts of various modules and scheduling functions.

b) **Volume II**: The Technical Specification for Support Services, which includes the Application Architecture, design, Sizing, SLA, Penalty and the NLDC infrastructure.
The infrastructure environment will be DC-DR model, wherein the DC will be at NLDC, Delhi and DR will be at ERLDC, Kolkata.

VOLUME - I

FUNCTIONAL FEATURES

AND

SYSTEM REQUIREMENT SPECIFICATION

4. Functional Requirement of WBES Application:

The scheduling process in the present regime generally called ABT (Availability Based Tariff) regime is in accordance to Indian Electricity Grid Code Regulations 2010 and subsequent amendments thereof issued by CERC. Chapter 6 of IEGC is dedicated to the modus operandi of Scheduling. All input / output like generation availability, requisition from beneficiaries, drawl and dispatch schedules and other associated data and calculations would be done for as per the time block specified in IEGC. At present its duration is 15 minutes (one day consists of 96-time blocks). All interactions shall require appropriate login by the users.

There are different kinds of generator being scheduled by RLDC viz Thermal, Nuclear, Gas, Hydro, Renewable Energy (Wind, Solar, Hybrid) & also different kinds of generators envisaged in future like Standalone Energy Storage Systems. Each of these have different set of rules and is dealt differently. These generators can enter into power purchase agreement with beneficiaries/buyers or sell in the power exchange. Each of the generators require either of the access viz Long-term access or Medium-term access or Short-term open access for getting their power scheduled. The rules for each of the access is different. Among the long term, the power in central sector plants is shared among the states/beneficiaries in the ratio of share allocation allocated by Ministry of power. In addition to the above sale to the buyer, the power gets scheduled to the grid in the form of ancillary services, AGC, security constrained economic Despatch etc.
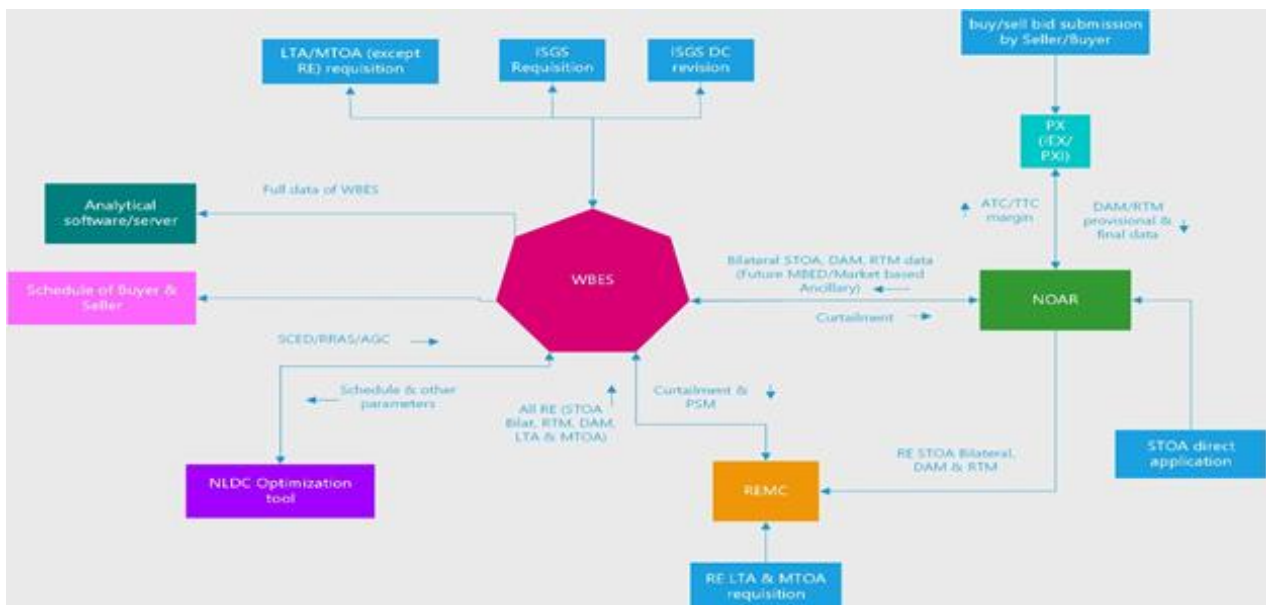
Figure 1: Inter-connection of WBES and flow of information

The LTA, MTOA related information of conventional plants is punched directly in the WBES, Renewable related information flows through REMC, Short term open access – Bilateral and collective flow through NOAR, centralized schedules such as of ancillary services, AGC, Security Constrained Economic Despatch (SCED) flow through NLDC. The tentative flow of information is shown in Fig-1.

All schedules for implementation shall be affected through appropriate approval by authenticated users at RLDC/NLDC level. The proposed software shall be capable of affecting the day ahead or in advance as decided by the commission for scheduling and subsequent revisions as per the provisions of IEGC 2010 within stipulated time lines. Revisions can be on account of any of the stakeholder in the grid, for example generators (revised availability, unit tripping, etc.), beneficiaries (revised requisitions, load crash, surrender of power, etc.) or Open Access customers or Suo moto by RLDCs/NLDC (optimum scheduling, contingency, or for better system operation etc.). Once request for schedule revision is received from any of the users, the program shall recalculate the schedules and the revised schedule shall be updated at all interfaces with a new revision number sequentially generated by system along with the reason for such revision.

5. Approach of the technical specification

The Technical specifications document is prepared keeping the following in mind
   a. Centralised application and Centralized Common Database
   b. User specific content shall be visible to the concern users, through the authenticated login and credentials and verified through OTP.
   c. The module explanations have been split as below:
       i. Scheduling Process
       ii. All the reporting requirements are covered under Reports section which is split into "Process" reports and "External" reports
       iii. Annexure covering details of web pages and expected features
       iv. Flow chart showing detailed logic

Vendor is expected to read the main document along with annexures and flow charts for understanding the requirements and development of a centralized solution.

6. Configuration

The program is required to be made as modular as possible. Similarly, the flexibility shall be made available in the front end to adapt to various regulatory changes. Accordingly, most of the features which could be made configurable is identified and detailed, which is given in the Annexures under 'Configuration' viz assignment of user roles, utility definition, time block definition, precision to be

used, transaction management, Loss applicability and loss exemption, preferred path assignment for inter-regional (IR) optimization, overloading enable/disable feature for hydro stations, consent for un-requisitioned surplus (URS), schedule fixation method, link preference for IR transactions, transmission loss applicability, definition of flow area, Link/Path/Flow Gate, Peak Hour, Time of the day and Peak Season Declaration, LTA/MTOA/STOA contract definition, flexible control, system alert configuration, Module specific requirement. Further configurable modules (if any) shall be identified during system requirement specification (SRS) preparation by the vendor in consultation with POSOCO team.

7. Scheduling Process

Scheduling for a day commences a day in advance and real time revisions of schedules are done on the day of operation as per provisions of IEGC and relevant orders and regulations of Hon'ble Commission issued from time to time. For the purpose of scheduling, each day (24 Hours) at present is divided into 96 blocks of 15 minutes duration each.

Eg:- **Block 01** 0000-0015 hrs

Block 02 0015-0030 hrs

Block 96 2345-2400 hrs

Chronology of scheduling activity in time line format is shown below to represent the interaction of various users.

Time Line	Time lines of Scheduling Activities
Hrs	**On D-1 i.e. one day ahead of the day of operation**
0600	ISGS shall submit declared capacity for next day from 0000 hrs to 2400 hrs (15 min block wise)
0800	Each RLDC shall prepare and publish the Entitlement(R-0) of next day for beneficiaries (15 min block wise) and subsequent revision
0800	File upload for PSA and subsequent revision for creation of entitlements.
0900	Each RLDC/NLDC shall send ATC file to NLDC/RLDC for next day
0945	The original beneficiary shall communicate its consent to the ISGS by 9.45 AM each day about the quantum and duration of power for next day for sale in the market.

1500	Beneficiaries shall submit requisition from each ISGS and mutually agreed quantum of LTA/MTOA for scheduling
1500	Beneficiary surrender gate closure for RSD submission.
1600	NLDC shall send scheduling request for collective transactions for next day (PX file) to each RLDC
1700	RLDC shall confirm acceptance of PX file to NLDC
1700	Gate closure to beneficiary submission for revival of units from RSD.
1730	NLDC shall intimate Power Exchanges about acceptance by RLDCs
1800	RLDC shall prepare and publish drawal schedule for beneficiaries and dispatch schedule (R-0) for ISGS for next day (15 min block wise) incorporating all requisition, LTA, MTOA, STOA
1800	New RSD decision/information and publish
1900	RLDC to display on its website the ISGS stations having schedule less than technical minimum level
2000	The beneficiaries may submit revised requisition w.r.t. technical minimum to RLDC; RLDC may provide tech minimum schedule Suo-moto as per the grid conditions;
2100	ISGS may opt for taking out any unit under Reserve Shutdown under intimation to RLDC
2200	ISGS/SLDCs shall inform any modifications/changes to be made in drawal schedule/ foreseen capabilities if any, to RLDC which shall be incorporated in the R1 schedule for next day.
Hrs	**On the day of operation (D-Day)**
0000	Day of Operation starts
Any time	Request for revisions of any requisition, LTA, MTOA, STOA
Any time	Incorporation of Ancillary services, SCED and SCUC
Any time	Incorporation of RTM schedules power exchange wise
Any time	Request by beneficiaries surrender entitlements to take units under RSD or revival units by requesting their entitlements
During Shift	Reconciliation of Schedules on regular basis or atleast once in each shift

Day	After Day of Operation
By D+2	Issuance of Implemented schedule by RLDC
By D+5	Implemented schedule open for checking by regional entities
D+5	Issuance of final schedule after reconciling with regional entities/ interregional / transnational beneficiaries

Table 1: Schedule Activity Time Line

7.1   Declared Capability (DC)

The submission of declared capability varies for different types of ISGS/Regional generators viz. Thermal, Hydro, Gas, Nuclear, Renewable energy (RE) generators like solar and wind. Each generator type has a particular format for availability declaration with different business logic as detailed in annexure section.

Each interstate generating station (ISGS) advises the concerned RLDC, the ex-power plant on-bar DC in MW, off-bar DC in MW, ramp in %/min or MW/min (i.e., both ramp up, ramp down capabilities), normative dc, units on bar MW for every time block and MWH foreseen for the next day, i.e., from 0000 Hrs to 2400 Hrs of the following day. ISGS are declaring the declared capability (DC) and other Regional Entity Generators are sharing the contract wise (i.e LTA /MTOA wise) declared capability. Thermal & Gas stations are declaring DC in block wise MW while Hydro generators are submitting their daily energy in MU (or MWh) in addition to block wise MW. The renewable energy (RE) generator's availability is received from regional REMC application directly through the API from REMC portal.

There shall be provisions for DC submission through web-based API (in csv/xml format etc.) from a GENCO's internal software. Same facility may be extended to a generating company for submitting DC revisions for multiple generating plants simultaneously.

The generator can submit its 'revised' declaration for the concerned day, i.e., for 'day of operation' or for 'day-ahead'. However, flexibility in punching the DC from D-2 to D-n days in the design stage itself is to be planned so that any change in the regulation can be accommodated with minimal re-configuration.

Two sets of Declared Capability are being used, one declared by the generator and the other declared capability used by RLDCs for the purpose of scheduling. The DC considered for scheduling by RLDC is computed by taking the Minimum of the On-Bar Normative DC and the On-Bar DC submitted by the Generator. The treatment is slightly different for Gas power stations using multiple fuels viz. APM Gas, NAPM gas, RLNG and/or liquid fuel. In case of such multiple fuel-

based Gas power stations, if the On Bar DC submitted by the Generator is more than On Bar Normative DC, then the On Bar DC of costliest fuel type will be reduced, to the extent it is more than the On Bar Normative DC.

On bar normative DC for Gas based generators may also vary block-wise with respect to variable block-wise ambient temperature. There shall be provision for calculation of block-wise On Bar Normative DC using block-wise ambient temperature values (and/or other similar parameters) furnished by the generator. Correlation matrix to define correlation between Normative DC/Installed Capacity and ambient temperature of the plant shall be uploaded in utility definition section. The option to calculate block-wise Normative DC/Installed capacity using ambient temperature or using constant value of Normative DC calculated as explained above shall be made available in configuration module.

For better utilization of available gas-based generation resources declaration of gas-based stations may also be done similar to hydro power stations i.e., block wise declared capability (DC), machine availability and energy (MUs) corresponding to fuel availability.

Negative DC shall be allowed for Nuclear stations of southern Region. According a generic configuration shall be made in generator configuration to select the generator to allow negative DC or not.

Further details are covered in Annexure.

7.1.1   Unit status

Unit status of generator will be taken as input from the Generators which shall be used to get the outage and revival of the units along with reason and time. The generators/owner can mention the unit status as Planned shutdown, Reserve shutdown and Forced outage provision to enter for future planned shutdowns. Unit status shall be changed to RSD New or Running New by operator on approval in the RSD section in line to the New RSD procedure.

7.2   Share Allocation

Every beneficiary has a share allocation (in %) in the power generated by an ISGS as decided by Ministry of Power (MoP), Govt. of India from time to time and communicated to RLDCs by respective RPCs. Further, the beneficiaries are entitled to avail power from other regional entity generators as per the power purchase agreements (PPAs) signed between those Generators and the said beneficiaries. Share allocations are usually in block wise percentage values except for some exceptional cases where the share is expressed in MW on first charge basis (particularly for some hydro plants in Northern region).

The share allocation is further categorised as on-bar share allocation and off-bar share allocation (buffer Share allocation). The total share allocation is the sum of on-bar and off bar share allocation. The on-bar and off-bar share allocations are further divided into three sub-categories i.e., allocated, unallocated and reserved. Allocated and unallocated quantum of share allocation are entered in percentage (%) share and reserved type share allocation may be in MW or percentage (configurable). The expected features for this part are covered in the Annexure. In some exceptional case share allocation may be in the form of a conditional linear equation. (Eg RGPPL).

7.3   Entitlement

Entitlement for each state is prepared based on Share allocation table and declarations by each ISGS. Three sets of On-Bar and Off-Bar entitlements are computed for each of the beneficiary from each of the ISGS for each of the time block.

A.   Based on 'DC given by the generator'

    a.   On bar entitlement = (On-bar + Off-Bar SCUC DC given by the generator Minus Reserve MW, Minus Merchant capacity) * On-bar Share Percentage

    b.   Off bar entitlement = (Off- bar DC given by the generator Minus Reserve MW, Minus Merchant capacity) * off-bar-Share Percentage

    c.   Total entitlement = On bar entitlement + Off bar entitlement

B.   Based on 'DC considered for scheduling'.

    a.   On bar entitlement = (On- bar + Off-Bar SCUC DC considered for scheduling Minus Reserve MW, Minus Merchant) * On-bar-Share Percentage

    b.   Off bar entitlement = (Off- bar DC considered for scheduling Minus Reserve MW, Minus Merchant') * off-bar-Share Percentage

    c.   Total entitlement = On bar entitlement + Off bar entitlement

       DC considered for scheduling is the minimum of Normative DC and DC given by the generator

C.   Final Entitlement for Requisition
One of the above two computations will be used as input for the third set based on the configuration and the other would be used for reporting purpose. This entitlement is calculated after deducting the following quantum given below. If the computed restricted entitlement becomes negative, the same will be replaced with zero.

i. Power sold in market: Each beneficiary can give their consent for sale for their entitled power to an ISGS. Then the ISGS can sell this power in the market. Since the beneficiary has already forgone its right, the same power cannot be requisitioned by it.

ii. Power Regulation: Restriction can be imposed on the beneficiary by the generator for non-payment of dues for certain conditions as detailed in Power Regulation module. Accordingly, the same power cannot be requisitioned by the beneficiary.

iii. Payment security regulation: Necessary payment security mechanism such as Letter of Credit etc needs to be in place for scheduling which is detailed in Payment security module. If it is not there, the same cannot be requisitioned by the beneficiary.

b. There are certain exceptions wherein computed entitlements are not used and requires to be over-ridden by the RLDC Eg: New RSD procedure in SRLDC. The exception entitlement would be uploaded for such generator (eg NSPCL and SSP). In this case, the uploaded entitlement after necessary checks will over-ride the entitlement calculated above. If file is not uploaded, the originally entitlement calculated will be taken by default.

c. Entitlements are rounded off to the nearest two decimal places or as per the grid code (IEGC) as amended from time to time for each transaction. Further, adjustment is to be done in line with the agreed philosophy in order to make the sum of all entitlements equal to 100%.

d. All the above calculations applicable to ISGS is to be made applicable to regional entity IPPs/Sellers based on the configuration.

e. The above On Bar Entitlement for gas stations is further segregated in to closed cycle On-Bar and open cycle On-Bar.

7.4   Requisition

Each beneficiary submits the block wise requisition against his 'final entitlement after restriction' from each of the ISGS after getting authenticated. The beneficiaries generally submit their first requisition on day ahead basis. They are allowed to revise their requisition in the real time also w.e.f 7th and 8th time block (or as per amendments in IEGC from time to time). Any revision in requisition made in odd time blocks becomes effective from 7th time block and any revision in schedule made in even time blocks becomes 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.

A beneficiary can surrender its full entitlement, or partly requisition and partly surrender its entitled power. The **Default Requisitions** are created along with creation of first entitlement. The default requisition can be '0' (zero) or equal to full entitlement based on the configuration. The beneficiary is forced to surrender the URS availed quantum (if any) before surrendering its own entitled power.

There shall be provisions for requisition submission through web-based API/csv/xml etc. from a beneficiary's internal software so that it may submit requisition directly for a single or multiple generator together.

As per current practice, the Requisition for Nuclear stations is booked in full and made equal to entitlement and no surrender is possible. However, in future surrender of entitlement may be allowed to beneficiaries of Nuclear plants.

As per current practice, the hydro plants are used as peak load plants and scheduling is being done as per regional demand pattern and frequency profile by respective RLDCs. ISGS hydro stations are treated as must run power plants. They declare their capability block wise (in MW) as well as daily energy (in MU or MWh) on day ahead basis. Entitlement is being calculated based on the share allocation and schedule is being prepared as per entitlement. Hydro stations being must run in nature, their beneficiaries are not entitled to change schedule as per their requisition. However, for better harnessing of hydro potential, overall hydro scheduling methodology may be required to be changed in line with the optimization algorithm used for scheduling thermal power stations. In that case, it should be possible to give rights to states/beneficiaries to choose their schedule from its' hydro plant as per their requirement without hampering daily energy (in MWh) declared by the power station and RLDCs/NLDC should be able to prepare the schedule of hydro stations as per system requirement without considering the requisitions of beneficiaries. Differential if any in the schedule prepared by RLDCs/NLDC and sum of requisitions of beneficiaries may be addressed with suitable balancing products to be introduced at RLDCs or NLDC level.

The program shall be capable of introducing predefined ramping (in case of introduction of ramp-rates for requisitions) and technical minimum limits while furnishing requisitions based on the configuration. This may be enabled or disabled.

Further details are covered in Annexure section

7.5   Un-Requisitioned Surplus (URS).

The beneficiaries of an ISGS can surrender their share of entitlement. Such surrendered power is known as Un-Requisitioned Surplus (URS). This URS power can be availed by any other beneficiary of the same station, before the gate closure. There may be multiple beneficiaries simultaneously surrendering and multiple beneficiaries requesting URS at the same time.

The URS reallocation is done on the basis of consent given by generator and beneficiary as explained below:

i.   **Standing Consent:** Both Generating station and its beneficiaries (surrendering and requesting beneficiaries) give their standing consents to RLDC that the decision of the concerned RLDC will be binding on them with regard to scheduling and dispatch of URS power. If standing consent from generator and each beneficiary has been obtained then the

URS Reallocation will be done by RLDCs on first come first serve basis. However, if multiple URS requests are received in the same time block, those will be treated at par & scheduled on proportionate basis.

ii. **No Standing consent:** There may be cases where a generator wants to sell URS power to particular beneficiaries or may not want to sell URS power to certain other beneficiaries with whom it has a payment related dispute or any other contractual issue. In this type of cases each beneficiary may submit standing consent to RLDC whereas generator may not submit standing consent to RLDC. In such cases, URS power can be sold by the generator as per the provisions of the PPA. Since, in such cases standing consent will not be available with RLDC, it will reschedule URS power as requested/approved by a generator against the URS requisition of individual beneficiary.

Original beneficiary will always have the first right and thus the original beneficiary will be allowed to recall with 7/8-time blocks notice (or as per the respective IEGC provisions revised from time to time).

a. The available URS is taken as equal to the minimum of [(Sum of on bar Entitlements) - (Sum of Requisitions) - (Power Sold in short-term market by STOA bilateral or collective transactions)], subject to the Link ATC margin availability, Flow Area ATC margin availability, Flow path ATC margin availability.

b. The following philosophy is to be followed in the following cases.

   i. **Standing Consent given by both generator and Beneficiary:** The URS reallocation will be done on first come first serve basis, however the URS request received in the same time block will be treated at par & shared on proportional basis.

   ii. **Standing Consent given by the Beneficiary only and Real time URS approved by Generator:** Beneficiary will be allowed to enter the URS request, however the same will be considered for further process after approval/moderation from the generator.

   iii. **No consent for URS Reallocation by the Seller to a particular Beneficiary:** The URS from that particular plant to the beneficiary for that particular block will not be shown and will not be allowed to request.

   iv. **No consent for selling URS by the beneficiary for a particular plant:** The power surrendered by the particular beneficiary shall not be added in the available URS from that station.

c. The URS shall be restricted to the quantum available if the value entered by the user is more than the available quantum. The allocated URS shall be reduced in pro-rata of availed URS in

case the original beneficiary recalls the surrendered power. URS already Approved/Scheduled shall not be reduced for a fresh requisition by another entity. The requisition should be first adjusted against OnBar + OffBar requisition (if available) and balance remaining quantum should be considered as URS automatically.

d. There shall be provisions for URS requisition submission through web-based API/csv/xml etc. from a beneficiary's internal software so that it may submit URS requisition directly for a single or multiple generator together.

e. The program shall be capable of introducing predefined ramping (in case of introduction of ramp-rates for URS requisitions).

7.6   Long Term Access-LTA

Long term access (LTA) transactions are basically scheduled as per existing long-term power purchase agreement between generators (IPP) & States/beneficiaries. Time period of those agreements are between 7 year to 25 years as per the CERC regulations and amendments thereof from time to time. LTA is required to be incorporated in the schedule to finalize the drawl / injection schedules of regional entities.

These are basically first category of bilateral contracts and are configured as per the configuration module. The program shall allow the seller to declare the contract wise declared capability within the LTA quantum approved by CTU. However, in case of spillage and high inflow condition for Hydro generating stations, this limit is relaxed to 110% of the contract amount as per CERC regulations / orders which can vary over time.

On similar lines of ISGS, restrictions are imposed on the transaction due to various reasons like payment security mechanism, Regulation of power supply, transmission constraints, some associated NOCs etc. Accordingly, the allowable scheduling limit is worked out by finding the Minimum of (Declared DC, Restricted quantum & NoC) and the above components are displayed. The applicant of concerned LTA is allowed to punch the mutually agreed quantum of the buyer and seller within the allowable scheduling limit. The mutually agreed quantum restricted to allowable scheduling limit forms the basis for scheduling for that particular transaction between seller and buyer.

There shall be provisions for LTA requisition submission through web-based API/csv/xml etc. from an applicant's internal software so that it may submit LTA requisition directly for a single or multiple generators altogether.

Further details are covered in Annexure. The treatment of loss would be discussed in the scheduling process.

7.7   Medium Term Open Access-MTOA

Medium term open access (LTA) transactions are basically medium-term power purchase agreement between generators (IPP) & States/beneficiaries. Time period of those agreements are between 3 months year to 5 years as per CERC regulations & amendments thereof from time to time. MTOA is required to be incorporated in the schedule to finalize the drawl / injection schedules of regional entities.

These are basically second category of bilateral contracts and are configured as per the configuration module. All the other features as explained in LTA are applicable to MTOA. Accordingly, similar features to be provided. However separate module to be created. The treatment of loss would be discussed in the scheduling process.

7.8   Short Term Open Access-STOA-Bilateral

Short term open access (STOA) transactions are the third category of bilateral power transactions which need to be incorporated in the schedule to finalize the drawal / injection schedules of regional entities. These contracts are path specific. RLDC(s) shall incorporate the quantum of power to be exchanged in day-ahead / intra-day schedules, which includes the STOA transactions approved under various type like Advance, FCFS, DayAhead, Contingency etc.

All type of bilateral contracts is approved in the National Open Access Registry-NOAR and synced to WBES. The Approval / schedule finalized in NOAR under various categories such as Advance, First Come First Serve, Day Ahead and contingency shall get incorporated using web API from NOAR to scheduling program (WBES). Similarly, any revision in STOA schedule in WBES, due to revision by generator due to unit tripping or transmission constraint / curtailment / other grid security reasons shall be sent to NOAR from WBES using Web API.

The to and fro exchange of information between NOAR and WBES shall be through API and data exchange to be scheduled at specified intervals (say every 15 minutes or so) as per the config file decided during the implementation.

7.9   Power Exchange

Collective transaction under STOA is processed by power Exchanges and approved by NLDC. Regulation envisages multi exchange operation in India. Presently two power exchanges are operating in the country with a third exchange in the pipeline.

Currently Two types of collective transactions are available from Power Exchanges viz Day Ahead Market (DAM) and Real Time Market (RTM).

i.   Day Ahead Market for Collective transactions: These are the transactions cleared in the day ahead market of power exchange.

ii. Real Time Market: These are the transactions cleared close to the delivery period on the day of operation

iii. Green Day Ahead Market for Collective transactions: These are the RE transactions cleared in the day ahead market of power exchange

In near future two more collective product are envisaged like Market Based Ancillary Services, G-RTM etc. The programmed shall be flexible such that the admin user of WBES is able to add such future transactions using admin rights without necessity for any change or with minimum change in code including the content management modules, for ease of introducing any such product in near future.

There shall be a separate identifier should be used for green power so that he same could be accounted for RPO. Further, an identified for HPO also could be mentioned. In fact, a configurable identifier could be used for any accounting.

The details of the collective transactions are received in WBES through NOAR from power exchange through API. The exchange of information between NOAR and WBES shall be through API and data exchange to be scheduled at specified intervals say every 15 minutes or so as decided during the implementation.

Normally the information is exchanged in WBES from NOAR through API. However, there shall be provision for importing using .csv/.xls/.xlsx/xml file as a fall-back arrangement. The file format shall be based on NOAR software at the time of implementation.

The value of PX Transactions is received at Regional Periphery, shall be scheduled for the concerned regional entity after application of transmission loss (%). There shall be provision to insert any other STOA collective product/sub-product as & when introduced by CERC through relevant regulations/orders.

Further details are covered in Annexure section.

7.10   Market Based Economic Despatch (MBED).

It is envisaged that PX may introduce some more products on similar lines of day ahead market and real time market for achieving market based economic dispatch (MBED). A discussion paper on MBED has been floated by the CERC and the same is under consideration for rolling out in near future. Hence the programme shall have the feature to add such type of transaction in the configuration module. All the other features viz data receipt though NOAR as main data exchange, fall back mechanism etc. shall be on similar lines of Power exchange explained above.

The program shall be flexible such that the user of WBES is able to add such transactions using admin rights without necessity for any change or requires minimum change in code or include the content management modules, for ease of introducing any such product in near future.

Separate bilateral contract settlement (BCS) web page may require for account settlement, which includes Plant DC, Plant MBED, Beneficiary Entitlement, Beneficiary Requisition, Quantum considered for BCS etc. The display page format will be discussed during implementation.

7.11   Renewable Energy (RE) Transactions.

The objective of RE scheduling is to obtain quantum of power to be injected by renewable energy resources in a particular area, so that integrated planning for supply-demand gap management in that area may be dealt well ahead of occurrence. It involves collection of information from RE generators and integration with forecasting tools, which are processed and accordingly final schedule is prepared.

The entire process is carried out in separate RE scheduling software provided as part of renewable energy management centre (REMC). The schedules are processed in REMC software. The processed information viz schedule submitted by the generator, all the transactions along with losses and schedules at each of the boundary, contract details etc. are provided through API to WBES software. The API and the final data to be exchanged would be finalised at the time of integration between REMC and WBES. The current API and data can be referred by the vendor to understand the preliminary requirement.

The information of contract definition, requisition and schedule of LTA, MTOA, STOA-Bilateral and PX would be added in LTA, MTOA, STOA, PX schedules/contract. However, these transactions shall not be editable in WBES except in case of requirement of curtailment. If any RE change is required same need to be done in REMC only and the same would be processed on next revision in WBES. The transaction shall be shown under separate category REMC.

Similarly, the curtailment information and other information of WBES if any would be finalised and such information shall be exchanged through API to REMC from WBES.

There shall be continuous monitoring of the status of data syncing between REMC and a log shall be kept and available as a report. A message shall pop upon failure of data sync which shall stop on acknowledgment.

Presently there is three Regional REMC portal – WRLDC-REMC, NRLDC-REMC and SRLDC-REMC. The RE data will be to and fro exchanged between above three REMC portal and centralized WBES.

7.12   Reserve Regulation Ancillary Services (RRAS) Transactions

The Reserve Regulation Ancillary Services (RRAS) scheduling process is centrally coordinated   by NLDC through an in-house software.   The detailed information is provided through API to WBES software. The API and the final data to be exchanged would be finalised at the time of integration between by NLDC RRAS software and the WBES. The current API and data can be referred by the vendor to understand the preliminary requirement.

These RRAS transactions are processed during schedule revision in WBES. The transaction shall be shown under separate category (RRAS) in WBES. The counter-party for every RRAS transaction would be the regional virtual ancillary entity (VAE) and the VAE schedule would incorporate the appropriate injection and drawal losses

Similarly, the schedule and other information of WBES as required shall be exchanged through API to NLDC RRAS Software from WBES as per the configured time interval.

Normally the information is exchanged in WBES from NLDC RRAS through API. However, there shall be provision for importing using .csv/.xls/.xlsx/xml file as a fallback arrangement. The file format shall be based on NLDC RRAS software at the time of implementation.

There shall be continuous monitoring of the status of data syncing between NLDC RRAS and WBES. A log shall be kept and made available as a report. A message shall pop upon failure of data sync which shall stop on acknowledgment.

There shall be provision for excluding specific generators, region for a specific time range/interval from RRAS optimization

The data as required for preparation of reports mentioned in annexure shall also be considered while preparing for exchange of data

After the rollout of market based ancillary services in near future the program shall be flexible such that the user of WBES is able to add such transactions using admin rights without necessity for any change or requires minimum change in code or include the content management modules. With market based ancillary services, there may also be a need to earmark committed reserves ahead of real-time and schedule actual dispatch closer to real-time. In the expanding ambit of RRAS, program shall be capable of API integration with SLDC's scheduling software so that there may be hassle

free flow of requisite information across SLDCs and RLDCs and vice-versa on predefined time stamps near to real time.

TRAS and SRAS- The time blockwise details of the followings to be fetched rom NLDC in regards to TRAS and SRAS and added in schedule– TRAS Up committed in DAM, TRAS Up committed in RTM, TRAS Up required, TRAS Up Schedule in DAM, TRAS Up in RTM, TRAS Down committed in DAM, TRAS Down committed in RTM, TRAS Down required, TRAS Down Schedule in DAM, TRAS Down in RTM shall be fetched from NLDC. Similarly, all the time blockwise details of SRAS also to be fetched from NLDC, stored and added in schedule.

7.13   SCED Transactions

The Security Constrained Economic Despatch (SCED) facilitates centralized optimal scheduling of electricity from NLDC based on a national level merit order after all the beneficiaries & generators exercise their freedom & choice to requisition and schedule as per the grid code. It is another thin layer of centralized optimization introduced by NLDC over and above the existing decentralized multilateral scheduling so as to bring economy at the national level. It was introduced on a pilot basis since April 1, 2019 for 6 months as per the CERC order on SCED. Subsequently, the CERC has since extended the pilot SCED two times & as per latest order it would be in force up to September 30, 2021 and in all likelihood it may continue further. The CERC has also developed a method for sharing the savings generated out of reduction in generation cost due to the optimization exercise carried out at pan-India level under the SCED mechanism. SCED has enabled the achievement of pan-India, multi-area optimisation without disturbing the freedom or choice of any utility.

To facilitate the objective, the following is envisaged

- An external optimization tool viz GAMS or Excel solver would be used to finalize the optimized value for all the generators under SCED

- WBES shall expose an API for sharing the DC, Normative on bar capacity, Pmax, Pmin, injection schedules, ramp-up and ramp-down rates, variable charges as declared in real time / reserves regulation ancillary services (RRAS), technical minimum as per the IEGC provisions, and interregional schedules and transfer margins of all identified generators and corridors etc.

- WBES shall also able to accept optimized SCED values, exposed through the API for SCED Software at NLDC.

- The accepted optimized differential SCED schedules would be added/subtracted during preparation of schedules in WBES, as explained in the schedule section

- The counter-party for every SCED transaction would be the regional virtual SCED entity (VSCED) and the VSCED schedule would incorporate the appropriate injection and drawal losses.

The SCED values are computed by NLDC in-house developed software. The detailed information is provided through API to WBES software. The API and the final data to be exchanged would be finalised at the time of integration between by NLDC SCED software and WBES. The data as required for preparation of reports mentioned in annexure shall also be considered while exchange of data

These SCED transactions are processed during schedule revision in WBES. The transaction shall be shown under separate category SCED.

Similarly, the schedule and other information of WBES as required shall be exchanged through API to NLDC SCED from WBES.

Normally the information is exchanged in WBES from NLDC SCED through API. However, there shall be provision for importing using .csv/.xls/.xlsx/xml file as a fallback arrangement. The file format shall be based on NLDC SCED software at the time of implementation.

There shall be continuous monitoring of the status of data syncing between NLDC SCED and WBES. A log shall be kept and made available as a report. A message shall pop upon failure of data sync which shall stop on acknowledgment.

There shall be provision for include / exclude specific generators, region for a specific time range from SCED optimization. By default, the regional entity generator (IPPs) shall be excluded from the SCED, but can be included in SCED through a user toggle, which would enable the ability to collect required data from generators, provide the data through API to SCED application, and incorporate the SCED output in schedule.

In the expanding ambit of SCED program shall be capable of API integration with SLDCs scheduling software so that there may be hassle-free flow of requisite information across SLDCs and RLDCs and visa-versa on predefined time stamps near to real time.

7.14   Curtailment

Curtailment may happen due to various reasons like congestion in certain area which in turn affects other areas/electrical regions, HVDC pole tripping, inability to supply/generate as per contracted capacity, massive load crash, inclement weather conditions, etc. When curtailments involving large number of transactions are to be affected at a short notice and on selective basis as per rules & guidelines, the problem becomes all the trickier and more cumbersome. OA curtailment may be full or partial and direction based.

Curtailment sequence shall be URS, followed by STOAs (Bilateral followed by Day ahead Collective transactions), MTOA and finally LTA/ISGS Requisitions. Provided that while curtailing collective transactions, day ahead transactions shall be curtailed first followed by real time transactions. Effective timeline(block) for implementation and withdrawal of curtailment shall be as per the applicable CERC regulation and as defined in the configuration module.

7.15 Schedule

The schedules undergo revisions on account of various reasons and have to be facilitated accordingly. In general, the schedule is made account on the following reasons.

A. Revision by ISGS on account on variation in Declared Capability

B. Revision by beneficiaries: Revision of requisitions against / URS

C. Revision of LTA/MTOA/STOA/PX Day ahead and RTM

D. Revision of RRAS

E. Revision of SCED

F. Revision of SCUC

G. Revision by REMC

H. Revision by RLDCs

> Open access Curtailments

> Suo moto Revision

The schedule creation runs at predefined interval in auto mode. However, there shall also be facility to manually trigger the schedule using 'create schedule' option by authorised users viz RLDC/NLDC in general.

a. The programme shall auto identify the affected parties and accordingly remarks may be framed. In addition, there shall be an option for entering additional remarks if any by the RLDC operator.

b. There shall be unique revision number for All India level. The revision number shall increase for each revision. The Number increment for schedule revision shall be separate for day ahead, current day and post facto day schedule creations.

c. For the day ahead creation of any schedule revision for any day, the schedule revision shall fix each block's schedule Blk 1 to Blk 96 for the day.

d. For the current day (day of operation) manual schedule revision or auto schedule revision, the schedule fixation shall be done for the forward block only as per the gate closure concept. There shall not be any fixation of schedule for the past blocks.

e. There shall be proper tagging of revision number with date on which it is created. For example, Week ahead revisions may be tagged like WA-0, WA-1 with date and time stamping.

f. Revisions across RLDCs shall remain synchronized all the times. The programme shall compute the despatch schedule for ISGS/Seller, drawl schedule for Beneficiary / Buyer, Inter Regional Schedule and Transnational schedule.

    a. Despatch schedule: The methodology of computation / deriving despatch schedules varies for different types. Accordingly, the same is summarised below. Further If the there is any schedule restriction for any transaction, Schedule for a buyer/seller combination shall be limited to the restricted value. Further Programme should check for violation of schedule exceeding Installed capacity for Regional Entities and facilitate POP up.

        a. Thermal: As explained in annexure. The ramp philosophy based on previous block schedules of generator would be finalised at the time of implementation of SR.

        b. Gas: As explained in annexure. Further the ramp philosophy based on previous block schedules of generator would be finalised at the time of implementation of SR.

        c. Nuclear schedule: There is no surrender allowed for nuclear stations at present. Accordingly, the schedule is computed by simply summing the requisitions of all beneficiaries.

        d. Hydro Schedule: There is no surrender allowed for Hydro stations at present. Accordingly, the schedule is computed by simply summing the requisitions (equal to Optimized entitlements) of all beneficiaries.

        e. Renewable's schedule: The schedule sent by the REMC scheduling tool would be incorporated in respective generator and buyer schedule.

    b. Buyer schedule: After computing the ex-bus schedules for the ISGS/Sellers, the losses for each of the transactions at each of the boundary are computed as explained in the Transmission Loss Module section. The drawl schedule is computed by summing up the

moderated requisition from ISGS, mutually agreed quantum / requisition of LTA/MTOA/STOA- Bilateral, PX, Real Time and SCED.

c. Inter-Regional Schedules: Inter-regional schedules are computed as explained in inter regional section.

d. Transnational Schedules: Transnational schedules are computed as explained in Transnational section.

7.16   Transmission Loss Module

Loss Computation in General:

After computing the ex-bus schedules for the ISGS/Sellers, the losses for each of the transactions at each of the boundary for each of the blocks are computed. No wheeling loss is applicable. The respective losses shall not be applicable based on the configuration where Skip Loss is applied.

The module should be provided so that these type of loss calculation could be made user defined, which could be included or excluded as per the admin requirement.

a. **Block wise Regional/National Schedule transmission loss (% and MW)**

    i.   National Transmission Loss:

        a. Sum of All Scheduled Injection excluding inter-regional = S_i

        b. Sum of All Scheduled Withdrawal excluding inter-regional = S_w

        c. **National Scheduled transmission loss (in %) =** $[100 * (S_i - S_w) / S_i]\%$

        d. **National Scheduled transmission loss (MW)=** $(S_i - S_w) / S_i$

    ii. **Regional Transmission loss:**

        a. Sum of All Scheduled Injection including Inter regional = S_i

        b. Sum of All Scheduled Withdrawal including Inter regional = S_w

        c. **Regional Schedule transmission loss (%) =** $(S_i - S_w) / S_i\%$

        d. **Regional Schedule transmission loss (MW)=** $(S_i - S_w) / S_i$

    iii. **The recent CERC regulation of Sharing of ISTS Transmission Charges & loss Regulations 2020 (effective from 1.11.2020), there is one single ISTS transmission (in %) computed on weekly basis & the same is uploaded by NLDC as per the said regulations. This %age ISTS loss is used in scheduling at regional level.**

b. **Loss Computation for LTA, ISGS, MTOA, RRAS, SCED**

Treatment of LTA/ISGS/MTOA RRAS and SCED transactions while scheduling is same as far as Transmission Loss is concerned. Both injection PoC and with drawl PoC losses are borne by the buyer. The computation philosophy is explained below. Let us consider a case where the Injecting DIC is located in Region-1, Drawee DIC is located in Region-3 and let the contracted quantum power be P. Let us also consider an intervening region Region-2 for illustration. Further let Effective PoC Loss percentage of the injecting DIC in Region-1 be 'a' and that of drawee DIC in Region-3 be 'b'.

Computation

    a. Schedule at Injecting DIC Exbus viz S_i= P

    b. Schedule at inter-regional boundary between Region-1 & Region-2 viz $S_{R1\text{-}R2}$

       = P* (1-a/100) rounded up to two decimals

    c. Schedule at inter-regional boundary between Region-2 and Region-3 viz $S_{R2\text{-}R3}$= $S_{R1\text{-}R2}$

    d. Schedule for drawee State viz S_d= $S_{R1\text{-}R2}$*(1-b/100) rounded up to two decimals

In addition to the above PoC loss, state loss/ Discom loss may also be applied appropriately on embedded customers before applying PoC Losses.

c. **Loss Computation for STOA (Bilateral)**

Injection PoC is borne by the seller and withdrawl PoC losses are borne by the buyer. Application of Transmission Loss for the purpose of scheduling STOA transactions under PoC methodology is illustrated below. Let us consider a case where the Injecting DIC is located in Region-1, Drawee DIC is located in Region-3 and let the contracted quantum power be P. Let us also consider an intervening region Region-2 for illustration. Further let Effective PoC Loss percentage of the injecting DIC in Region-1 be 'a' and that of drawee DIC in Region-3 be 'b'.

Computation

    a. Schedule at Injecting DIC viz Si = P / (1-a/100) rounded up to two decimals

    b. Schedule at inter-regional boundary between Region-1 & Region-2 viz $S_{R1\text{-}R2}$

       = P

    c. Schedule at inter-regional boundary between Region-2 and Region-3 viz $S_{R2\text{-}R3}$

$$= S_{R1-R2} = P$$

  d. Schedule for drawee DIC viz $S_d = S_{R1-R2}*(1-b/100)$ rounded up to two decimals

d. Loss Computation for PX- Collective and Real Time and MBED products.

Injection PoC is borne by the seller and withdrawl PoC losses are borne by the buyer similar to STOA(Bilateral). Application of Transmission Loss for the purpose of scheduling Px under PoC methodology is illustrated below. There is no one to one identification for buyer seller combination in a Power exchange. Hence Let us consider a case where the Injecting DIC is located in Region-1, Drawee DIC is located in Region-3 and let the contracted quantum power be P. Further let Effective PoC Loss percentage of the injecting DIC in Region-1 be 'a' and that of drawee DIC in Region-3 be 'b'. Both the cases are treated as two different transactions.

Computation for Injecting Utility located in Region 1

  a. Schedule at Injecting DIC viz $Si = P / (1-a/100)$ rounded up to two decimals

  b. Schedule at inter-regional boundary between Region-1 & Region-2 viz $S_{R1-R2} = P$

Computation for Drawee Utility located in Region 3

  a. Schedule at inter-regional boundary between Region-3 & Region-2 viz $S_{R3-R2} = P$

  b. Schedule for drawee DIC viz $Sd = P *(1-b/100)$ rounded up to two decimals

The philosophy of loss application for different type of transactions may change in future. Thus, applicability of loss to different transaction through the numerical formula shall be made configurable. This shall be made configurable in the type of transaction create module.

7.17 Inter-Regional schedule computation

The inter-Regional schedules are computed as follows whenever the schedules are created.

a. Initially all type of transactions is booked in the specific path / link mentioned in the contract definition and sensitivity option chosen in ATC module.

b. Preliminary ATC violation check is made for all links in both the directions. The inter-regional schedules are finalised in case there is no ATC violation, i.e., net schedule of link/path is less that its ATC

c. If ATC violation exists subsequent to Sl no (b), say for import of a region, Software shall check

- Is total Import ATC of the region less than or greater than the net schedule in the link connecting to the region.

- If the net schedule is less than the total Import ATC of the region, then the congested amount shall be re-routed to uncongested route. However, no partial rerouting of a transaction shall be done.

- If the net schedule over the links connecting to the region is greater than the total Import ATC of the region, then sensitivity option shall be bypassed, and all the transaction shall be scheduled as defined in configuration module. Then system shall then ask for curtailment. In case of ATC Violation, after routing, the actual violating route should be shown with suggested quantum. Then user can select the type of transaction. Software shall also suggest required curtailment figure. User can select transactions and curtail them. In case of curtailment, ISGS schedules are recomputed

d. If ATC violation still exists subsequent to sl no (c) viz even after routing, then system asks for curtailment. In case of ATC Violation, after routing, the actual violating route should be shown with suggested quantum. Then user can select the type of transaction. User is also given a suggested curtailment figure. User can select transactions and curtail them. In case of curtailment, ISGS schedules are recomputed

e. Software should not allow schedule creation without ATC availability. Software should allow schedule creation only if schedule on links and paths is not more than ATC.

f. In case of ATC revision, the IR schedules should adjust flows according to updated ATC so that schedule on all links and paths remains within ATC

g. Updated data should appear in all regions' constituent schedule after preparation of full schedule.

h. Once the schedules are finalised, User shall be able to drill down to transaction types and then further into transaction details.

i. Similar approach may be considered at the time of state injection/drawl schedule preparation. State Injection and drawl schedule may be restricted to its declared Import/Export TTC.

7.18 Trans-National Scheduling

NLDC shall be responsible to facilitate the schedule and dispatch of power pertaining to trans-national. India is connected with neighbouring country likes Bangladesh, Nepal and Bhutan through the cross-border transmission lines. There would be one control area for Bhutan and Bangladesh and two control area for Nepal, i.e., Nepal-East and Nepal- North for the purpose of

congestion management. The inter-regional ATC is computed by modelling the utility of Bangladesh, Bhutan and Nepal-East as part of utility of Eastern Region, whereas the Nepal-North utility is considered as part of utility of Northern Region.

All the Injection/Drawal schedule of cross-border utilities shall be made visible in NLDC WBES reports, even though these utilities shall continue to be part of the regional WBES of the region with which the entity is connected. The user input interface (for entry of DC, requisition, URS etc.) shall be through NLDC website.

7.19   Un Requisitioned Surplus (URS) Power Sale & PSM Power sale in the market

The beneficiary having surplus may allow the generator to sell its share of power through various market. In such cases the original beneficiary will communicate its consent to the ISGS by 9:45 AM each day about the quantum and duration of power for next day for sale in the market. The original beneficiary may also provide a standing consent to the ISGS for sale of power in the market for specified duration and specified quantum. The ISGS shall not sell the power of any beneficiary in the market without its express consent.

Two set of information is to be taken w.r.t sale of URS Power in the market

  i.   Consent of the beneficiary

       Beneficiary shall be able to submit the consent for sale from a particular generator from the beneficiary. The features required to capture the same is detailed in annexure.

  ii.   Beneficiary wise split up of actual power sold from the generator.

       On receipt of the consent, the ISGS may sell the power in the market viz STOA(Bilateral) or Power exchange Day ahead and RTM. The Total URS power sold by ISGS through STOA is available with RLDC. However, the URS Power sold by ISGS through Power exchange is intimated by NLDC in day ahead. NLDC will upload the Power Exchange file as defined in the Power Exchange module, the details of total sell of URS power among the beneficiaries is not available with RLDC. To facilitate the same to be provided by ISGS, the features are envisaged as explained in annexure.

   Additionally, the power under PSM shall be captured, is explained in PSM section.

7.20   Available Transfer Capacity ATC

   All Inter regional, cross-border and intra-regional and State ATC figures are declared four months in advance. ATC declaration is revised by NLDC from time-to-time depending on grid conditions in consultation with RLDCs and SLDCs . Software shall have the provision to enter

ATC for different links/paths/flow areas/ States. In future real time dynamic ATC assessment is likely to be carried out by NLDC/RLDCs for Interregional and intra-regional paths/links/flow areas. WBES shall be capable of API integration with respective software at NLDC/RLDCs as the case may be so that real time assessed ATC may be incorporated in WBES without manual intervention. ATC margin computation is calculated for Day Ahead Market during day ahead as well as in Real time for real time market

1. ATC margin calculation for Day Ahead Market (DAM)

ATC margin link/Path/area wise shall be calculated for real time margin:

ATC Margin (Link/Path/Area) = ATC - (ISGS+LTA+MTOA+STOA+REMC+URS) + Reverse direction*(ISGS+URS+LTA+MTOA+STOA+REMC)

> *Reverse direction shall be a % figure for each link which shall be configurable by NLDC.
> ISGS details shall be considered as per the total of entitlements.
> LTA, MTOA shall be considered as per the contracted quantum.

   a. For a region, ATC margin is calculated corridor-wise as well as region- wise

   > For example, for NR, ATC margin for NR-WR and NR-ER is calculated and ATC margin for Net of NR import is also checked.

   b. Generally, all the ISGS/LTA/MTOA details shall be reflected in Inter-regional schedule as per the path details given against the transaction.

   c. Since in real time the distribution of power flow over different corridors may not be the same as the schedule quantum. These flows would depend on the sensitivity.

   User shall have the option to select sensitivity option. If selected, user would be able to fill sensitivity in %.

   > For example: In case of NR import, sensitivity over various corridors, viz. WR- NR and ER-NR may be assigned as 60% and 40% respectively.

   The transactions shall be routed over different corridors in line with the chosen sensitivity. However, for any transaction, its full quantum shall be routed over one specific path only and it shall not be split over multiple paths.

   d. If any congestion is found during schedule preparation, then congested quantum may be routed to a non-congested corridor

Once all the entitlements are prepared for all stations, an auto schedule program shall run automatically and calculate the ATC margin for each Link/path/Area and store the details at specific location in the database.

The ATC margin shall be computed for each time block

2. Normally, the schedules approved in Power Exchanges shall get incorporated in scheduling software through API. User shall also have the provision to upload the Power Exchange file (file formats like csv,.xls,.xlsx etc) manually.

3. Real time ATC Margin computation (for every schedule Revision): ATC margins in real time are automatically calculated whenever schedule is created. The scheduled values for each of the transaction at each of the respective link are considered for computing the ATC margin. The following formula shall be used for ATC computation.

RealTimeATCMargin(Link/Area)=

ATC-(ISGS+URS+LTA+MTOA+STOA+PX+REMC+RTM)

+ Reverse direction_real time*(ISGS+URS+LTA+MTOA+STOA+PX+REMC+RTM)

Reverse direction_real time = shall be value in % and shall be different for each link/area. By default, it shall be 100% for real time ATC margin calculation

4. In case of Power exchange, for deriving the margin of Flow area wise the net of quantum of power sold under collective transaction (Buy-Sell) of all utility under the same Flow shall be considered.

7.21   Regulation of Power Supply

As per CERC order (Regulation of power) Power Supply Regulation is imposed on a defaulting state by ISGS or Transmission Licensee should be as per procedure stated in Chapter III (Regulation by Generating Company) and Chapter IV (Regulation by Transmission Licensee) of the Regulation. Regulation of power supply is applied to Beneficiaries from ISGS block wise for specified time period. The regulated power can be sold in the market and as real time URS (as and when it is approved by CERC) to other beneficiaries through the URS module.

a. The Regulated entitlement shall be the entitlement after deducting the % or MW from the unregulated entitlement.

b. URS shall not be allowed for the regulated entity from the specified ISGS for the specified blocks.

c. The Schedule of Regulated entity shall not exceed the regulated entitlement from the specified ISGS for the specified blocks

d. The details of power sold in the market shall be considered while finalizing the schedules. The provision for uploading the split of power sold w.r.t regulated power explained in annexure

e. The finer details apart from the above point's w.r.t impact of regulation on entitlement, URS and schedule are explained in the respective modules.

7.22 Payment Security Mechanism

MOP vide OM dt 28th June, 17th July, 23rd July, 9th Aug '19 has advised that the power shall be scheduled for despatch only after intimation that a letter of credit to the required quantum of power is opened. Further concerned Load Despatch centre shall ensure that any entity which has not furnished an LC of requisite amount or not paid an advance, will not be able to schedule power and will have no access to procure power from Power Exchange(s). Accordingly, PSM (Payment Security Mechanism) module need to be implemented in scheduling module.

a. There shall be provision to enter the PSM values in the scheduling programme. Additionally, the Programme shall have a feature to upload PSM information in agreed format.

b. The program shall have a feature to update the PSM values through Web API.

c. A notification shall be triggered in the process management with "PSM" tag for intimation to the user for making fresh entitlements.

d. The PSM power can be sold in the market

e. The PSM entitlement shall be the entitlement after deducting the % or MW from the unregulated entitlement.

f. URS shall not be allowed for the PSM entity from the specified ISGS for the specified blocks.

g. The Schedule of Regulated entity shall not exceed the PSM entitlement from the specified ISGS for the specified blocks.

f. The details of power sold in the market shall be considered while finalizing the schedules. The provision for uploading the split of power sold w.r.t PSM power explained in annexure

h. The finer details apart from the above point's w.r.t impact of PSM on entitlement, URS and schedule are explained in the respective modules.

7.23   New Reserve Shutdown

As decided in the SRPC meeting the New RSD procedure is applicable to SR region. As per the New RSD procedure-

Unit status of each generator is required as mentioned in the section 7.1.1 and full unit capacity entitlements are default shown to all beneficiaries to take call on surrender or requesting their share for D+1 and above.

a) Unit can be taken into RSD:
   a. Surrenders by beneficiaries are specific to particular unit and if sum of the surrenders from the beneficiaries is more than or equal to unit capacity for more than 3 days for that generator. The number of days to consider under should be able to change with admin access in the new programme.
   b. Then approve button will be shown to operator to take call on it. If approved by operator New share allocations on bar and off bar will be calculated. Examples are attached in annexure.
   c. In case if sum of surrenders is more than two units' capacity and operator can take call to take out one unit or two units. In case if one unit is only going on RSD then the surrenders will be considered on pro-rata for calculating new share allocations.
   d. If unit is under New RSD and for D+1 day sum of surrenders is less than the unit capacity then new share allocation percentages will not be calculated and to consider again unit into New RSD procedure for RSD the minimum number of days criteria has to be met.
   e. In case of PSM/regulation is imposed by the generator for any beneficiary the share shall not be available to beneficiary for surrender.
b) RSD unit revival:
   a. Unit can be revived by beneficiaries if sum of requisitions is more than or equal to technical minimum of unit at least one day (this can be modified by admin in future). New share allocations will be calculated accordingly.
   b. If sum of requisitions for the future days is less than technical minimum then unit will be considered under regular MoP share allocations.
   c. If PSM/regulation is imposed by generator to any beneficiary the entitlements have to be reduced accordingly and same should be considered for revival of units.

In present timelines for New RSD procedure are 1500Hrs and 1700Hrs and share allocation calculation will be done accordingly. Share allocation calculations along with the colour coding need to be shown to all shareholding beneficiaries and generator.

Provision to download share allocation file in .xlsx and .csv.

Provision to upload share allocation file in .xlsx,.csv and through api, after all checks only file uploaded need to override existing for the next day and provision to change for current day future blocks if required through provided user logins.

8. Other Modules/Common Features

8.1 Implemented Schedules

Programme shall have feature to mark the revision as final implemented schedule. Once implemented, the same shall be available for download in all the formats

8.2 Common Features

The common features envisaged in the scheduling programme are summarized below and the same has to be implemented

a. The file upload input wherever mentioned shall be possible to upload in xls, xlsx, csv, xml format

b. The following options shall be provided where block wise input is provided

   i. Entering value for individual block wise

   ii. Entering value for range of blocks for all the blocks

   iii. Entering value for selected range of blocks only

   iv. Copy paste from excel

   v. Copy paste from csv.

c. Server side validation shall be done for all inputs apart from client side validation.

d. Time considered shall be that of server

e. Current day, day ahead scheduling & other day's options may be provided on scheduling portal instead of selecting date on every web page to avoid any confusion to operators while submitting requisitions. In case of other day, any date can be selected subject to user rights

f. Graph between n-1 and n revision

g. Changes shall be highlighted for all input pages between n-1 and n revision

h. Acronyms shall be displayed at all locations unless specifically mentioned

i. The user shall have provision to submit both intra-regional and interregional requisition in the local RLDC / NLDC user portal

j. Compatible with all type of browsers viz Mozila Firefox, internet explorer etc apart from google chrome also.

k. The entire scheduling programme along with report section should be made smart phone friendly.

l. Sorting of STOA, LTA and MTOAs may be sorted based on approval no's, Utility Name etc.

m. Necessary optimisation may be done in software to enhance the speed of data processing.

n. Inter-regional LTAs, MTOAs, STOAs There should be consented single point entry for all the three type of transactions.

o. User specific content shall be visible to the concern users, through the authenticated login and credentials and verified through OTP.

8.3   Process Management

The process management is the key to the operator to know any changes in the entire scheduling programme. Accordingly, the following features are envisaged.

a. The process management shall have the following columns as below for current day and day ahead separately

   i. Declaration Pending: It will contain the following

   • List of sellers for which DC is yet to be declared for day ahead.

   • List of PX file sold info pending. This is triggered on uploading of the Power Exchange file by the NLDC.

   ii. Entitlement Pending: It will contain the list of sellers (whose DC is given) for which entitlement is not created. This list will be for the sellers of the local RLDC as well as the sellers in which that region has share.

   iii. Requisition Pending: It will contain the following

   • List of Buyer -Seller combination (whose entitlement is created) for which requisition is not published- ISGS

   • List of approval numbers of the contracts for which the requisition is not entered. -LTA/MTOA.

iv. RSD/Revival of units calculations pending status.

v. Scheduling: It will contain the following

- List of buyer-Seller combinations (for which Requisition/URS/Curtailment/Power regulation/any other changes effecting ISGS schedule is published) but not considered while preparation of the full schedule

- List of approval numbers of the contracts for which the requisition is curtailed/changed but not considered while preparation of the full schedule. - LTA/MTOA/STOA/PX.

- TTC/ATC, and Px files uploaded by NLDC but not yet incorporated in the schedule (NLDC).

- Intra schedule prepared by RLDC and inter regional schedule is not prepared by NLDC.

b. NLDC to get the update on process about inter regional transactions. And show pending transactions for preparation of interregional schedules

c. A date selector to select the date. By default, it will select to current date. Any other date selection shall be possible with proper user rights.

d. The Process shall also trigger flag of all effected regions for change in entitlement and change in schedule forcing effected region to prepare entitlements and schedule respectively to affect the change with a new revision number.

e. The Process shall also trigger flag of all effected regions for revision/change/curtailment of LTA/MTOA/STOA forcing effected region prepare schedule respectively to affect the change with a new revision number.

f. Any interchange from REMC shall trigger the process management

g. The inter-regional generator change shall be shown in red colour if seller region is yet to implement and green colour if seller region has implemented the change.

h. The pending violations viz ATC violation, Flow gate violation etc also to be listed in the process management until the violation is fixed

i. There shall be a pop up for any change in the status and an acknowledgment button to acknowledge all alarms together.

8.4   Summary screen

Apart from the process management, the following summary screen to be provided which contains the following

    a. Declaration snapshot with details like ISGS, Latest Revision Number, Is Entitlement Created, is schedule Created, Published time.

    b. Requisition Snapshot with details like Seller, Buyer, Latest Revision Number, is schedule Created, Published time

    c. Schedule snapshot with details like Latest Revision Number, Schedule Date, Published time

    d. Notification with detailed message eg "user of Kerala_Beneficiary Buyer KSEB's Requisition for Seller TALST2 is published for 27-08-2018 date on 27-08-2018 at 12:55:23"

    e. Noting sheet shall be generated with each schedule revision which contain each scheduling utilities (regional entities) drawl/injection schedule and incremental change.

8.5   Notification

Personalized Email & SMS Notification shall be sent to the specific user whenever there is a change in schedule for respective entity and while taking Units into RSD and Revival of units from RSD. The Personalized Email notification shall contain the latest file containing the following

    i.   Personalised Notification Message

    ii.   Respective entity Schedule

    iii. Changes w.r.t previous revision.

    iv. New share allocation percentages.

8.6   Logs/Audit Trail

Considering all interactions through software, every user interaction shall be recorded as valid logs under user level and system level as the case may be. WBES application should have audit trail through event logging for each and every activity, irrespective of success or failure of the interaction. The system shall provide audit trail of user and system activities that enables data changes to be tracked and reported, including changes made by system administrator. All users of the application including system administrator must have unique IDs. Each time the users log into the application or makes any changes /new entry made to any of the data, a log with user ID, timestamp and IP-address must be generated.

Full data and system audit ability such as version controls and retrieving data according to the date and time should be available.

8.7   Data to be exchanged with other systems

Scheduling software system envisaged to be developed here is required to exchange data with other systems. Data exchange may be divided in two categories, viz., data exchange with system internal to POSOCO and data exchange with other utilities which are external to POSOCO. A tentative list of systems for both the categories is given below. The detailing and finalization of the same shall be done during SRS finalization stage. Scheduling software shall fulfil all requirements of data exchange.

a.   Data exchange Internal to POSOCO

i.   Exchange of data from any of the internal system of POSOCO like IT, OT or both, shall be seamless, without requirement of manual intervention. Scheduling software shall expose pre-defined web services which may be used by other software system for importing as well as exporting of data. The data exchange format shall be agreed upon during SRS development phase. Format used may be JSON or XML for which schema shall be decided during development of SRS. However, bidder may suggest any other better format which may improve the performance along with meeting the requirements of this technical specification. Decision of POSOCO shall be final.

ii.   Since, at present data exchange with other internal systems being done through Comma Separated Values (CSV) files / XML, proposed scheduling software shall also export in Comma Separated Values (CSV) files/XML and import data from CSV files/XML. Column definitions for the same shall be provided by POSOCO during SRS development phase. The data exchange format shall be agreed upon during SRS development phase

iii. **Data exchange to SCADA:** Energy Schedule data would be integrated with EMS/SCADA system for update and further application purposes at SCADA end. In order to transfer data on every changes / every block, initially CSV/XML format is to be implemented based on standard procedure. The data transfer would be for the current (nth) block data and immediately preceding (nth -1) and successive (nth +1) block data. Separate view would be provided at Energy Scheduling system to select data point to be transferred to EMS/SCADA. Bidders are encouraged to implement changed based data points transfer for given scenario otherwise complete selected data points would be transferred. Typical

XML/CSV schema for SCADA interface would be provided by POSOCO. In near future, the provision shall also be there to transfer the SCADA data through Web API.

iv.   Application program interfaces (APIs) of the data could be provided to the RLDCs so that the extraction of data can be used efficiently for post facto analysis & reporting.

b. Data exchange External to POSOCO

i.   Scheduling system is required to exchange data with the constituents (Other power utilities, generating stations etc)... Recently API links have also been provided to SLDCs/Gencos to fetch relevant scheduling data.. Constituents have developed their scheduling system which can import/export data to RLDC/NLDC scheduling software. At present, constituents, utilities are uploading their requisition for ISGS/LTA/MTOAs through .csv / xml formats apart from manually entering on concern WBES web page which need to be further improvised to API based data exchange system .

ii.   All data exchange with constituent systems shall be carried out through CSV file transfer as well as through RESTful and SOAP web services. Web services shall transfer data in JSON and XML formats. JSON and XML schema will be finalized /provided by POSOCO. All web service communication shall take place on SSL communication with authorized subscriber only. Normally all exchange shall take place in pull or query-based method form constituent side except some of the message/data like last revision number etc. All uploading and downloading of data shall be affected by calling respective web services exposed by scheduling system. Before responding to any call to a web service, scheduling system should first authenticate the caller then check the authorization for access. In case of unauthorized call, it should provide the feedback to the caller. After authentication and authorization success, scheduling system should validate the data format against the schema, before importing sent data or exporting required data.

8.8   Data for storing remarks w.r.t discrepancy keeping

The scheduling software shall have the provision for recording the log/discrepancy/remarks for a selected date with provision for uploading details related with the discrepancy. This information is useful for passing the information to other shifts as well as implemented schedule person and acts as log book w.r.t schedule.

Scheduling software system envisaged to be developed here is required to exchange data with other systems.

9   Reports

The common features envisaged for all the reports are summarized below

a. The application shall provide reporting tool using reporting tools like Crystal Reports or any other tools with better features for generation of Textual (Data) reports and Graphical (Pie-Chart, Bar-Chart, Line Graph, 3-D, worm plots, etc) reports.

b.   Internal users within RLDCs and NLDC shall also be able to prepare customise reports using the tool.

c. The report shall be downloadable in pdf, xls, xlsx, csv, xml etc...

d. All the reports wherever feasible shall have the option to compare previous data viz any revision no/ any date with the any revision no/ any date

e. All the reports shall have search and sorting option.

f. The revision Number shown in the Process reports shall pertain to the local/ individual revision number

g. The revision Number shown in the external reports shall pertain to the schedule Revision Number

h. The maximum, minimum & average shall be displayed in all the reports wherever feasible. The MWH shall be additional shown wherever block wise MW values is displayed

i. All the drop-down filters shall have the possibility of selecting All or multiple

b. There should be option for choosing multiple dates. Same will be helpful for stakeholders for compiling data sets for different dates together.

j. All reports linked with schedule or part of the schedule process shall have Published time and Remarks

k. All the column headings in a table shall be freeze pane mode so that the same shall appear even as scroll down of data is done.

The tentative list of reports is given below. The Final list of reports will be finalized during the time of development.

The Reports are broadly classified under three sections as given below.

1) General Reports

2) Visualizations Tools

3) RPC Reports

9.1 General Reports:

All the existing reports, available in the public domain, in the given formats, under 'View Reports' section in the wbes.wrldc.in / wbes.nrldc.in / wbes.srldc.in / wbes.posoco.in / wbes.erldc.in shall all be covered. The Date format in each report shall be changed to 'From' date to 'To' Date with 'From' Time-Block to 'To'-Time Block. The drop drown shall have an option for single selection or multiple selection or All, with download in csv, excel, pdf, xml etc. For Eg:

a) Declaration Reports: It shall clearly show the Declaration Capacity of all the ISGS and Regional Generators capacity, with region, revision no, From date TO date, Remarks, publish time, Seller Selection may be single seller, Multiple seller, or All Seller, toggle option for OnBar/OffBar and DC Vs Sch Display, or any other category of DC.

b) Entitlement Reports: Entitlement for Buyer and Seller, with revision nos, remarks, publish time, region, with toggle option for OnBar / OffBar with RSD and without RSD , From date to Date, Single Selection, Multiple selection and All.

The Entitlement page shall have option to display the a) Entitlement as per the Seller DC including the Normative DC, b) Entitlement use for scheduling, c) Entitlement used for requisition after PSM, PX sold etc…

c) Requisition Reports: It shall have original requisition entered by the beneficiary, both seller wise and beneficiaries wise. It includes the remark, publish time, revision nos, From date TO date, Region, Single Selection, Multiple selection and All.

d) URS breakup Reports: It shall show the left-over Requisition by the beneficiaries, with respect to each seller due to regulation or less requisition. It shall have a toggle option to show the Regulated and Un-Requisition surplus. The page shall include the remark, publish time, revision nos, From date TO date, Region, Single Selection, Multiple selection and All.

e) URS Availed Reports: It show the URS availed by the beneficiaries against each seller/buyer, with toggle button to include the Regulated URS, Un-Requisition URS, URS requisition vs scheduled URS. The page shall include the remark, publish time, revision nos, From date TO date, Region, Single Selection, Multiple selection and All

f) Net Schedule Reports: It show the Net Schedule at the boundary of Seller and beneficiaries, after loss. It shows the algebraic summation of purchase and sell of power under different market portfolio like ISGS, URS, LTA, MTOA, STOA, PX, RTM, REMC, RRAS and SCED. The option for further drilling down under different market portfolio shall be available. There shall be a

toggle button to show the Net Schedule With or Without Loss. The page shall include the remark, publish time, revision nos, From date TO date, Region, Single Selection, Multiple selection and All.

g) Link / Path Schedule: It shall show the Net Schedule of each link / path with ATC limit and available ATC Margin, with the highlight in case of ATC limit violation. It drilled down options link/ path wise to show each transaction as per the different market portfolio.

h) LTA/ MTOA Reports: It shall show the Ex-bus / Ex-Periphery Schedule transaction wise, with option to select seller wise or buyer wise, trader wise. There shall be a toggle button to show the Net Schedule With or Without Loss. The page shall include the remark, publish time, revision nos, From date TO date, Region, Single Selection, Multiple selection and All.

i) DAM/ RTM Report: It show the PX/RTM transaction at the Regional boundary values.

j) Schedule Loss Reports: It show injection and drawl loss for each seller (both the ISGS and Regional Generators) and each Beneficiaries. It shall also show the details loss (injection and drawl) transaction wise and market portfolio wise for each seller and beneficiaries, including the total loss. This page shall showcase all the loss computed or applied to any buyer or seller to get the Net Schedule, so that the entire losses could be seen on a single page.

k) RRAS and SCED: It shall show all the RRAS/SCED imposed to for every seller. The page shall include the remark, publish time, revision nos, From date TO date, Region, Single Selection, Multiple selection and All.

l) Reports related to Renewable Power Obligation (RPO) and Renewable Generation Obligation (RGO) for both the buyer and Seller: The detailed RPO & RGO report format and configuration will be shared during development.

m) RSD reports: It shows any units under RSD units or revived with RSD New procedure. The page shall include new share allocation on bar and off bar along with PSM if any.

'Toggle' option is to be there to display daily MWhr/MU or blockwise MW quantum and option to plot that time-series data. This report section may be available in public through credential-based login

9.2   Visualization:

a) **Real Time Interactive Dashboard**: There shall be real time interactive user customised dashboard, which shall be updated in the real time. It shall clearly show the graphical parameter on moving the cursor, with feature to zoom-in and zoom-out or zoom-in the particular section of the plot. The option to increase / decrease the real-time interval duration of the curve, with

any specific start date or any fix duration. The option to select and deselect any parameter for comparison purpose, colour selection, download in csv, excel, pdf, or any other database file etc. There will minimum 10 such real time interactive dashboard. The graph details will be finalized during development.

b) **Offline Visualization**: These shall be a readymade plot, visible on the clicking the button, with feature to extract and display data 'From date and TO date, (including the current date and revision), selected and deselection of any parameter within the plot, zoom-in and zoom-out or zooming any section of the plot. Parameter colour selection, revision no, remarks, publish time, with or without loss. There should be option to export the following mentioned visualization data via different format like excel, csv, pdf or any other database file etc. The last one Year data could be easy extraction and visualization and demonstrated within 5 sec for different parameters. The tentative list of possible visualization plots are given below.

i. Visualize different parameter of the schedule within the same plot or different plot like DC, Normative DC, Seller DC, Entitlement, Requisition, DAM, RTM, SCED, LTA, MTOA, STOA, URS. Pmin, Pmax, Ramp-UP and Ramp Down, available reserves etc.

ii. Comparison Reports like DC Vs Schedule, RTM Vs DAM, FC Vs VC, Requisition Vs Schedule, Number of DC submission Vs Incremental change, Compare schedule with actual drawl for larger period – scatter plot & trend chart etc

iii. Visualizing the Events: Count the No of requisition, No of Schedule Preparation, RTM revision, URS revision, RRAS revision, curtailment for transmission constraint, etc. The same may be shown in the Total count of all revisions & a pie chart showing break-up of each category viz. Generator DC revision, Change in Requisition, Transmission Congestion, Grid Disturbance, Frequency of failure of communication or hardware etc, No of false attempt of login or etc…. for any date or range of days

iv. Finding different pattern of parameter like DC pattern, DC revision for any reason, Upward/Downward DC revision timing pattern Upward/Downward DC requisition pattern etc. Requisition pattern with RTM/DAM purchase, Reserves (URS / RSD) AGC energy (MWh) dispatched, Declaration of lower DC in peak hours, etc.

v. Discovering Statistical analysis: Correlation between net schedule, including the revision nos and DAM/RTM price, correlation interregional flow pattern with different type of generation or load pattern, Submission timing of any parameter by any type or any user etc

vi. Loss computation: The net schedule loss computation transaction wise for each beneficiary wise/ generator wise/ Control area wise/ Region Wise / All India Level. The loss will be

computed for each transaction separately both for injection and withdrawl Loss. The Loss computation shall be graphically presented for each beneficiary/Generator/ control area/ region / All Inia level, as per the user selected time duration.

9.3   RPC Reports:

These are fixed format reports generated on the weekly (DSM) and monthly (REA) basis for each RPC like WRPC, NERPC, ERPC, SRPC and NRPC. These reports are generated for each RLDC admin user request. For example, for NRPC, ERPC and NERPC have nearly 18 excel file for weekly report and 21 excel file for monthly reports. WRPC there are 21 files in *.DBF format for Weekly report and 28 files in *.DBF format for Monthly Reports. Similarly, SRPC there are 150 files in *.csv format for Weekly and 180 files in *.csv format for monthly reports and New RSD procedure implemented days with new .1br files. It may kindly be noted that the file content, format, data presentation and file type and number of files for Weekly (DSM) and Monthly (REA) reports for each RPC is different. The vendor is permitted to see all the existing RPC files for 5 regions. The data in the RPC Report need to be authentic since it is used for account purpose. There may be a requested for new RPC reports during operational / AMC period, the vendor shall not additionally charge for preparation of any new RPC Reports by any RLDCs.

Annexure - Web Based Energy Scheduling Application

10. Configuration

10.1   Configuration

10.1.1.   User Configuration

Role based user management system shall be adopted to configure different users so that menus/ data pertaining to specific user only are accessible.

a. This module shall have the provisions for System Administration and Configuration, namely, Creation/Modification/Deletion of User accounts, Roles and assignment of roles with rights.

b. There are three major activities envisaged in this module in the mentioned sequence

i. Roles Creation/Modification/Deletion: The first activity starts with the creation of roles before creation of the user. Accordingly, there shall be a Provision for Creation/Modification/Deletion of roles.

ii. Assignment/modification of Rights to a Role: Each role will be assigned the following rights for each of the modules/menus. Accordingly, provision for selecting a role and assign the rights for each of the module as below shall be generic made available.

Table 2: Details of User Rights

Module	Day ahead				Real time					Post facto			
	View	edit	Delete	All Rights	View	edit	Delete	No of blocks	All Rights	View	edit	Delete	All Rights
User	No	No	No	No	No	No	No	NA / Normal/ Next time Block	No	No	No	No	No
..	No	No	No	No	No	No	No		No	No	No	No	No
..	No	No	No	No	No	No	No		No	No	No	No	No

iii. User Accounts Creation/Modification/Deletion: Each User shall be created with the following provisions

   a) There shall be a web page where User can send a request for Registration with the details Like desired Username, name of schedule co-ordinator, address, email, Mobile Number, Landline number, Password, ftp server details etc.

   b) RLDC admin will Assign Utility / Multiple utility with whom the user is to be associated after creating the login details.

   c) Subsequently RLDC admin assigning a role or multiple roles to the user.

   d) After the above steps, Admin (RLDC) will confirm the user by sending an activation link to that registered email id. Upon activation by the user, the user will be able to use the scheduling software/ tool (WBES).

e) Password change: User should be forced to change the password on first login. Authentication otp/link to be sent to registered email ids & contact number (SMS) for any change of password in future with the help of change password by the user.

f) The user database should be centralized basis. It should be valid for all RLDCs.

g) Details of user should be exported in format (.db/.xml/.csv or any other database format), which can be imported by other regions software.

h) There should be on master key type system of hotel management system. In case of RLDC admin want to login as that user for any issue faced by user, RLDC will able to login as that user with the master key.

i) One umbrella/admin user may be created for each utility. Under that umbrella/admin login multiple logins can be created by the respective utility. That umbrella login will have certain rights and that login can further assign users rights for its slave users. User rights to be restricted to the rights given to umbrella user login.

j) If any user has multiple roles. A drop-down menu may be introduced in home page to change the roles.

c. By default, the following roles shall be created Super Administrator, Administrator, Supervisor, Scheduler, Generating Stations and Beneficiaries within and outside the concerned RLDC/NLDC with rights assigned with the help of RLDC.

d. All the above information viz lists of users with details, list of roles along with rights shall be available as a report and downloadable in pdf, xlsx, csv etc.... Further the report shall have the details of creation date and complete history of the changes made on the user credentials.

10.1.2. User Log In

This module will enable authentication and verification process to allow authorized members to log-in and access menus depending on his/her assigned roles & rights.

a. Pre-configured rights shall determine and activate the modules and menu accordingly for the authenticated user. Attempt to log in by un-authenticated users will display appropriate message/remark in message window.

b. There shall be Mobile OTP verification and /or Captcha to access scheduling programme.

c. There shall be a provision of to change password after getting Registration and Forgot password option to obtain new password

d. There shall be password lock with no of wrong password attempts (Configurable one)

e. Proper user login, logout rules shall be implemented. Software should maintain all user activities (SoE) in a separate database under respective user's login name with time stamp. IP and MaC address may be recorded and binding for each login and activities. A full-fledged module may be developed to visualize & analyse the SoE and details for all seasons.

f. Season time out for any login may be configurable from front end.

g. Limitation for simultaneous season for same login id (user id wise) may be also configurable from front end.

10.1.3.   Utility

This module will enable creation/modification/deletion of utilities and same shall be used in entire programme in all modules.

a. There should be provision to create, edit and delete (hide) utilities with proper user right options.

b. The following minimum fields are envisaged and any other additional fields for achieving functional requirements may be added accordingly.

Table 3: Utility Definition Attributes

Fields	Remarks
Utility Name	

Fields	Remarks

Utility Types	Major Utility Types are
	 • System operator viz RLDC, NLDC, SLDC
	 • Parent State for whom the scheduling is done apart from generators viz states.
	 • Transmission operator viz STU, CTU
	 • Generator viz ISGS, Regional Entities. Further Each category is subdivided into Thermal, Gas, Hydro, Renewable viz Solar, SPPD, SPD, Wind, Hybrid of Renewable and other Renewables, Storage (Any new Generation category may also be added by Admin)
	 • Utility viz Beneficiary, State Utility, embedded in state, Discom, Embedded in Discom, Trader.
	      o Further Each Beneficiary, State Utility & Embedded in state has to be associated with a Parent State.
	      o Each Embedded in Discom to be associated with a Discom.

Type of generator	• Applicable only to Generators • Types viz Thermal, Gas, Hydro, Nuclear, Solar, Wind
Is Station wise Declaration Required	• Applicable only to Generators • This flag will determine whether regional generators can declare station/stage wise declared capability or not and time dependent
Is unit wise details required	• Status of every Units on bar or off bar SCUC • Each unit of the plants shall be clearly defined • Ramp/tech min per unit, time dependent • This flag will determine whether regional generators can declare unit wise declared few details or not and time dependent • Normative Auxiliary consumption of each unit (time dependent) • Overload capacity of each unit

Fields	Remarks
Station Technical Minimum as Percentage of Normative DC	• Applicable only to Generators • This value is time dependent and will be used for computation of technical minimum • Configurable for each Generator
Is Share Allocation Sum 100%	• Applicable only to Generators • This flag will determine whether sum of share allocation should can be less than 100% or not and time dependent
On bar Normative is used or On Bar Installed Capacity is submitted by the generator	• Applicable only to Generators • This flag will determine whether generator is going to declare OnBar Normative is used or On Bar Installed Capacity
Applicable Peak Hours	• Applicable only to Generators (time dependent) • Mapping of Peak Hour time variant (time dependent)
Applicable Peak Season	• Applicable only to Generators (time dependent) • Mapping of Peak Season time variant (time dependent)
Is SCED provider	• Applicable only to Generators • This flag will determine whether generator is a SCED provider who will participate in the Ancillary services
Is SCUC provider	• Applicable to all Generators • This flag will determine whether generator is a SCUC provider
Is RRAS Provider	• Applicable only to Generators • This flag will determine whether generator is a RRAS provider who will participate in the Ancillary services

Fields	Remarks
Is Generator Part of other Region	• Applicable only to Generators • This flag will determine whether generator like Talcher Stage 2 part of SR scheduling but part of ER as for as ATC is concerned. • If 'Yes' then further Region shall be taken as input in which it has to be considered for ATC.
Is Buyer Part of other Region	• Applicable only to Buyer • If 'Yes' then further Region shall be taken as input in which it has to be considered for ATC.
Is URS allowed to Non-Beneficiary	• Applicable only to Generators • Normally URS is allowed to Beneficiary of the particular station. This flag will determine whether URS is also to be allowed to Non-Beneficiary and time dependent.
Is Negative DC allowed	Whether to allow negative DC entry or not
Is NEW RSD applicable to Generator	• Applicable only to Generators • This flag will allow whether to consider/exclude the generator for New RSD procedure.
Drawl Zone Injection Zone	• Common to all except utility type System operator, Transmission operator, Trader. • The zone assignment is time dependent
Acronym	• Unique code shall be used in the programme and same shall be able to change with time dependent
Open Access Code RPC Code Px Code Date of First Time Charging (FTC)	• Common to all except utility type RLDC. • Date of Commercial operation of unit shall be used for the start date for scheduling purpose.

Fields	Remarks
Date of Trial operation Date of Commissioning Date of Commercial Operation Date of Decommissioning Station Name	• Decommissioning date shall be used for the delisting for further process. • All Shall be Time dependent • Provision to enter Date of FTC, Trial operation, Commissioning shall be unit wise. The dates i.r.o. the complete plant will be equal to date i.r.o the last unit.
LTA operationalization	• Applicable to generator. • Sub Fields with date of operationalisation, MW
Auxiliary consumption percentage	• Facility to upload a table which includes auxiliary consumption percentage values at different generation levels
• Additional fields for Hydro	• Subtype – Storage, Run of River (RoR), RoR with pondage • Full Reservoir Level (FRL) • Minimum Drawdown Level (MDDL) of reservoir • Cavitation/Forbidden Zone (From MW & To MW) • Provision to upload beneficiary wise Free power allocation table (in specific format) • Water Storage Facility (Dropdown -Yes/No) • Number of time blocks for which water can be stored (for RoR with pondage type hydro) • Availability of pumping mode operation (Dropdown -Yes/No) • Availability of condenser mode operation (Dropdown -Yes/No)

Fields	Remarks
Additional fields for Gas	- type of fuels (Dropdown) - Each Gas Plant will have multiple Fuel Type, each Fuel Type will have different RPC Code, PX Code, DoC, DoD - Facility to upload Generator Response with ambient temperature in specific format. It shall be a set of data of Ambient Temp vis-a-vis Installed Capacity. The effective date for the change in above response, shall not affect the past data. This shall be used to calculate block-wise Normative On Bar DC, Technical minimum etc. - It shall be optional to use the above-mentioned temperature dependent Installed capacity or constant value of installed capacity. - Each Gas Plant will have multiple Fuel Type, each Fuel Type will have different RPC Code, PX Code, DoC, DoD
- Further there shall be provision to add Generator unit wise details viz Unit Name, installed capacity, Normative capacity, Auxiliary consumption, Ramp up, Ramp down, Commission date, Decommission date of First Time Charging (FTC), Date of Trial operation - Additional fields for Gas viz type of fuels - Additional fields for Renewable in line with REMC scheduling	

c. All the fields of Utility details shall be unique in the entire application. Same shall be modified by administrator of application/RLDC/ NLDC administrator only with time dependent

d. There shall be provision to add /modify any other type of category.

e. There shall be a provision to enter/Upload utility data base as per requirement.

f. All the above information viz list of Utilities with details shall be available as a report and downloadable in pdf, xlsx, csv etc.... Further the report shall have the details of creation date and complete history of the changes made on the all utility attributes.

10.1.4. Number of Blocks & Time Block duration

As per IEGC Regulations, each day is divided into 96 time blocks of 15 minutes each for the purpose of scheduling as on date, which may change to any time period per block in future. Provision shall be available to set the number of blocks and time duration of each block as part of configuration with time variant shall be provided (Like 1 minute, 5 minute, 15 minutes etc) which shall be defined by admin through configuration module

10.1.5. Gate closure for different product

As per current schedule methodology, which is prepared in line of IEGC,2010 (with subsequent amendments) & other CERC regulations, several time line/gate closure is there for submission of DC/requisition/Curtailment etc on Real time as well as on day ahead. This timeline also gets revised time to time with amendment of CERC regulations. Gate closure may be segregated in two categories:

Day ahead gate closure: As per IEGC regulations, it is mandatory to submit R-0 DC before 06:00hrs & R-0 requisition before 09:45hrs. This timeline can be changed time to time. There should be provision to change this timeline from configuration module.

 In future all data exchange will be shifted from manual data entry/upload through login to automatic data exchange over API or similar kind of latest data exchange technology. This gate closure will be also effective for data pulling over API from other application such as scheduling software of Generator/SLDC/NLDC etc. In case of introduction of any kind of new scheduling category such as MBED, RE power bundling, etc., options to set or revise timeline of gate closure for those products also to be created in the gate closure module.

Through this submodule of configuration module timeline for auto data pulling for Day ahead schedule may be determined, such as DC pulling from Genco's software at 06:00hrs, requisition pulling from SLDC's software at 09:45hrs. etc. Following tentative timeline may be considered:

a) Day ahead R-0 DC

b) Day ahead R-0 Requisition

c) R-0 URS generation

Real time gate closure:

As per IEGC regulations in vogue, DC declaration/requisition/curtailment by any of the appropriate user is allowed w.e.f 7th time block for odd time block & 8th time block for even time

block and curtailment & revoke of curtailment is allowed from 4th time block. However, to have flexibility in the programme, there shall be provision for setting the desired time block from which input change is allowed for each type of transactions and to individual users viz Availability declaration, Entitlements, Share Allocation, ISGS Requisition, LTA requisition, MTOA Requisition, STOA-Bilateral requisition, PX, Schedules, RRAS, Generator Type or any other module at the time of development. The same is time variant. There shall be provision in configuration module to set gate closure for different type of users at the time of user integration for all different type of categories for submission such as DC, Requisition, RRAS, SCED, curtailment, RSD etc.

10.1.6. Decimal Rounding off

As per present IEGC regulations, the availability declaration by ISGS shall have a resolution of one decimal (0.1) MW and one decimal MWH, all entitlements, requisitions and schedules shall be rounded off to the nearest two decimals at each control area boundary for each of the transaction and shall have resolution of 0.01MW. However, to facilitate the decimal rounding off to be flexible with time variant, there shall be provision for setting the desired rounding off decimal places for each of the transactions viz Availability declaration, Entitlements, Share Allocation, ISGS Requisition, LTA requisition, MTOA Requisition, STOA-Bilateral requisition, Day- ahead collective transactions, Ancillary services, SCED, SCUC, Real time Collective Transactions, Schedules, any other module at the time of development. The sum of the rounding off shall be with zero error. The decimal rounding off methodology shall be similar to the existing WBES provision The rounding off quantum in MW and MWHr at the time of submission of data by the users (at Input level) and at the time of calculation at each control area boundary shall be made configurable which can be changed by administrator as per the change in applicable regulations in future All the new changes in this module shall be time stamped, so that it could not change past days methodologies of calculation.

10.1.7. Transaction management module

Schedule of any utility is being done by aggregating all of its' transactions such as LTA/MTOA, STOA, ISGS, PXs etc. Each transaction is a contract. There may be chance of special treatment for any contract. These special treatments shall be managed through this module. This management module will be a time dependent module. Separate revisions will be created for any change of any field for different time period.

10.1.7.1. Boundary of Contract

As per CERC regulations, all LTA & MTOA transactions are defined at seller boundary and all STOA transactions (including exchange products) are defined at regional boundary. However, some

of the transactions have certain peculiarities due to the location & jurisdiction of the seller/buyer and also due to special treatment as per CERC orders on some particular transaction.

i. Consideration of contract amount to any control area boundary for any particular type of transaction shall be made configurable. Administrator shall have the right to define the applicable boundary for each transaction type or by any common rule. In the transaction management module RLDC admin can change/overwrite the rule and allocate any control area to any transactions input as per the dropdown of following control area boundary Seller (Parent state)

ii. Seller (embedded entity)

iii. Region

iv. Buyer (Parent state)

v. Buyer (embedded entity)

During the creation of any contract, this may be shown to the transaction creation pop-up/page. Any addition of control area to this list shall also be made configurable.

10.1.7.2. Loss Applicability

As per CERC (Sharing of Inter-State Transmission Charges and Losses) Regulations ISTS transmission loss is applicable to all type of transactions viz ISGS, LTA, MTOA & STOA & Different ancillary products at the time of schedule preparation. The methodology of loss application is changing time to time as per the revision made in this regulation. Loss applicability to any transaction shall be made configurable to administrator. For most of the transaction applicability of ISTS transmission loss is as per the CERC regulation except for few cases where applicability of ISTS transmission loss may be different than common rule as per the time-to-time order given by CERC. : Following are the control area losses which shall be applicable to each transaction with some mathematical formula as defined by Administrator

i. Seller (Parent State) loss

ii. Seller (Utility) loss

iii. Seller (regional) loss

iv. Buyer (Parent state) loss

v. Buyer (Utility) loss

vi. Buyer (Regional) loss

vii.   Wheeling regional Loss

Under each of above category, 3 options shall be available in drop down to choose following options:

   i.   **Yes:** Loss of that category will be applicable as per loss defined in utility configuration module of that utility

  ii.   **No:** No loss will be applicable

 iii.   **Custom:** option to fill any loss (in % term) for that transaction to.

Application of loss to different transactions (numerical formula) shall be made configurable in transaction loss application module

10.1.7.3.   Preferred path assignment

Several regions of India are connected with each other with several no of transmission corridor, which is called as path or regional links. Power can travel one region to another region through multiple regional link or path. For ease of the scheduling, the path in which LTA/MTOA/ISGS schedule will be scheduled, is being decided by NLDC. In normal condition, schedule is being done on that path/corridor based on some prefixed criteria (like less congestion/ shortest path etc.). In case of any congestion arises after TTC/ATC revision due to tripping of one or multiple transmission elements, LTA/MTOA/ISGS schedule is being rerouted through a predefined path/ link for less congested path before curtailment

- Each transaction should have one dedicated path for scheduling

- Administrator shall have the right to allocate multiple pre-defined preferable path/paths to each transaction with priority which is to be used for scheduling in case of rerouting due to congestion.

- The LTA/MTOA/ISGS schedule shall be reflected in the intervening link/path for each transaction.

10.1.7.4.   Overloading enable

As per CERC order no 74/MP/2018, Generator allowed to declare 110 % of the LTA contract amount, during spillage condition without granting LTA for the extra power.

Provision shall be made so that the generator shall declare any LTA contract up to its 110 % (% over load to be also made configurable) of the LTA approved contract quantum in case of spillage with some declaration enabler button to the generator.

10.1.7.5. DC Submission enable

Transaction wise DC submission is mandatory for some of the LTA/MTOA transactions. One toggle button or Yes/No choice must be there in this transaction management module to enable or disable the DC submission for any particular transaction.

Table 4: DC Submission for LTA and MTOA Transactions

Transaction no	Buyer	Seller	Contract amount	Contract defined boundary	Loss Applicable for seller	Loss Applicable for Buyer	Preffred Path 1	Preffred Path 2	Preffred Path 3	Overloading enable	Overloading %	DC option	Configuration Period
				Buyer/Seller/Region	Yes/No/Custom	Yes/No/Custom				Yes/No	10	Yes/No	1st July 2020 to 31st July 2020
				Buyer/Seller/Region	Yes/No/Custom	Yes/No/Custom				Yes/No	10	Yes/No	1st July 2020 to 31st July 2020
				-	-	-	-	-	-	-	-	-	-
				-	-	-	-	-	-	-	-	-	-
				Buyer/Seller/Region	Yes/No/Custom	Yes/No/Custom				Yes/No	10	Yes/No	1st July 2020 to 31st July 2020

10.1.8. Link preference for Path for Inter regional Scheduling

One of the tasks of the scheduling programme is to optimize the inter-regional flows across various links. Accordingly, the following provisions shall be there for path optimization for a specific link

a. The Programme shall list all the possible direct/indirect links and paths between regions in the database.

b. User shall allocate one IR path to each Inter regional transactions in normal case.

c. User shall allocate other possible IR path to each IR transaction with priority weightage.

d. In case rerouting requirement in any IR corridor, IR transactions in that corridor may be rerouted as per the preference given to each transaction.

e. User shall select the effective date & link for which the path priority is to be set. The programme shall list all the paths involved with those links. User shall be able to sort the path for that link with priority. Similarly, the priority will be set for all links.

f. The LTA/MTOA/ISGS schedule shall be reflected in the intervening link/path for each transaction

10.1.9. Consent for URS

The Config file shall capture the beneficiary / Generator consent for URS allocation. The beneficiary / Generator shall be time stamped.
The URS reallocation is done on the basis of consent given by generator and beneficiary as below. However, there are following situations which can be foreseen

  i.   Standing Consent given by both generator and Beneficiary:

  ii.   Standing Consent given by the Beneficiary only and Real time URS approved by Generator:

  iii. No consent for URS Reallocation by the Seller to a particular Beneficiary:

  iv.   No consent for selling URS by the beneficiary for a particular plant:

The programme shall have the following features for selecting the type of consent situation as above

a. Option to select either of the above methods seller-beneficiary with time blocks and time duration

b. Option to select the seller-beneficiary with time blocks, full or part value (in case of part, value to be taken as additional input) and time duration in case of option no (i) & (ii) is selected. Further in case of option No (v) additionally option shall be there to select the unit under RRAS support

c. By default, programme shall utilise the option No (i) unless specifically configured by the user.

10.1.10. Schedule fixation Method

During the schedule preparation, there are occasions where summation of requisitions of all type of transaction for a particular seller falls below technical minimum. The additional quantum required to maintain technical minimum can be fixed to any of the following methods.

i.   No Support/Jack up: No fixation done

ii.   Support through ancillary alone: The support upto the specified value is jacked up through RRAS.

iii.   Support through Additional URS by selected Beneficiary alone: The support upto the specified value is jacked up through URS on the identified beneficiary/beneficiaries.

iv.   Support through All Beneficiary Jack up alone

v.   Support through ancillary and Beneficiary jack up: The jack up is done up to 'x' value as per configuration on the beneficiary as explained above. The remaining jack up from 'x' value up to technical minimum is adjusted on RRAS for achieving technical minimum.

vi.   Support through Additional URS by selected Beneficiary and All Beneficiary jack up: The jack up is done upto 'x' value as per configuration on the all beneficiary as explained above. The remaining jack up from 'x' value up to technical minimum is adjusted on the selected beneficiaries by enforcing URS for achieving technical minimum.

The programme shall have the following features for selecting the type of fixation. This option for different type of schedule fixation shall be in each Generator DC page.

a. Option to select either of the above methods for a specific seller with time blocks for a time duration

b. Option to select the seller-beneficiary with time blocks and time duration in case of option no (iii) is selected

c. Option to select the seller-beneficiary with time blocks, 'x' value and time duration in case of option no (v) & (vi) is selected. Further in case of option No (v) additionally option shall be there to select the unit under RRAS support

d. By default, programme shall utilise the option No (iv) unless specifically configured by the user.

10.1.11.   Single Value Time variant Configuration

There are certain configurations used in the scheduling programme which are single value but time dependent and RLDC wise varying. These are explained below

a. There are two types of Declared Capability viz one submitted by the generator and another declared capability ceiled to normative values. Accordingly, there shall be a flag for configuring which 'DC is to be used for further computation of schedules.

b. Initial day ahead Requisition: Different region are having different practices in booking (by default) the first-time day ahead requisition viz "Full requisition" or "Zero Requisition" when the first-time entitlements are made. Accordingly, there shall be a flag for configuring the above.

c. URS day ahead Cut Off time for Prorata: The URS is generally done on Prorata if the request comes in the same time block. However, the request received till certain time block of current day for day ahead is treated at par viz URS service for day ahead will run on particular time as specified in URS configuration and similar to day of operation subsequently. Accordingly, there shall be a configuration for configuring the time.

d. Expected units on Bar in Declaration Module as Input: This flag will determine whether on bar Normative is computed by taking expected units on bar or on bar normative values will be taken as directly input and validated against possible values.

10.1.12. Transmission Loss

Transmission losses are considered while scheduling. Transmission losses are computed by RLDCs every week for the region based on meter data. This regional transmission loss (Loss Region) is further moderated in accordance to CERC (Sharing of Inter State Transmission Charges and Losses) Regulations, 2010 amended from time to time. All data in this module shall be implemented using time dependent data storage tables. The Transmission loss for each region will be manually entered on weekly basis through NLDC login. Presently, there is a single transmission loss at all India Basis, i.e., same transmission value for each region.

a. Each utility is linked with an injection zone and with drawl zone. Each zone is linked with a tier. Each tier is linked with a formula relating with weekly regional loss. Further state loss and Discom loss are applicable to the state embedded and Discom embedded customers respectively in addition to POC loss. Accordingly, the Programme shall have the following sub modules

    i. Creation/Modification/Deletion of Tiers

    ii. Creation/Modification/Deletion of Zones

    iii. Mapping of utilities to zones

    iv. Declaration/Modification of weekly SEM loss - National/Regional loss

    v. Declaration/Modification of State and Discom loss

b. Creation/Modification/Deletion of Tiers:
There shall be module to create any number of Tiers. Tier shall be defined through simple linear equation formula and be linked to National / Regional loss percentage (%). For Eg:

$$\text{Tier1} = (\text{LossReg}/2 + 1.00)\ \%,$$

However, each tier shall have provision for entering block wise/duration wise mathematical formulas like addition, subtraction, division, multiplication, linear equation etc. correlating with specific region/ multiple region/ other regional SEM loss. The formula is for a specified period/ time dependent. Tiers shall be created with details like Name which should be Unique.

c. Creation/Modification/Deletion of Zones:

There shall be module to create any number of Zones. Each zone shall have provision for entering block wise/duration wise mapping with tiers. The zone mapping with tiers is for a specified period/ time dependent. Zones shall be created with details like Name which should be Unique, from date, to date, block wise mapping. Provision for downloading the existing zones along with tier mapping and Bulk upload option shall be made.

There shall be provision to change no of slabs and difference between slabs from configuration page. This change must be time series bounded.

d. Mapping of utilities to Zones:

Each utility is mapped with an injection zone and with drawl zone which are time dependent. The above mapping is done in utility definition as explained in section No 2.3. Provision for downloading the existing utility along with zone mapping and Bulk upload option shall be made.

e. Declaration/Modification of weekly SEM loss
At present, SEM losses in percentage % are entered for all regions / All India on a weekly basis for each of the block. The loss is presently applicable from Monday to Sunday. However, there shall be provision to enter the SEM loss for any specified duration for each of the block. System should alert for entry of Regional loss / National Transmission before commencement of the week/ before the non-availability of the data for the upcoming day ahead and notify to the utilities after the entry like Regional losses/Tier losses updated. Data entry to be allowed upto 2 decimal or as per configuration.

f. Declaration/Modification of weekly All India SEM loss
At present, SEM losses are entered for all regions on a weekly basis for each of the block. However, there shall be provision to enter the SEM loss for All India any specified duration for each of the block. System should alert for entry of All India before commencement of the week/ before the non-availability of the data for the upcoming day ahead and notify to the utilities after the entry like All India losses/Tier losses updated. Data entry to be allowed up to 2 decimal/ as per configuration.

g. Declaration/Modification of weekly/Monthly State and DISCOM transmission loss.
   This module shall facilitate entry of state and Discom loss for each of the blocks which shall be valid for a specified time period. Data entry to be allowed upto 2 decimal/ as per configuration. Respective state/Discom shall be responsible for updating the losses as and when it changes through their login.

h. There shall be option to modify attributes/data of existing Tiers/Zones/Utility Zone Mapping/SEM loss/State & DISCOM loss.

i. There will be one separate page where % loss after computation from formula will be shown. In case of choosing special loss or skip loss in "Transaction management module", special loss/manual input loss will be shown in this page for readily checking.

j. The data of this page will be used to compute actual loss during preparation of schedule.

k. There shall be a report to view Tiers/Zones/Utility Zone Mapping/SEM loss/ State & DISCOM loss modification history and should be downloadable as csv, xls, .xlsx, pdf.

l. Any modification done on the existing Tiers/Zones/Utility Zone Mapping/SEM loss/ State & DISCOM loss shall notify the user through process management for preparation of schedule.

m. Actual loss computation is explained in section No 3.13.

n. There shall be an option to down load the existing zone tier mapping and modify and upload the same after selecting the date from which it is to be effective

o. There shall be an option to down load the existing utility zone mapping, modify and upload the same after selecting the date from which it is to be effective.

p. There shall be an option to down load the existing Regional / All India Transmission loss% for each of the zones for a selected date

10.1.13. Flow Area

There are certain scenarios under which a user would like to group a set of utilities for the purpose of monitoring, schedule preparation, curtailment, ATC violation etc. Such grouping is known as flow areas. The programme shall have the following features to facilitate the same.

a. Flow areas shall be created with a Name & Description of the flow area.

b. The Programme shall list all the utilities in the database. User shall be able to select/deselect single/ multiple utilities and create the flow area with the specified name.

c. Any utilities selected shall include all their Embedded utilities during processing of the information at different modules like curtailment, schedule etc. The same is illustrated with few examples below

d. If North Region is selected as part of flow area, all the utilities under Northern region are considered to be part of flow area

e. If a utility of type Parent state eg Karnataka_State is selected as part of flow area, all the utilities under Karnataka_State are considered to be part of flow area

f. If a utility of type DISCOM eg BESCOM is selected as part of flow area, all the utilities under BESCOM are considered to be part of flow area and so on

g. There shall be a report to view list of flow areas along with modification history and should be downloadable as csv, xls, .xlsx, pdf.

h. There shall be option to modify attributes/data of existing flow areas.

10.1.14. Link/Path/Flow Gate

There are three different types of possible links in a specified direction which is required to monitor, schedule, curtail, declare ATC etc

 i. Physical Direct Link viz East-South, West-South, West-North etc

 ii. Physical Indirect Link (Path) viz North-West-South, North-East-South etc

 iii. Virtual Link Flow Gate viz FlowArea1-FlowArea2 , Flow Area1-Flow Area3 etc
The programme shall have the following features to facilitate the same.

a. Flow Gates shall be created with a Name, Description, IsLinkPhysical.

b. The Programme shall list all the flow areas in the database. User shall be able to select/deselect single/ multiple flow areas for 'From Flow Area' & 'To Flow Area' and create the flow gate with the specified name.

c. There shall be a report to view list of flow gates along with modification history and should be downloadable as csv, xls, .xlsx, pdf.

d. There shall be option to modify attributes/data of existing flow gates.

e. The physical links/path shall be used for Inter Regional Scheduling for which ATC is compulsory.

10.1.15. Peak Hour and Peak Season Declaration

There shall be a web page for inputting the peak hours and off-peak hours. The declaration is valid for a defined time period. This is used in the scheduling process like declaration etc for validation and highlighting.

The number of hours of "Peak" and "Off-Peak" periods during a day shall be four and twenty respectively.

The hours of Peak and Off-Peak periods during a day shall be declared, configured by the concerned RLDC, may be a week/day ahead in advance. The High Demand Season (period of three months, consecutive or otherwise) and Low Demand Season (period of remaining nine months, consecutive or otherwise) in a region shall be declared by the concerned RLDC, may be six months/ day ahead in advance. All time limits in months should be configurable.

Provided further that in respect of a generating station having beneficiaries across different regions, the High Demand Season and the Peak Hours shall correspond to the High Demand Season and Peak Hours of the region in which majority of its beneficiaries, in terms of percentage of allocation of share, are located.

There shall be a provision to enter, upload for declaration of Peak hours and Peak seasons on Monthly/Weekly and block wise in configuration of Generators Utility.

Programme shall have check while entering Declaration by a Generator peak hour blocks Declaration shall not be less than off peak hour blocks declaration.

Download option to be available to download all the data related to peak hours, and off-peak hours and its Declaration for a range of dates based on the filters available in input.

10.1.16. LTA/MTOA/STOA contract definition

There are three types of transaction viz Long-term access (LTA) transactions, Medium term Open access (MTOA) transactions and Short-term open access (STOA) transactions which are detailed in Annexure

This section deliberates the definition of the contracts. Similar features are expected for all the three contract definitions

a. The web page shall have the following filters

    i. Approval Number

    ii. Effective Date Range

    iii. Applicant

    iv. Buyer

   v. Seller

   vi. Trader

   vii. Path: On selection of the buyer and seller combination, the path shall display all the possible paths.

   viii. Requisition By: Applicant/Buyer/Seller/Buyer SLDC/Seller SLDC

   ix. Block wise contract MW (also, at which boundary (Seller/Buyer) it is defined)

   x. Is Regulated Power.

   xi. Is Regulated Power due to Payment Security Mechanism?

   xii. Is REMC Power

b. A Download option to be available to download all the transaction based on the filters available in input.

c. The option for Tagging for each LTA/MTOA/STOA transaction like Solar, Non-Solar and Hydro etc.

10.1.17. Flexible Control area

Mixing of different power source such as solar, battery, thermal, wind, hydro etc. is future of flexible generation. Ministry of power issued guideline for mixing of power from different kind of power plants which are geographically apart from each other. This kind of mixing power may be done by two or more power plants belongs to different owner and specific time bounded. To accommodate this kind of mixing of power, creation of virtual single entity for publication of schedule for this virtual entity. One module may be developed in configuration, where virtual entity may be created with combination of several separate power generators.

10.1.18. System Alert configuration

It has been envisaged that, this next generation WBES will come with facility to give alert on several system health or error such as failure of auto schedule or any other software issues, dedicated communication link issue, data synchronization issues, application and database server level issues, issues in interaction with other software's etc. one separate module will be there to accept acknowledgement & observe current system condition. Along with this page several auto generated mail, call, msg alert. Exact cause and location of the error must be available in the error message with category wise differentiation like software error, server error, communication error etc. For

minor errors or repetitive errors, steps for resolving the same may be incorporated in the error message.

One submodule is required under configuration module, where following can be defined:

a) Different kind error & system emergencies.

b) Contact (mail/phone no) of different concerned person.

c) Assign of person, to whom alert msg.

The module must also be capable of checking the various outputs of the WBES and show list of violations (if any) in an error message before the output is published. Apart from the minimum validation checks in respective modules issues in output like multiplication of output data, erroneous negative values, etc. Facility to define other validation checks (if required) must be available using admin privileges.

All errors should be logged with date and time stamp and should be easily traceable and should be downloadable for particular date/time range.

10.1.19. Module specific requirement

Scheduling methodology prepared based on IEGC & some additional CERC regulations, which are being amended time to time. Due to changes in scheduling method,

10.1.19.1. Declaration

a) Submission of unit wise DC

b) Unit Status (On Bar/Off Bar/Off Bar SCUC)

c) Whether DC to be taken as rolling basis or ad hock basis

   i. If rolling basis, then how many day before DC will be taken.

   ii. If ad hock basis, when DC will be taken and DC of how many days to be taken together.

d) Limit of no of DC revision on Day ahead & real time

e) Interval of DC revision for Day ahead & real time.

f) Upto which decimal, DC submission will be allowed.

g) Which fields to be activated

h) Calculation of Tech min for each generator

i) Calculation of Normative DC for individual generators.

j) Calculation of Ramp Up/Down for individual Generator

10.1.19.2. Requisition

a) Whether requisition to be allowed for a Buyer-Seller combination. This may be defined in transaction management module.

b) Bulk requisition allow option for a generator or a type of generator also may be provided.

c) Limit of no of requisition revision on Day ahead & real time

d) Interval of requisition revision for Day ahead & real time

e) Lower limit of requisition submission. (% term)

f) Lower/Upper limit of requisition (MW/%) - based on day ahead/week ahead requisition.

10.1.19.3. URS

a) Whether URS requisition to be allowed for a Buyer-Seller combination. This may be defined in transaction management module.

b) Option for giving standing clearance of URS by Generator and its' beneficiaries.

c) Whether to allow URS to utility from a generator, in which that utility doesn't have any allocation.

d) Limit of no of URS requisition revision on Day ahead & real time.

e) Whether approval of URS will be computed once or each time block fresh approval of URS will be granted.

10.1.19.4. PSM

a) PSM data entry by : Buyer or seller or trader or all

b) PSM check method: Seller data or Buyer data or AND logic between Seller & buyer .

10.1.19.5. Implemented schedule

a) Will it be just algebraic sum or not (time bound)

In case of any auto-adjustment required in ISGS module for any specific date & generator, it can be selected from this module.

10.1.20. Revision Number:

The revision in DC Page: The revision for any particular plant, will be increased for any change in DC of that plant after click the button save and publish.

The revision in New RSD Surrender/Revival pages: The revision for any particular plant will be increased for any change in surrender and revival requests by the beneficiaries after click the button save and publish.

The Requisition: The revision nos of requisition will be increase for any change in beneficiary requisition against its Plant Entitlement.

The URS Page: The revision nos of URS will be appended for any change in beneficiary URS against that plant.

The PX, ATC File and PSM: The revision nos will be appended with nos of upload / Change of PX, ATC Margin and PSM.

The Entitlement: There shall be single revision nos for Entitlement at all India level. There will be no regional level Revision Nos for Entitlement. The entitlement will be auto generated on (D-1) day ahead, (D-2), (D-3)….(D-7), at fixed time interval as defined in the Config page. On the day of operation, the entitlement is auto created with appended revision nos on each time block or as defined in the configuration page. The post facto Entitlement will be manually generated by any of the authorised RLDCs user, the entitlement will be created for all India level.

The Schedule Revision Nos: There will be a single Schedule creation revision nos at all India Level. The revision created on (D-1) day ahead, D-2, D-3 shall be as per the fixed time line as defined in the Config page. On the day of operation, the Schedule is auto created and published, in fixed interval as defined in the config page. The post facto (after the day of operation) schedule is manually created by any of the authorised RLDCs users. However, the manual schedule created by different RLDCs, would be published on a single revision nos at a defined time of the day as per the config page. All the manual schedule revision created by the RLDCs, before the published time, will be included in a single revision at the time of schedule publishing. The Schedule in post-facto, for any date, will be auto published with increased revision number, at defined time only if any of the RLDCs have manually created the schedule revision.

The schedule revision number and its increment for 'D-n' day or 'D' day or Post facto (after D day onwards) shall be separate

11   Declared Capability (DC)

a. ISGS are declaring the declared capability (DC) and other Regional Entity Generators are sharing the contract wise declared capability. Thermal, Gas, Nuclear and Renewable stations are declaring DC in block wise MW. Hydro generators are submitting their daily energy in MU in addition to block wise MW. *However, provision shall be kept in the Programme for the declaring the DC by ISGS only or both ISGS and Regional generator as per the configuration.*

b. The generator shall enter unit wise their Declared Capacity through their individual login account.

c. This functionality shall be invoked through an interface where user will be able to select the appropriate format from the menu for availability submission. User shall be able to submit the availability data as 'day-ahead' or 'revised' declaration for the concerned day, i.e., for 'day of operation' or for 'day-ahead' through a dropdown option. *Flexibility in punching the DC from D-2 to D- n days in the design stage itself so that any change in the regulation can be accommodated with minimal configuration.*

d. Each generator type will have a particular format for availability declaration with different business logic as detailed below. Modular development may be kept flexible to accommodate further format types (if any) in the future.

e. There will be a provision to declare peak hour and off-peak hour for a Day. Out of 24 Hrs or 96 Blocks certain Hours or blocks shall be declared as peak/off-peak hours. Entry provision will be enabled month ahead

f. The following fields are auto computed for all the block wise information & common to all types of generators viz. (Thermal, Gas, Hydro, Nuclear, RE-Solar, RE-Wind, etc) in addition to the specific fields mentioned subsequently.

> ❖ MWhr
>
> ❖ Max
>
> ❖ Min
>
> ❖ Average

> ➤ **Availability Declaration by Thermal stations shall include the following for each of the blocks**

Table 5: Declared Capability (Thermal) Input Fields for each block

Sl No	Field Name	Input (I) / Output(O)	Remarks
a	Status of Units	I	Generator shall declare unit wise DC for each block. Generator shall declare Status of the unit for each block (On Bar/Off Bar/Off Bar SCUC)
b	On Bar Normative Capability / Installed Capacity in MW	I/O	• Depending on the configuration

Sl No	Field Name	Input (I) / Output(O)	Remarks
c	Ramp Up in MW/Block	O	o If sl No (a) is taken as input then Sl No (a) will auto compute Sl (b) to (i) else.
d	Ramp Down in MW/Block	O	• Ramp rate will be maximum of
E	Technical Minimum generation level	O	o Change in DC o Allowed ramp rate • By default, the sl no (e) value is 55% of sl No (b). The Percentage shall be configurable in configuration page with effective from date/time to effective to date/time along with reason.
F	N-1 revision of Total DC	O	Previous revision will be shown. In case of R0, previous day's last revision may be shown
G	Total Declared Capability in MW	O	Sum of On bar, off bar and Off bar SCUC DC
H	Unit wise On Bar Declared Capability in MW	I	Shall be declared by Generator.
I	Unit wise Off Bar/Off Bar SCUC Declared Capability in MW	I	Shall be declared by Generator.
J	Fuel shortage as	I	Drop Down Yes/No with default as No
K	Reason/remarks for Dc Revision	I	Editable dropdown with common reasons. Remark submission is must before saving

Table 6:DC for Gas Input Fields for each TB

> **Availability Declaration by Gas stations shall include the following for each of the time blocks**

Table 5: Declared Capability (Gas) Input Fields

Sl No	Field Name	Input (I) / Output(O)	Remarks
For a complete Gas Generating Plant			
a	Expected Units on Bar	I	Check box. (Optional based on the configuration), - GT in Closed-Cycle - Showing Show GT in Open-Cycle
b	Temperature	I	Ambient Temperature shall be shown in each Time Block. implemented in 4th time block.
d	On Bar Normative Capability – Tot	O	Normative DC will be automatically calculated from Sl No (a),(b)
e	N-1 revision of Total DC	O	Previous revision will be shown. In case of R0, previous day's last revision may be shown
f	Ramp Up in MW/Block	O	• It shall have separate Ramp for Open /Close cycle both Ramp-up and Down
g	Ramp Down in MW/Block	O	o Sl No (a) will be taken as input and Sl No (f) to (h) will be auto computed
h	Technical Minimum generation level	O	• Ramp rate will be maximum of o Change in DC o Allowed ramp rate • separate Tech Min for Open and Closed Cycle
i	Toggle Button T1 and T2	O	The Tech Min for OC and CC shall be shown separately. Further there shall be toggle button, for T1 or T2: T1- Tech Min to Beneficiaries on Merit Order fuel wise/ mode wise/RRAS/URS/ OC/CC, as per the Fixation features. The Plant Tech Min data send to NLDC for RRAS / SCED

Sl No	Field Name	Input (I) / Output(O)	Remarks
			T2- Zero Tech min fixation to Beneficiaries, but Tech Min data of both CC and OC send to NLDC for RRAS / SCED
j	On Bar Declared Capability (in Closed Cycle) in MW	O	Will be automatically calculated from summation of OnBar DC (CC) for each Fuel type in that plant
k	On Bar Declared Capability (in Open Cycle) in MW	O	Will be automatically calculated from summation of OnBar DC (OC) for each Fuel type in that plant
l	Total On-Bar Declared Capability (for a complete generating plant) in MW	O	Will be automatically calculated from summation of Sl No (j) and (k)
m	Off Bar Declared Capability in MW	O	Will be automatically calculated from summation of Off-Bar DC for all fuel types in that plant
n	Total Plant Declaration Capability in MW	O	It is sum of the Plant OnBar DC and Plant OffBar DC
o	Max DC	O	it is 105% of the Installed Capacity. The summation of the OnBar DC-Tot, shall not cross the 105% of the Plant IC
p	Merit order of Fuel Type	O	Cheapest A (CC) > A (OC) > B (CC)> B(OC) > C (CC)> C (OC) > D(CC) > D(OC) Costliest. The Merit order may be changeable on 4th TB, incase special treatment for any fuel type. Where A, B, C, and D is the Fuel Type
q	Fuel shortage as	O	Drop Down Yes/No with default as No
r	Reason/remarks	O	Remarks shall be entered mandatory before saving

For Individual fuels type

Sl No	Field Name	Input (I) / Output(O)	Remarks
M	N-1 revision of Total DC	O	Previous revision will be shown. In case of R0, previous day's last revision may be shown
N	Total Declared Capability (for a fuel type) in MW	O	Sum of On bar and Off bar DC
P	On Bar Declared Capability(in Closed Cycle) in MW	I	
Q	On Bar Declared Capability(in Open Cycle) in MW	I	
R	Off Bar Declared Capability in MW	I	
S	Fuel shortage as	I	Drop Down Yes/No with default as No
T	Reason/remarks	I	Editable dropdown with common reasons and entry is mandatory before saving

Table 7: DC for Gas Plant

					Normative DC Check Box:			Toggle T1 / T2		Cheapest A (CC) > A (OC) > B (CC)> B(OC) > C (CC)> C (OC) > D(CC) > D(OC) Costliest							
Select Ambient Temp:																	
Time Block	Time Desc	ICon AT	MaxDC	DC[n-1]	DC[n]	DC(OC)-On Bar	DC(CC)-On Bar	DC On Bar-Tot	DC Off Bar-Tot	N or DC	TM (OC)	TM (CC)	RUP (OC)	RD (OC)	RUP (CC)	RD (CC)	Plant RUP	Plant R Down
1	00:00 - 00:15																	

Select Ambient Temp:					Normative DC Check Box:			Toggle T1 / T2		Cheapest A (CC) > A (OC) > B (CC)> B(OC) > C (CC)> C (OC) > D(CC) > D(OC) Costliest								
Time Block	Time Desc	IC on AT	Max DC	DC[n-1]	DC[n]	DC(OC)-On Bar	DC(CC)-On Bar	DC On Bar-Tot	DC Off Bar-Tot	Nor DC	TM(OC)	TM(CC)	RUP(OC)	RD(OC)	RUP(CC)	RD(CC)	Plant R UP	Plant R Down
2	00:15 - 00:30																	
….																		
96																		
AT: Ambient Temp										DC(OC): DC in Open Cycle								
Nor DC: Plant Normative DC										DC(CC): DC in Closed Cycle								
TM: Technical Minimum										Max DC: 105% of Installed capacity								
R UP: Ramp UP										R D: Ramp Down								

Gas Fuel Type Dc Page

Time Block	Time Desc	DC[n-1]	DC[n]	DC (OC)	DC (CC)	DC OffBar
1	00:00-00:15					
2	00:15-00:30					
…						
96						

➢ **Availability Declaration by Hydro stations shall include the following:**

ISGS hydro station, shall declares its' capability block wise MW as well as daily energy in Mus, on day ahead basis. Entitlement is being calculated based on the share allocation and schedule is being prepared as per entitlement. For being as must run power plant, beneficiaries of Hydro ISGS plants are not entitled to change requisition as per their requirement.

However, there is a provision to change the overall hydro scheduling methodology in line of thermal optimization process. In that case, it is possible to give rights to states/beneficiaries to choose their requisition from its' hydro plant as per their requirement without hampering daily energy in Mus declared by the plant. In case of 2nd Methodology some plant related extra static information is required, which are also described in below table as option for 2nd method.

The toggle button will help to switch from 1st method to 2nd method without major intervention of developer.

Table 8:Declared Capability (Hydro) Input Fields for each block

Sl No	Field Name	Input (I) / Output(O)	Remarks
a	Expected Units on Bar	I	Check box. (Optional based on the configuration)
b	Blockwise Declared Capacity in MW	I	
c	Units on bar	I	Block wise quick fill option
d	Declared Energy in MWhr	I	
e	Water shortage as	I	Drop Down Yes/No with default as No
f	Reason/remarks for DC Revision	I	Editable dropdown with common reasons
g	Spillage	I	Block wise quick fill option(configurable)
h	Effective/ Max MW	I	Single entry on page
i	Reservoir level(mt/ft)	I	Optional/ 2nd Methodology (Optional based on the configuration)
j	Inflow of previous day(cumecs)	I	Optional/ 2nd Methodology (Optional based on the configuration)
k	Time duration for which maximum generation can be sustained at a stretch	I	MW and time duration
l	Minimum 'must-run' generation (if	I	MW and time duration

Sl No	Field Name	Input (I) / Output(O)	Remarks
	any) along with time period		
m	Expected energy of previous day	I	Optional / 2nd Methodology (Optional based on the configuration)
n	Metered energy of previous day	I	Optional/ 2nd Methodology (Optional based on the configuration)

A similar additional webpage for hydro shall be provided for moderation by the RLDC for optimization. The entitlements & further process shall be based on the moderated declared capability. There shall be provision for manual entry as well as file upload. Further the moderated values shall be checked for forbidden zone and Normative DC and declared Energy (MU) and auto adjusted.

There shall be provision to exchange designated data with an external hydro optimization tool. The optimization module shall take input data from hydro DC module and provide moderated hydro DC. This shall be alternative o manual moderation by RLDC. Option to select manual moderation or moderation by external hydro optimization tool shall be available in configuration module

> ➤ **Availability Declaration by Regional Entities shall include the following for each of the blocks**

  a) Regional Entities shall declare DC for each contract of the Generator.

  b) Declared DC by Generator shall be 105 % or 110% of the contact value. Percentage limitation shall be made configurable.

  c) DC considered for the schedule shall be within the contract value.

  d) Time line for DC declaration shall be as per Thermal/Hydro Module

  i. Following general provision shall be available for all type of plant DC declaration module Revision Number should be unique to individual seller for a particular date

  ii. Software will give pre populated ramp up/down and technical min values of the station with the previous entered values for the day ahead for Revision zero. User may change the same

iii. Provision shall also be made to facilitate revision of previously declared availability along with reasons thereof, as per the relevant clauses of IEGC or Operating Procedure of the Region.

iv. Generator shall mention reasons of DC Revision against each time block where there is a change in On-bar or Off-bar DC with respect to previous time block or On-Bar DC is less than Normative DC. The reason shall be either from drop down menu or if not available in drop down then reason can be mentioned in text which will be added to drop down for future reference.

v. If any ISGS is not providing DC by 05:45 Hrs or as per configuration, auto generated notification shall be sent to registered email id & mobile number for immediate action.

vi. On completion of declaration by all ISGS, a pop-up message to be enabled seeking for further action by RLDC. In case of any technical problem in doing the same by ISGS, RLDC shift engineers have to co-ordinate in entering the DC using admin log-in from where All ISGS DC and other required field can be entered manually.

vii. All data exchanged through this interface are to be maintained in the database for relevant date. Each interaction shall be logged in with unique reference ID accessible to users and RLDCs/NLDC concerned. Message regarding submission of capacity declaration/revisions should be system generated from the generator side after confirmation. This should appear in a message area to the generators/beneficiaries/RLDC and should be archived as sequence of events (SOE) for the relevant date.

viii. The following minimum validation checks shall be available

➢ Only numeric should be allowed except remarks input column

➢ 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. (Gate closure logic may change time to time as per change in regulation). Provision shall be made in configuration module where ADMIN can change Gare Closure time period on its own.

➢ Resolution: All the declaration should be rounded to 1 decimal place and shall not allow the user to enter more than 2 decimals or in line with the IEGC at the

time of implementation. There should be an option in admin module to configure decimal points

➢ **Ramp up/Down:** The Ramp Up / down shall be compared with pro-rata station ramp rate considering the on bar Normative/Installed Capacity or depending on the on-bar unit details. Programme will show the above violation and ask for confirmation before saving by the generator.

➢ 'On-bar'-Normative/Installed Capacity: (If Unit selection module is not available): The administrator shall have the options in the master configuration for selecting the following input methods. Depending on the input method the onbar normative values are directly taken from the user or computed.

   ❖ On bar normative method: The programme shall allow the user to enter On bar Normative values within a set of predefined values from the master table.

   ❖ On Bar Installed Capacity: The programme shall allow the user to enter on bar installed capacity within a set of combination of unit installed capacity. The on bar Normative will be derived/computed by the formula (100-Auxilary %) * On bar Installed Capacity entered by the user.

➢ Generator can declare DC up to 105 % installed capacity in case of Thermal/Gas/Nuclear and 110 % of installed capacity in case of Hydro. % limitation shall be made configurable by ADMIN. Shall be stored separately.

➢ For thermal generating stations, DC (Block wise) accepted for scheduling purpose shall be within normative DC.

➢ For Hydro generator: -

   a. In case of spillage condition on - DC accepted is per declared by Generator

➢ In case of spillage condition off - DC accepted is within normative and declared forbidden zone

➢ 2% or any other % value (as per configuration module) Variation in DC between adjacent blocks shall be highlighted and published or rejected depending on RLDC acceptance or otherwise.

➢ Programme shall check that the declaration values during peak hours/blocks shall be more than or equal to off peak hours/blocks. However, the Programme will show the above block-wise violation and ask for confirmation before saving

by the generator. Provision shall also be there to not allow generator to reduce its DC during OFF peak hour as defined without RLDC consent.

- ➤ The injecting utility shall be visible based on the Commissioning date. eg: ISGS NLCTS2EXP U2 created in April 2017 should not appearing in march 2017 data for all modules

- ➤ System shall not accept request for revision including R0 (revision zero) by generators until all fields are completed.

- ➤ In Hydro after getting units on bar forbidden zone, if plant get schedule in their forbidden zone, then there should be a pop-up warning.

g. The following Reports shall be available and downloadable in pdf, xlsx, csv etc…

   i. Summary Page showing Latest DC as submitted by the generator along with Total. The respective revision No will be displayed at the top.

   ii. Revision wise Declared Capability detail as submitted by the generator

   iii. Revision wise Unit status as submitted by the generator

   iv. Revision wise Declared Capability detail as considered for scheduling by

   v. Summary of 2% violations with details for ISGS/ RLDC.

   vi. Summary of Violation details of Peak hour less than Off peak hour

h. Declaration page in report page should have the filters like generators, date, region, revision Number.

i. Published time to be shown

j. Declared DC and Accepted DC for scheduling for any generator for particular time period should be downloadable in .xlxs/.csv format.

k. An option to display the above reports in Graphical form shall be available

12 Share Allocation

a. Share table shall be implemented using 'time-dependent-data-storage' technique so that retrospective/post-facto schedule preparation/corrections are possible.

b. Share allocation table shall be designed as block wise ISGS vs beneficiaries' table.

c. The share allocation is majorly categorised as on-bar share allocation and off-bar share allocation (buffer share allocation). The total share allocation is the sum of on-bar and off bar share

allocation. The on-bar and off-bar share allocations are further divided into allocated, unallocated, merchant and reserved. Allocated and unallocated quantum of share allocation are entered in percentage share, merchant will be in MW or percentage and reserved type share allocation may be in MW only (configurable).

d. The programme shall have the facility to upload total share, on bar share and off bar share separately. Whenever total share is uploaded on-bar share allocation and off-bar share allocation would be made equal to total share.

e. The beneficiaries under Reserve (in MW) will have preference treatment, and the left over after Reserve (MW) will be shared in percentage among the beneficiaries having allocated and Unallocated share.

f. The merchant will be in MW or percentage, which will only be associated with utility defined as merchant in Configuration.

g. Share table should be optimized i.e. only transactions having some values should only be added in the share table. For example, if a beneficiary has allocated share in some ISGS/CGS only that transaction should be added in share table.

h. The following provisions shall be available for creation of share allocation from a specific date region wise seller buyer combination

   i. **File Upload**: Provision for uploading the share allocation data through a CSV file eg Shareallocation_Upload_DDMMYYYY.csv shall be available. Date shall be taken from the file name. The data read from the file shall be shown as preview for viewing and confirmation before saving.

   ii. **Create Option:** Provision for creating share allocation for seller – Buyer combination block wise w.e.f specified date through the web page

   iii. **Copy to Create New:** Provision for copying the existing share allocation as on particular date to a new temporary table shall be available.   User can then modify as per the requirement and the final data can be saved w.e.f the specified date

i. Modifications in share table shall be possible just before the operating day and shall have provision to enter an effective date. Further it shall be possible to edit for any previous day, for the current day as well as the day ahead using admin privileges. If the changes are done for current day or day ahead then user shall be notified for creation of new entitlement through process management.

j. The share allocation table shall be region specific with provision for incorporating allocations of inter-regional beneficiaries / Trans-National, i.e., generators specific to a region and beneficiaries may be located in different regions.

k. The seller Region (RLDC) by default or any other agency as per the right assigned by the Admin shall only have the provision to upload share allocation table.

l. All India share allocation shall be created after stitching all share allocation tables uploaded by the Region/any other agency

m. Provision for adding remarks shall be available.

n. Provision for sending mail or message or popup or beep to constituents whenever their share is revised with details of changes and actual share allocation for checking & confirming the same through proper acknowledgement & status of confirmation shall be made visible to RLDC/Admin user. However, the share allocation will be utilised on effective date irrespective of the confirmation.

o. Generally, Sum of Allocated and unallocated share of all beneficiaries in an ISGS/CGS shall be hundred. However, there may be exceptions, accordingly to capture the same, provision for specifying the seller, block wise where share allocation will not be 100% should be available in the configuration module.

p. In some exceptional case Share allocation may be in conditional linear equation based on the declared capacity. (Eg RGPPL, wherein if the DC <= 560MW, then the 100% share is allocated among the beneficiaries say A, B and C. If the DC is more than 560MW then 560MW will be shared among the beneficiaries say A, B, C, D in 100% percentage and the remaining DC above 560 MW will be shared among the beneficiaries say D and E in 100% percentage).

q. All the above features applicable to ISGS shall be made applicable to IPPs/Sellers also upon configuration by admin.

r. Other minimum validation checks to be available

   i. Only numeric and positive values shall be allowed

   ii. For all generators except in case of exceptions as mentioned in (n) above, check for hundred percentages shall be applied on the ISGS/CGS based on the configuration for all time blocks. In case Sum of % allocated and unallocated share of all beneficiaries in an ISGS/CGS less or more than 100% in any of the above-mentioned input methods, the programme shall notify the details of blocks & seller and data shall not be saved.

s. The following Reports shall be available and downloadable in pdf, xlsx, csv etc. for all the three total share allocation, on-bar and off-bar share allocation.

   i. Summary of ISGS vs Beneficiary/utility average share allocation

   ii. Block wise Regional ISGS vs All Beneficiaries.

   iii. Block wise All India ISGS vs All Beneficiaries

   iv. Block wise Beneficiary /utility vs All ISGS share

   v. Block wise All Beneficiaries /utility vs All ISGS share

   vi. Share allocation history of a particular ISGS in % or MW: Average for the share allocation effective period, if % or MW is 0 or BLANK it shall be highlighted to be shown on selection of a particular ISGS station form a dropdown for a particular period.

   vii. Download change option should be there to compare change in share allocation between different dates in terms of percentage as well as MW for the above reports.

t. The following filter shall be available

   i. Date

   ii. Region which includes 'All' option also

   iii. Provision for viewing the reports in `Share Percentage / MW shall be available. Further if MW is selected then option for selecting Installed capacity or Normative Capacity shall be available

13 Entitlement

f. The Entitlement will have a single revision number for all India level. The details about the revision is discussed under 'Revision Number'.

g. The entitlement revision number shall be applicable to ISGS as well as applicable to IPPs/Sellers also upon configuration by admin.

h. Depending upon the configuration, Programme shall compute requisition 'equal to entitlement' or 'zero requisition' or 'blank' during the preparation of first-time day ahead entitlements. During the subsequent creation of entitlements, requisitions will be computed based on the previous requisition type explained in detail in requisition section

i. Day Ahead Entitlements R0: All the ISGS DC is a must for creating entitlement. Accordingly, Programme shall check for the availability of DC of all ISGS/Sellers for day ahead and display the list of ISGS for which DC is not available.

j. The report of Block wise Beneficiary/Buyer/Parent State vs ISGS/Seller with On bar, Offbar & Total shall be available and downloadable in pdf, xlsx, csv etc... with the following filters

    i. Date

    ii. Region which includes 'All' option also

    iii. Seller which includes 'All' option also

    iv. Beneficiary which includes 'All' option also

    v. Provision for viewing the unregulated(full) or Regulated view and or payment security view

    vi. Provision for viewing the Beneficiary wise or Parent State view

    vii. Provision for viewing the entitlements based on 'DC considered for scheduling' and 'DC given by generator'

k. A mark or an indicator shall be shown on the column header as well as individual blocks whose power is regulated or sold in market. There shall be also different indicators for power regulation as well as power sold in the market.

l. Entitlement for a buyer should show "NA" if seller of other region has not given his declaration/ Created Entitlement.

m. Proper information exchange will be enabled among entitlement module, LTA/MTOA module and BCS settlement module as discussed in section.

14 Reserve shutdown

Applicable to thermal stations

a) Every beneficiary should be able to access the requisition module through their authenticated login

b) Unit status of plants along with the colour coding if unit is under RSD- RSD old, RSD New, if unit is running-Running New, Running Old

c) In surrender and revival section date selector from and to date shall be made available and default D+1 to D+3 days data should be shown and same shall be variable to change with admin access.

d) In surrender section Beneficiary shall surrender single value (provision for time variant blocks like 96Tb may be kept and same will be enabled/disabled with admin access) for whole day for each generator and minimum entitlement value will be shown in the header

for the reference. If beneficiary enters more than entitlement then surrender value for calculation will be considered upto entitlement only.

e) In revival section beneficiaries can request upto their entitlement in the RSD unit and same shall be shown in header for the available minimum entitlement in whole day (provision for time variant blocks like 96Tb may be kept and same will be enabled/disabled with admin access). If beneficiary enters more than available entitlement in the revival section for calculation will be considered upto entitlement only.

f) **Default values:** In surrender and revival sections default beneficiary values shall be zeros and provision to make full entitlements with admin access.

g) **Gate closures:** In surrender page gate closure for D+1 is 15:00Hrs of current D-day and for revival is 17:00Hrs of current D-day. Provision to make change gate closure timelines on requirement basis with admin access

h) **Share allocation creation:** Presently calculations are being done manual approval from operator at 15:05 Hrs and 17:05Hrs, pop ups are required to show pending actions. Provision to create auto calculation of share allocations with enable/disable option with admin at prescribed times.

Web page contains Sub-pages:

A.   Unit Status
B.   Surrender Request
C.   RSD Suggestion
D.   RSD Calculation
E.   Revival Request
F.   Revival Suggestion
G.   Calculation Details
H.   Allocation Details

A. Unit Status Page-
   a. Every beneficiary should be able to access the requisition module through their authenticated login.
   b. Generator can enter the status of the unit with authenticated login. Drop down contains outage details like Forced, Planned and Synchronised/Running.

Unit status Table Details:

Column no.	Field Name	Input (I) / Output(O)	Remarks
A	Unit Name	O	Read only
B	Unit Installed Capacity	O	Read Only
C	Status	I/O	Forced, planned, RSD and Synchronised/Running
D	Outage Time	I/O	
E	Reason	I/O	
F	Remarks	I/O	
G	Sync Time	I/O	
H	New RSD status	O	If unit is Running in status -Running Old, Running New, If unit is RSD in status, then New and RSD old

B. Surrender Request Page-

    a. Every beneficiary should be able to access the requisition module through their authenticated login.

    b. Based on date selected Beneficiary can enter the Maximum allowed surrender values single entry however provision should be available to take block wise maximum available entitlement to surrender.

    c. PSM value will be taken if any Regulation/Power regulation is there.

Default page contains:

    a. From Date

    b. To Date

    c. Toggle Button to Select All/Specified Generator. In case of selection of All Sum of surrender values will be shown default.

On selection of the unit, it contains share allocated beneficiaries in the list as per MoP:

The sample table looks like:

Date	Beneficiary-1	Beneficiary-2	----	Beneficiary-N	Sum of PSM	Total Surrender Value
Allowed Surrender	Min Ent value	Min Ent value	Min Ent value	Min Ent value	If Any	Sum total

dd-mm-yy(From)	Input	Input	Input	Input	Blocked for Entry	
-----	Input	Input	Input	Input		
dd-mm-yy(To)	Input	Input	Input	Input		

Column no.	Field Name	Input (I) / Output(O)	Remarks
A	Toggle	I	All/ Generator Station wise
B	Beneficiary surrender	I	- In case of Single value entry of Surrender-Can surrender max upto the minimum entitlement available in day - In case if entry allowed for all blocks then restriction upto Entitlement available in the TB

C. RSD Suggestion Page-

Page gives suggestion to operator as mentioned in the flow chart annexure.

Default page contains:

- Selection of Date and Default date for next day(D+1).
- Approve button enable condition is attached in flow chart annexure.

Table of contents for RSD Suggestion Page is as mentioned below:

Generator	Existing RSD	Suggested RSD	On Bar +Off bar DC	Surrender	Suggested RSD Units	New RSD Quantum	Reason	Beneficiaries Surrendered	On bar Units	RSD Units	Approve
Station 1	Status Of Unit		DC entered	As per Surrender Request page	If any		Enough quantum/Not enough	Beneficiaries surrender list	From unit status page	From unit status page	Button will be available if RSD criteria met

Statio n 2									

D. Run Calculation:
  a. Page shows all the generator list and On bar & Off bar units
  b. Calculations can be run for individual and all generators at a time.

Default page contains:

  a. Date Selection

Generator	On bar units	Off bar units	Outage units	Calculation Button	Remarks
Station -1				**Button to Run Calculations**	
Station -2				**Button to Run Calculations**	

E. Revival Request:
  a. Every beneficiary should be able to access the revival request module through their authenticated login.
  b. Based on date selected Beneficiary can enter the Maximum allowed revival values single entry however provision should be available to take block wise maximum available entitlement from Off bar .
  c. PSM value will be taken if any Regulation/Power regulation is there.

Default page contains:

  a. From Date
  b. To Date
  c. Toggle Button to Select All/Specified Generator. In case of selection of All Sum of revival values will be shown default.

  Table details

Date	Beneficiary-1	Beneficiary-2	----	Beneficiary-N	Sum of PSM	Total Revival Value

Off bar Ent	Min Ent value	Min Ent value	Min Ent value	Min Ent value	If Any	Sum total
dd-mm-yy(From)	Input	Input	Input	Input	Blocked for Entry	
-----	Input	Input	Input	Input		
dd-mm-yy(To)	Input	Input	Input	Input		

F.   Revival Suggestion:

Page gives suggestion to operator as mentioned in the flow chart annexure.

Default page contains:

- Selection of Date and Default date for next day(D+1).
- Approve button enable condition is attached in flow chart annexure.

Table of contents for Revival Suggestion Page is as mentioned below:

Generator	On bar Units	Off bar units	Outage Units	Calculation Status	Revive	Change Running New to MoP	Remarks
Station 1	Status Of Unit	From Status page	From Status page	As per Surrender Request page	If any as per logic from Flowchart	Share allocations will be restored back full / from selected TB	Enough quantum/ Not enough
Station 2							

G.   Allocation Details:
    a. Calculation flow chart is attached in Annexure
    b. Share allocations will be calculated and displayed same.
    c. Calculation Status

Default page contains:

    b. Date Selection

    c. Generator Selection drop down

    d. All or individual beneficiary selection

    e. Download files in different formats

    f. Selection button to use New share allocation or MoP share allocations.

    g. On bar/Off bar share allocation drop down selection.

    h. Calculation status-Not calculated/Surrender Calculated/Calculated based on flow chart process automatically.

Table of page contains:

Block	MoP Allocation %	MoP Ent MW	Surrender MW	Surrender Considered	Requisition MW	On bar Ent MW	On bar Alloc %	Off bar Ent MW	Off bar Alloc %	PSM MW	PSM %
1											
96											

15 Requisition

Applicable to all type of stations

a. Every beneficiary should be able to access the requisition module through their authenticated login

b. The dropdown for req. should have the sequence of costliest plant to cheapest plant. Provision for option to update the variable charges for a particular period may be provided in config module. Based on that variable charges, sequencing of costliest to cheapest may be done. Variable charge of each ISGS shall be shown to their beneficiaries at the time requisition submission process. The sequence shall be user defined as well.

c. First instance of submission of requisition on day-ahead shall be considered as day-ahead requisition. Subsequent submissions through this channel shall be treated as revised requisition with provision for assigning reason for revision. Accordingly, system generated revision request code shall be assigned.

d. Beneficiaries shall give requisition for every time block against total entitlement of each ISGS. User shall be able to enter through any of the following ways

i. Every individual time blocks

ii. Sequence of blocks: User shall enter all the time blocks but shall be possible to group and submit requisition eg blk 1 to blk 10: 100 MW, blk11 to blk 96: 80MW

iii. Range of blocks: User shall be possible to enter requisition for a specific range of blocks eg blk 40 to blk 45 : 75MW.

e. Beneficiaries may have option to upload one requisition file to change the requisition in bulk. Format for the file may be available/downloaded in requisition page. In that format option to select any of the sellers is to be present for any particular beneficiary). While uploading csv, zero requisition should be treated as full surrender.

f. One separate page may be developed where beneficiary can visualize the plant wise requisition as well as total requisition.

g. **Default Requisition:** After creation of first entitlement, by one set of default requisition is required to be considered as 0th Requisition. It can be Full surrender or Full requisition as per the Regional specific requirement.

h. **Gate closure/Req. closure time:** As per IEGC, 2010 and subsequent amendment or any successor regulation, timeline or gate closure for submission of requisition for Day ahead as well as real time. These gate closures are not fixed for internal. These may be changed based on change in market mechanism or change in regulation/order. These gate closure may be configurable from configuration module.

For example, Day/Term Ahead requisition: For days D, D+1…D+n, the requisition to be submitted before D-(no.of days)-(no.of hours before req. can be submitted) with D being Monday, Tuesday, Any day etc.

Similarly, Intra-Day Requisition: For schedule period of t, t+1…t+n blocks, the gate closure will be t-n, where n is no. of blocks before req. to be submitted.

The following fields are auto computed for all the block wise information & common to all types of generators viz. (Thermal, Gas, Hydro, Nuclear, RE-Solar, RE-Wind, etc) in addition to the specific fields mentioned subsequently.

❖ MWHR

❖ Max

❖ Min

❖ Average

➢ **Nuclear stations shall include the following for each of the blocks**

The Requisition will be booked full viz made equal to entitlement and No surrender shall be possible. However, in near future provision for surrender by the beneficiaries shall be included. Any change in beneficiaries' requisition due to DC change etc. above a certain MW (can be configurable by beneficiary/RLDC) to be intimated to beneficiary through an automated e-mail and message.

➢ **Hydro stations shall include the following for each of the blocks**

beneficiaries Requisition for hydro power plant may configurable from configuration module. One toggle button may be provided in utility module, where two option will be available as follows:

i. Allow requisition: It will allow the beneficiary to change the requisition.

ii. Block requisition: This will not allow beneficiary to change the requisition.

As per current practice, ISGS hydro station, must run power plant, declares its' capability block wise MW as well as daily energy on day ahead basis. Entitlement is being calculated based on the share allocation and beneficiaries schedule is being prepared as per their entitlement. For being a must run power plant, beneficiaries of ISGS plants are not entitled to change schedule as per their requirement.

However, there is a chance of changing the overall hydro scheduling methodology in line of thermal optimization process. In that case, it is possible to give rights to states/beneficiaries to choose their schedule from its' hydro plant as per their requirement without hampering daily energy declared by the plant.

The toggle button will help to switch from 1st method to 2nd method without major intervention of developer.

Table 9:Requisition Common Fields

Column no.	Field Name	Input (I) / Output(O)	Remarks
A	Total entitlement	O	All the fields are Read only
B	N-1 Requisition	O	
C	Requisition	O	

➢ **Thermal stations shall include the following for each of the blocks**

Table 10: Requisition table for Thermal Plants

Column no.	Field Name	Input (I) / Output(O)	Remarks
A	Total entitlement	O	
B	On Bar Entitlement	O	
C	Off bar Entitlement	O	
E	Final Entitlement	O	Entitlement referred is the effective entitlement after the deduction of power regulation, RSD block amount and market (PX/STOA) sold quantum
D	N-1 bar Requisition	O	Provision to hide/unhide these columns shall be available. Default will be hidden
E	Input Type	I	Dropdown shall have following four types every block i. Full Surrender ii. Full Requisition iii. Partial Requisition iv. Surrender by Value No of input types and its logic may be changed in future. Provision for any future change must be there.
F	Input Value	I	This column will be enabled for editing only for sl No iii to iv.
G	Requisition	I/O	Depending on the selection of sl. no (f) and value in (g) the following is envisaged and both columns are read-only. i. Full Surrender: Total Requisition will be made zero

Column no.	Field Name	Input (I) / Output(O)	Remarks
			ii. Full () Requisition: • Requisition will be booked up to total entitlement. • In case of any PSM/Regulation, PX/STOA sell, RSD blocked amount or any other deduction, requisition will be limited to final entitlement (total entitlement after deduction of PSM/RSD/PX/STOA sell or any regulation) iii. Partial Requisition: • The values entered in sl No (g) will be treated as requisition and value shall restricted to final entitlement (total entitlement after deduction of PSM/RSD/PX/STOA sell or any regulation) iv. Surrender by Value: The values entered in sl No (g) will be subtracted from final entitlement and the result will be treated as requisition and any

Column no.	Field Name	Input (I) / Output(O)	Remarks
			negative output value will be treated as zero

> **Gas stations shall include the following for each of the blocks**

Table 11: Requisition Table for Gas Plants in Closed Cycle

Column no.	Field Name	Input (I) / Output(O)	Remarks
A	Total entitlement	O	Entitlement referred is the effective entitlement after the deduction of power regulation and market sold quantum
B	On Bar Entitlement	O	
C	Off bar Entitlement	O	
D	Final Entitlement	O	Entitlement referred is the effective entitlement after the deduction of power regulation, RSD block amount and market (PX/STOA) sold quantum
E	N-1 bar Requisition	O	Provision to hide/unhide these columns shall be available. Default will be hidden
F	Input Type	I	Dropdown shall have following four types every block i. Full Surrender ii. Full Requisition iii. Partial Requisition iv. Surrender by Value

Column no.	Field Name	Input (I) / Output(O)	Remarks
			No of input types and its logic may be changed in future. Provision for any future change must be there.
G	Input Value	I	This column will be enabled for editing only for sl No iii to iv.
H	Requisition	O	Depending on the selection of sl no (f) and value in (g) the following is envisaged and both columns are read-only.

    i.   Full Surrender: Total Requisition will be made zero

    ii. Full Requisition:

- Requisition will be booked upto Total Entitlement (OnBar CC Entitlement + OffBar Entitlement)

- In case of any PSM/Regulation, PX/STOA sell, RSD blocked amount or any other deduction, requisition will be limited to final entitlement (total entitlement after deduction of PSM/RSD/PX/STOA sell or any regulation)

    iii. Partial Requisition:

- The values entered in sl No (g) will be treated as Partial requisition and value entered shall restricted to OnBar CC

Column no.	Field Name	Input (I) / Output(O)	Remarks
			Entitlement + OffBar Entitlement after deduction of PSM/RSD/PX/STOA sell or any regulation)

iv. Surrender by Value:

- The values entered in sl No (h) will be subtracted from final entitlement and the result will be treated as requisition and any negative output value will be treated as zero.

Table 12: Requisition for Open Cycle Gas Plant

Column no.	Field Name	Input (I) / Output(O)	Remarks
I	On Bar Entitlement	O	Entitlement referred is the effective entitlement after the deduction of power regulation and market sold quantum, PSM
	Off Bar Entitlement	O	
			Off bar (OC) Entitlement = (Off-bar (CC) entitlement (sl No (c))- (Off-bar (CC) requisition (sl No (i))
J	Total Entitlement		On Bar Entitlement + Off Bar Entitlement
K	N-1 Requisition	O	Provision to hide/unhide these columns shall be available. Default will be hidden
L	Input Type	I	Dropdown shall have following four types for every block

Column no.	Field Name	Input (I) / Output(O)	Remarks
			i. Full Surrender
			ii. Full (On bar (OC)) Requisition
			iii. Partial Requisition
			iv. On bar Surrender by Value
M	Input Value	I	This column will be enabled for editing only for sl No iii to iv.
N	Requisition	O	Depending on the selection of sl no (n) and value in (o) the following is envisaged and both columns are read-only.

       i.   Full Surrender: Total Requisition will be made zero

       ii. Full Requisition:

- Requisition will be booked upto Total Entitlement (OnBar OC Entitlement + OffBar OC Entitlement)

- In case of any PSM/Regulation, PX/STOA sell, RSD blocked amount or any other deduction, requisition will be limited to final entitlement (total entitlement after deduction of PSM/RSD/PX/STOA sell or any regulation)

      iii. Partial Requisition:

Column no.	Field Name	Input (I) / Output(O)	Remarks
			• The values entered in sl No (o) will be treated as Partial requisition and value entered shall restricted to OnBar OC Entitlement + OffBar OC Entitlement after deduction of PSM/RSD/PX/STOA sell or any regulation)
			iv. Surrender by Value:
			• The values entered in sl No (o) will be subtracted from final entitlement and the result will be treated as requisition and any negative output value will be treated as zero.

16 Un-Requisition Surplus Availing &Recall Module

f. User shall be able to request/revise URS by respective login only for Current day, Day-Ahead and Post facto depending upon the roles.

There are two type of URS: Regulated URS, where in the URS is generated due to any regulation like PSM, Power Regulation, etc. The UnRegulated URS is generated due to less requisition by the beneficiary against its entitlement.

g. There shall be an input page for the user to request URS. The web page shall have two columns for each of the seller/buyer viz Available URS (read only) along with input column (Editable) for requesting URS for each of the blocks with the following filters

> ➢ Date
>
> ➢ Region which includes 'All' option also
>
> ➢ Seller which includes 'All' option also
>
> ➢ Beneficiary which includes 'All' option also

> ➢ Provision for viewing the Unregulated URS, Regulated URS and Total URS

Based on the login the filters will be applied as below

i. Beneficiary login: All sellers where the beneficiary is having share and requisitioned full and no power supply regulation/PSM to be filtered. As per merit order, cheapest generator should be in left and costliest generator in extreme right. Merit order may be decided as per variable cost input.

ii. Generator: All Beneficiary for whom the share is allocated from that generator will be filtered

iii. RLDC: RLDC shall have option to select Buyer wise view or seller wise view by selecting buyer name /seller name in dropdown. Further flexibility for selecting buyer & seller should be present to choose the URS view

h. An additional column shall be available in URS request page for entering the total URS request. Further the following provision shall be available for auto filling of URS as below

i. Beneficiary login: The user will select the ISGS stations by ticking the check box and will enter the Total URS requisition in Total Column and the URS requisition columns for the selected ISGS stations and selected Time blocks will be auto-filled according to the merit order of the ISGS stations so that the total URS requisition is achieved.

Table 13: Beneficiary Login URS Requisition Input Fields

Buyer view

Header/	Dropdown	For Date	Toggle Button (Buyer/Seller view) <Buyer> <Seller>	
For Inputs	Buyer<Beneficiary> <ALL>	<Calender>		
Body Showing Outputs		<ISGS> ISGS$_1$,ISGS$_2$, _ _ ISGS$_n$ 🔲 💬 ,____🔲		
	<Time Block>	<Check Box> 🔲	URS Available<MW>	URS Requisition<MW>	Total

1		MW_1	MW_1	$<MW>$
2		MW_2	MW_2	MW_1
|	▭▭	|	|	MW_2
|	|	|	|	|
N	|	MW_n	MW_n	|
				MW_n

ii. Generator: The user will select the Beneficiaries by ticking the check box and will enter the Total URS requisition in Total Column and the URS requisition columns for the selected Beneficiaries and selected Time blocks will be auto-filled in pro-rata of the entitlements so that the total URS requisition is achieved.

Table 14:Seller Login URS Requisition Input Fields

Seller view

Header/	Dropdown	For Date		Toggle Button (Buyer/Seller view) $<Buyer>$ $<Seller>$	
For Inputs	Seller $<ISGS>$ $<ALL>$	$<Calender>$			
Body			$<Beneficiary>$ $Ben_1, Ben_2, \_\_ Ben_n$		
Showing Outputs			▭ ▭ ,___▭		
	$<Time Block>$	$<Check Box>$ ▭	URS Available$<MW>$	URS Requisition$<MW>$	Total $<MW>$
	1		MW_1	MW_1	MW_1
	2		MW_2	MW_2	

				MW_2
N		MW_n	MW_n	
				MW_n

i. The available URS shown will be equal to Minimum of [(Sum of On bar Entitlements) - (Sum of Requisitions) - (Power Sold through market)], Link ATC margin available, Flow Area ATC margin available, Flow path ATC margin available.

j. While requesting URS, if URS margin available changes and the requested URS is violating the Available URS, then a pop-up to be displayed that the "URS Available is modified. Please check the URS Approved in Preview and submit".

k. A preview to be shown before the beneficiary submits the URS request. The preview template is given below. Refer to Sl.No(XIII)

Table 15: URS Requisition Preview

<Time Block>	URS requested	URS available	URS modified
1	MW_1	MW_1	MW_1
2	MW_2	MW_2	MW_2
N	MW_n	MW_n	MW_n

l. The URS request page shall also display a notification with details of the blocks in which Surrender/Regulation was requested/applied.

m. There shall be an identification for blocks which do not have URS can be shown with grey colour back colour and with URS can be shown with white back ground and bold text

n. The following checks shall be taken care in the input page with features described

    v. **Standing Consent given by both generator and Beneficiary:** The URS ReAllocation will be done on first come first serve basis however the URS request received in the same time block will be treated at par & shared on proportional basis. A service shall be run every block (configurable) for doing the Prorata for current day. However, the URS service for day ahead will run on particular time as specified in URS configuration table and similar to day of operation subsequently. Additionally, Provision for running the service manually shall be made.

    vi. **Standing Consent given by the Beneficiary only and Real time URS approved by Generator:** Beneficiary will be allowed to enter the URS request however the same will be considered for further process after approval/moderation from the generator. URS Request quantum by the requisitioner, URS Approved quantum by the Generator and URS schedule quantum to the generators shall kept separately for each block. Each process needs to be time stamped and recorded for future reference.

    vii. **No consent for URS Reallocation by the Seller to a particular Beneficiary:** The URS from that particular plant to the beneficiary for that particular block will not be shown and will not be allowed to request.

    viii. **No consent for selling URS by the beneficiary for a particular plant:** The power surrendered by the particular beneficiary shall not be added in the available URS from that station.

o. In case of Sl no (ii)above,

    ix. The generator shall receive notification whenever the beneficiary URS request is given.

    x. There may be one extra column for Generator which will be automatically populated with the beneficiary URS request quantum. The generator can approve by pressing an approval button as it is or with moderation by editing. Further Generator shall have an option to reject with a click of a button

    xi. The blocks where URS request approval of the generator is pending shall be highlighted

    xii. In case of missing of one or more block to approve, it may be considered as deemed approved/reject as per configuration.

p. The programme shall show the URS as zero for the specific blocks from a particular plant to a particular beneficiary under the following conditions

i. Surrender by Beneficiary: The beneficiary is expected to avail the URS only after availing his own share of requisition of power.

ii. Power Regulation / PSM

iii. Violation of limits viz Flow gate / ATC violation/ Flow area/ISGS/Seller/Regions/Links: If Beneficiary schedule is part of the Flow gate / ATC violation/ Flow area/ISGS/Seller/Regions/Links schedule and Flow gate / ATC violation/ Flow area/ISGS/Seller/Regions/Links violation occurs

q. There shall be a provision for uploading the URS request through an excel file or through API.

r. The URS available page shall auto-refresh with specified time interval(configurable)

s. Programme shall a feature URS claim by beneficiaries shall be allowed if the request comes revision wef 7th time block odd time block & 8th time block for even time block counting prevailing time block as 1st block. If URS Requisition page is kept open and after elapse of one time block, the data should accept from next allowed time block based on server time not on the client side

t. Presently URS can be availed by any other beneficiary of the same station, however provision shall be available to extend the same to any other beneficiary also in future. Accordingly, configuration may be made to select an option to avail URS where Share is available or not and same shall be configurable at block wise w.e.f specific period without necessitating development.

u. URS requisitioned by other regional beneficiary/ies of the ISGS or URS approved quantum by the generator for the URS requisition by other region beneficiary shall be scheduled by RLDC on the direct path between seller region and buyer region. Before approval of the URS by RLDC or auto URS module particular link available ATC margin need to be checked and approved as per the margin available in that link.

v. Then user will see all the sellers (in GAS both the Open Cycle and Closed Cycle separately) with available URS which is the summation of URS values from Surrender and Regulation

w. Download button should be available for buyer to download the available URS along with URS requisition column such that Buyer can bulk upload URS request after filling the data.

x. Programme shall have an option to compute Real time /Day-ahead ATC with auto service and manually also to notify while entering URS by states/buyers where the ATC violation block wise.

y. The following reports shall be available within the user Login credential and downloadable in pdf, xlsx, csv etc... with the following filters and provision for seeing the data in charts.

    i. Report of Total URS generated at each generator point and its break up of each beneficiary and URS requisitioned by the beneficiaries at each generator point and URS scheduled to beneficiary at each generator point and after all consideration URS available at each generator point URS for each of the blocks for each of the revision

        ➢ Date

        ➢ Revision No, By default latest revision number to be shown for the selected date.

        ➢ Region which includes 'All' option also

        ➢ Seller which includes 'All' option also

        ➢ Beneficiary which includes 'All' option also

        ➢ Provision for viewing the UnRequisition URS, Regulated URS and Total URS

    Based on the login the filters will be applied as below

        ➢ Beneficiary login: All sellers sorted by merit order where the beneficiary is have share will be filtered

        ➢ Generator: All Beneficiary for whom the share is allocated from that generator will be filtered

        ➢ RLDC: All the generators of respective region sorted by merit order will be filtered.

    ii. URS Sharing report (Surrendered state URS Vs Availed states URS by ISGS wise at scheduled stage): The URS is allocated to multiple beneficiaries as explained above. However, the URS is temporary allocation of power which was surrendered by multiple beneficiaries. The prorata allocation is done among the multiple surrendering beneficiaries based on the surrender to the total URS. This report details the quantum of URS taken by a beneficiary from another surrendering beneficiary for each of the station.

    iii. Actual URS available (entitlement – requisition) for each generator and its beneficiary combination, URS availed by the beneficiaries from generators & URS available after schedule (entitlement – schedule) for each generator and its beneficiary combination may be included in report

z. Provision for uploading the data of regulated URS quantum sold under PX to be available separately.

17 LTA/MTOA-Common Features

a. There are currently 6 set of information for each LTA/MTOA being submitted by the seller/ buyer/RLDC. Additional information may be taken in future for applying limits. Accordingly, the same may be configurable. The following are the 6 set of information being submitted by the seller/buyer/RLDC

i. Block wise contract quantum: The block wise contract quantum would be displayed in this column. The LTA transactions shall be created by the administrator. Each LTA/MTOA transactions contract amount may vary or change for different date range

ii. Contract wise Declaration from the generator

This information is punched by the seller limited to the contract and the time line of submission of DC and MW limitation is mentioned in DC section. The limitation of availability declaration over contract amount of any transaction shall be made configurable as per the Generator type of the transaction. For example, DC declared for any LTA contract may be allowed up to 105 % of the contract amount and similarly for Hydro generator DC declared amount may be allowed up to 110 % of the contract amount subject to spillage declaration by the generator. Hence limiting percentage value will be kept as configurable from configuration page for different type of fuels.

There shall be a checkbox to select the box to declare the spillage condition by the generator. Only after selecting the checkbox, the 110% overloading DC declaration will be activated. Option for section of spillage period shall be provided.

This DC declaration section shall not be made mandatory to each LTA contracts. A selection enabler shall be there to choose whether generator to declare DC against the contract or not required DC is similar to contract.

iii. Restrictions

Various kinds of restrictions are imposed in MW and Percentage on the transaction, viz. PSM, Regulation, Regulation of power supply, RLDC imposed regulation (due to transmission constraint, NOC issues) etc. Data generated from respective module will be populated in this column.

The LTA module will have provision to accommodate any kind of future restrictions required as a result of regulatory changes in future such that dependency on the vendors would be reduced.

iv. **No Objection Certificate Quantum**

There must be a column to fill the NoC quantum for any transaction from RLDC user. This may be activated or deactivated from configuration module for each transaction.

v. **"Allowable schedule limit"**

This column will reflect how much portion of the contracted quantum is available for scheduling against which the applicant shall punch the mutually agreed requisition.

Allowable scheduling quantum for any transaction shall be calculated as follows

A=Minimum (contract MW, DC declared by Generator) less restrictions if any as mentioned in section - iii exception

if spillage condition is enabled then

A= DC declared by the generator less restrictions if any as mentioned in section - iii exception

B = NOC quantum of the LTA transaction in MW

C= scheduling allowable limit for any transaction= Minimum of A and B

This logic may be changed in future as per amendments of CERC regulations.

vi. **Mutually agreed Quantum from the applicant**

One utility between seller, buyer, trader, applicant shall be assigned by the administrator for each LTA transactions for submission of requisition.

vii. **URS generated for each transactions**

URS available for each LTA transactions shall be Allowable schedule limit of that transaction as per section-v and requisition submitted by the utility as per section-vi

b. The web page shall have the following filters

      i.   Date

      ii. LTA Approval No

          ➢ Buyer

          ➢ Seller

          ➢ Applicant

      iii. Revision No

c. On selection of date and Approval No, the details of the transaction viz Applicant, Seller, Buyer, link/path shall be displayed. Also, historical "Allowable schedule Limit" values with corresponding durations will be visible on selection of past dates

d. The following block wise fields shall be available

      i.   Contract Quantum: Read only

      ii. Declared Capability editable/read only input column depending on the user

      iii. Restrictions: Read only. On clicking the header, the details such as PSM, Regulation of Power supply, Transmission constraint shall be displayed.

      iv. NoC

      v.   Allowable Schedule Limit: Read Only

      vi. Mutually agreed quantum/Requisition editable/read only input column depending on the user

e. Based on the login the following entries are to be allowed

      i.   Seller is allowed to punch the declared capability only. Block wise declared capability shall not be allowed more than contract capacity. Requisition column will be read only

      ii. Based on the configuration of assigned utility as per section a-vi is allowed to punch only the requisition. Block wise requisition shall not be allowed more than the allowable scheduling limit as per section a-v. Other columns will be read only.

      iii. RLDC is allowed to enter/modify both the inputs in case of requirement with remarks as compulsory

f. The declared capability information input is taken for selected LTA/MTOA depending upon the configuration.

g. In case of one utility has multiple LTA, data uploading or through API, option should be provided. Data to be updated to those transactions only, for which that utility has the rights. Necessary validation as explained above to be taken care.

h. There shall be an option for entering the remarks

i. Provision to incorporate subsequent revisions (including real time revisions) of LTA/MTOA transactions (real time revisions - RLDC operator intervention) of both DC and Requisitions. LTA DC and Requisitions may be revised from 7th and 8th block (for 15 min block scheduling) as on date. The same shall be configurable. 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.

j. Only numeric data to be allowed and Resolution should be allowed up to 2 decimals. Resolution to be kept configurable.

k. Requisition may be restricted to the allowed limited value in case of scheduling limit is imposed to any transaction for a particular time period

l. Whether to apply loss at both regional and state buyer and seller boundaries or a single boundary should be configurable from transaction management module.

m. In each LTA/MTOA contract, UnRequisition and regulated URS will be calculated individually and these values shall be used and shared with other software modules.

n. There must be option for one or more flag of Green LTA/ MTOA or any special tag as directed by MoP or CERC. These tags may also be directly fetched from STOA/REMC or any other software or may be created as input provided by any user. For Eg Tag may Solar, Non-Solar and Hydro

o. The module shall be able to exchange information through API with other software's such as REMC/NLDC/Utility etc.

p. Losses applicability for LTA/ MTOA transactions should be configurable.

q. A Download option to be available to download all the information for specific utility based on the login for a particular date with following information along with block wise data.

    iv. Date

    v. Revision No

    vi. LTA/MTOA Approval No

vii. Applicant

viii. Seller

ix. Buyer

x. Link/path

18 STOA

a. Normally the contracts are defined in the NOAR and updated in WBES through API. However, there shall be provision for

    i.   Adding contracts in WBES as fall back arrangement in the configuration.

    ii.   Import using .csv/.xls/.xlsx/xml file using file upload after downloading from the database of STOA program (NOAR).

b. There shall be an option to select the option to 'overwrite' the existing transaction or not. Accordingly, the transactions contract value shall get overwritten or only new transactions will get added. By default, value of existing contracts shall not get overwritten.

c. The web page shall have the following filters

    i.   Date

    ii.   STOA Approval No

    iii.   Applicant

    iv.   Seller

    v.   Buyer

    vi.   Revision No

    vii.   Link / Path

    viii.   Skip Loss

d. On selection of date and Approval No, the details of the transaction viz Applicant, Seller, Buyer, link/path shall be displayed

e. The following block wise fields shall be available

    i.   Contract Quantum: Read only

    ii.   Requisition editable/read only input column depending on the user

f. The requisition is made equal to the contract value when the contract is created or contract value is modified.

g. At present, STOA requisition revision is allowed only in case of unit tripping w.e.f 7th and 8th time block or the time of intimation whichever is later. However, the programme shall allow only the RLDC user to revise the requisition based on the request received from the applicant. The requisition value shall be restricted to the contract quantum. 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.

h. There shall be an option for entering the remarks

i. Only numeric data to be allowed and Resolution should be allowed up to 2 decimals. Resolution to be kept configurable.

j. There should be provision of directly fetching REMC STOAs from REMC module (Similar to REMC LTA/MTOA).

k. Losses applicability for STOA transactions should be configurable. Present Regulations allow skip loss facilities for renewable LTA/MTOA/STOA only.

l. There must be option for one or more flag of Green STOA (G-Tam) or any special tag as directed by MoP or CERC. These tags may be directly fetched from STOA/REMC or any other software or may be created as input provided by any user. For Eg Tag may Solar, Non-Solar and Hydro

r. A Download option to be available to download all the information for specific utility based on the login for a particular date with following information along with block wise data.

> i.   Date
>
> ii. Revision No
>
> iii. STOA Approval No
>
> iv. Applicant
>
> v.   Seller
>
> vi. Buyer
>
> vii. Link/path
>
> viii.Skip Loss

19 Power Exchange (Day Ahead Market (DAM), Real Time Market (RTM) or any new product through collective Transactions).

a. Normally the information should be exchanged in WBES from NOAR through API.

b. The information shall be DAM, RTM or any new market segment introduced by CERC/MoP like Green Day Ahead Market (GDAM).

c. However, there shall be provision for importing using .csv/.xls/.xlsx/xml file as a fallback arrangement. The file format shall be agreed as per NOAR at the time of implementation. User shall be able to upload the Power Exchange file by respective login only for day-ahead and for current day revision of Power exchange. File upload option shall provide different types of file formats like csv,.xls,.xlsx etc. In addition to the file upload, there shall be a fetch option to fetch the latest data from a specific location after validation and warning messages to be issued in case of error.

d. Accordingly, there shall be an input page for the user to upload the power exchange file from NLDC which contains block wise information for all registered entities, links and paths. Further the web page shall have the following filters for the user to select before uploading the file.

  i.   Date

  ii. Type of Exchange

  iii. Type of Exchange Transaction Day ahead and RTM Transactions

  iv. Revision no: Latest revision no will be shown and will get updated on uploading the file.

e. Data Received through API/ PX files shall be saved in the database for each revision wise and Exchange type wise. The revision number as received from the PX shall also be stored.

f. Every utility registered with PX has got a unique code. The Gas Plant will have separate code for each Fuel Type. Further Gas may also have separate code for Open Cycle and Closed Cycle for each fuel type.

g. While uploading/fetching the file/data through API, the programme shall check the available code in the file/data in API with the database for utility/link/path matching and accept the data only if it exists. An error message with clear details shall be thrown in case of any utility, link & path code is not matching and shall not accept the file upload/fetch/data through API viz partial information shall not be taken.

h. Since collective transaction (DAM, RTM etc) are simply added in the total block wise Net Schedule of regional entity. No addition checks (Ramps etc.) are required for computation of Schedule. So, Admin/User may have the option to define any new collective transaction segment/new power exchange in the net schedule for each regional entity.

20 Curtailment

To enable the same, curtailment tool shall have the following provisions.

a. Curtailment sequence shall by default be URS, followed by STOAs (Bilateral followed by Day ahead Collective transactions), MTOA and finally LTA/ISGS Requisitions. Provided that while curtailing collective transactions, day ahead transactions shall be curtailed first followed by real time transactions. There shall also be provisions to change the priority of transactions during curtailment in configuration module or insert a new category of transaction in the priority sequence.

b. The software shall have provision for multiple selection like selecting all the LTA and ISGS together or selecting all the ISGS, LTA and URS together or selecting all the LTA, MTOA and STOA etc.

c. It shall be possible to make curtailments

    i.   Manually as a stand alone or

    ii.   Automatically when ATC violation occurs across Links, Paths, flow areas etc during the preparation of schedule.

d. Software should be able to group under import and export based on the filter combination selected for every time block to implement the above curtailment sequence as and when called upon.

e. **Curtailment Filters:** User shall be able to select the following

    i.   Date /block time

    ii.   Select path/link (the corridor in which curtailment required to be initiated)

    iii.   With selection of path or link, all the type of transactions in that particular path with separate import and export group shall be shown viz. Export ISGS (all beneficiary schedule), ISGS (URS scheduled), LTA/MTOA/STOA (All transactions), Power Exchange (DAM/RTM). This part shall be made configurable. Any new type of transaction if introduced in the

scheduling methodology as per the appropriate guideline of commission shall be added to this module

iv. Type of transaction: User may select a single type or multiple types viz STOA, PX, RTM, MTOA, LTA, ISGS with sub types Requisition & URS shown for any particular link or path

v. Seller viz with possibility of selecting multi-Seller as well as All options

vi. Buyer viz with possibility of selecting multi-Buyer as well as All options

vii. Import /Export

viii. Boundary viz Injecting State Boundary /Regional boundary/ Generator ex-pp quantum/Boundary as per Contract Input.

ix. Link/Path/Flowgate/Region type

   ➢ Linkwise viz WR-SR, ER-SR etc

   ➢ Path viz NR-WR-SR, NR-ER-SR, WR-SR etc

   ➢ Flowgate viz group of plants/ Pooling stations

   ➢ Region

f. All the above filters except date filter shall have "All" Option as well as facility for selecting Multiple options

g. Whenever any Seller / Buyer are selected, all the embedded utilities transactions are also to be listed.

h. There shall be an option to select "Unit Tripping" Yes or NO in case seller filter is applied.

i. There shall be an option to select the "Original values "or "Latest Values". The latest values will be shown in case of "Latest Value selection". The values shown will be as below for "Original Values" Option,

   i. STOA: Revision zero or original value in case of no unit tripping and Latest values in case of unit tripping for the specific blocks or in case of any past curtailment

   ii. LTA/MTOA: Latest schedule of each transaction.

   iii. ISGS: Latest schedule to the beneficiary from the ISGS.

j. Based on the above selection, the transactions shall get listed. However, the following features shall be available

    i. To exclude certain transactions

    ii. To Select all transactions

    iii. To De-select all transactions

    iv. Copy Total of all Transactions

k. ATC values, if available for that link / path will be shown for all the blocks along with the transactions total.

l. **Curtailment Options:** The curtailment shall be possible with either of the following methods.

    i. By Percentage:

    ii. By MW

    iii. Restrict/Limit to certain MW

m. There shall be a Provision for entering the above inputs with the possibility of entering individual block as well as group of blocks

n. A preview shall be available before applying the actual curtailment with the curtailment blocks highlighted and can be saved for further process.

o. The curtailed values shall not change the original values and will be stored separately. The minimum of the original value and curtailed value will be scheduled.

p. The curtailment details shall also be sent to NOAR.

q. In case of curtailment email / SMS shall be send to the effected buyer, trader, applicant and seller, for information/demand management

r. **Revise Curtailment Restoration (partially or fully):** The scheduling Programme shall allow the above restoration for a group of blocks (selectable)

s. The following will be followed in case of restoration

    i. STOA: The value shall be restored as below

        ➢ Blocks where unit tripping is not there: Restored to Revision zero or original value

        ➢ Blocks where unit tripping is there: Restored to latest unit tripping value

        ➢ Restoration of such details shall be sent to NOAR and the buyer and seller

    ii. LTA/MTOA: Latest Revision submitted by the applicant

    iii. ISGS: Latest schedule of the beneficiary as per requisition submitted by the applicant

t. A preview shall be available before restoring with the restoration blocks highlighted and can be saved for further process.

u. The following minimum checks shall be available

   i. If Curtailment "By percentage" is selected, the allowed value shall not be more than 100 and only positive numbers.

   ii. If Curtailment "By MW" or "Restrict/Limit to certain MW" is selected, the allowed value shall be less than or equal to the total of selected transactions in that particular block. It shall allow only positive numbers

v. The following Reports shall be available and downloadable in pdf, xlsx, csv etc...

   i. Revision wise Curtailment report with blocks highlighted

   ii. Unit Tripping Revisions

w. Published time to be shown

x. An option to display the above reports in Graphical form shall be available

21 Schedule Creation.

1. For day ahead module schedule shall be run for start block to end block of the day.

2. For the same day schedule revision only for the ahead blocks (as per the gate closure) schedule shall be prepared. There shall not be any change in schedule of the past blocks and all schedule related fixation as explained below shall be done for the ahead blocks only.

3. The following methodology shall be followed for Thermal and Gas Schedule
4. Further the ramp philosophy based on previous block schedules of generator would be finalised at the time of implementation of SR.

5.

g. **Thermal Schedule:**

   i. All requisitions submitted by the Constituents against each ISGS as well as LTA, MTOA, STOA (Bilateral & Px), URS, REMC shall be summed up.

   ii. Technical Minimum of the Plant: The above sum shall be checked for violation of technical minimum value for each time block. The fixation is done as below depending on the configuration.

a. No Support/Jack up: No fixation done

b. Support through ancillary alone: The support upto the specified value is jacked up through RRAS.

c. Support through Additional URS by selected Beneficiary alone: The support upto the specified value is jacked up through URS for selected beneficiary/beneficiaries.

d. Support through All Beneficiary Jack up alone: Each beneficiary eligible technical minimum is calculated as share percentage multiplied by station technical minimum. In case of technical minimum violation (requisition less that its eligible tech min requisition), the same beneficiaries requisition shall be jacked up in the ratio of their violation w.r.t eligible technical minimum. Jacked up requisition shall not be more than entitlement.

   In case of Power Supply Regulation, the schedule of the beneficiary during fixation shall not exceed the restricted entitlement viz Onbar entitlement minus (sum of Market Sold, Regulated Quantum, Regulated due to PSM & Curtailment). The jacking up shall be done in the following steps

   o Jacking up on the beneficiaries who has surrendered below 55% or any technical minimum value selected in configuration module of normative entitlement

      ▪ Maximum upto 55% for all beneficiaries excluding regulated entity

      ▪ Maximum upto regulated entitlement for the regulated entity

   o If further jacking up is required, then Jacking up on all the beneficiaries who has surrendered shall be done upto

      ▪ Maximum upto entitlement for all beneficiaries excluding regulated entity

      ▪ Maximum upto regulated entitlement for the regulated entity

e. Support through ancillary and Beneficiary jack up: The jack up is done upto 'x' value as per configuration on the beneficiary as explained above. The remaining jack up from 'x' value up to technical minimum is adjusted on RRAS for achieving technical minimum.

f. Support through Additional URS by selected Beneficiary and All Beneficiary jack up: The jack up is done upto 'x' value as per configuration on the all beneficiary as explained above. The remaining jack up from 'x' value up to technical minimum is

adjusted on the selected beneficiaries by enforcing URS for achieving technical minimum.

iii. Ramp UP/ Down Check: Subsequent to (ii) above, the revised sum will be checked for ramp violation. The sum shall be checked for violation of ramp rates down/up value for each time block. Each beneficiaries eligibility for ramp up/down is calculated as for share percentage multiplied by station ramp rates down/up. In case of ramp violation, the same shall be jacked up /down on the violators to fix the ramp to the extent possible in the ratio of their violation w.r.t eligible ramp rates. Jacked up/down due to ramp up/down correction in requisition shall not be more than entitlement. If the ramp violation is due to change in share allocation, then the same shall not be treated as ramp violation.

Jacking up/down for ramp violation in case of Regulation of Power supply: The ramp violation fixation for the regulated entity shall be maximum up to the regulated entitlement for the regulated entity

iv. There may be violations getting unfixed to some extent in the following situations and is acceptable

➤ Ramp rates violation unfixed due to sudden change in Px sale.

➤ Power Supply Regulation: The buyer/beneficiary – seller/ISGS combination on whom constraint is put shall not be scheduled more than the allowed value while finalizing the schedule. Further adjustment is done on other beneficiary up to the entitlement if required as above.

➤ Power Supply Regulation: Station Schedule may come less than technical minimum in case of regulated quantum is more than 45% of Normative DC and no ancillary support

➤ Curtailment case: buyer-seller (ISGS) combination on whom curtailment has been imposed. In case of violation (tech min or ramping), the violation amount is not being adjusted in other buyer of that ISGS, that amount to be unfixed.

v. Subsequent to the above the schedule of generator would be sum of all moderated requisitions, LTA, MTOA, STOA (Bilateral & Px), URS, REMC, RRAS, SCED.

vi. There shall be a provision to send the Plant Pmax and Pmin value to NLDC for SCED/RRAS, even though the tech min is not imposed on the Plant, without any fixation.

vii. Loss applicability to all the transactions at the time of schedule preparation shall be as per the methodology mentioned in loss and transaction section

h. Gas Schedule:

For each fuel type:

i. All requisitions submitted by the Constituents against each ISGS as well as LTA, MTOA, STOA Bilateral & Px), URS, REMC, RRAS and SCED shall be summed up.

For whole generating plant (includes all fuel-types):

ii. The Gas Plant Technical Minimum: The sum of schedule of all fuel type, excluding RRAS, SCED, shall be checked for violation of technical minimum value for each time block. The fixation is done as below depending on the configuration.

The fixation shall be separate for Open Cycle and Closed Cycle at the Plant Level and not at the Fuel type.

➢ No Support/Jack up: No fixation done

➢ Support through ancillary alone: The support upto the specified value is jacked up through RRAS (in the order of the merit order of fuel-types based on configuration) *.

➢ Support through Additional URS by selected Beneficiary alone: The support upto the specified value is jacked up through URS for selected beneficiary/beneficiaries (in the order of the merit order of fuel-types based on configuration) *.

➢ Support through All Beneficiary Jack up alone: Each beneficiary is eligible for share percentage multiplied by station technical minimum. In case of technical minimum violation, the same shall be jacked up on the violators of technical minimum in the ratio of their violation w.r.t eligible technical minimum (in the order of the merit order of fuel-types based on configuration) *.

➢ Support through ancillary and Beneficiary jack up: The jack up is done upto 'x' value as per configuration on the beneficiary as explained above. The remaining jack up from 'x' value up to technical minimum is adjusted on RRAS for achieving technical minimum (in the order of the merit order of fuel-types based on configuration) *.

➢ Support through Additional URS by selected Beneficiary and All Beneficiary jack up: The jack up is done upto 'x' value as per configuration on the all beneficiary as explained above. The remaining jack up from 'x' value up to technical minimum is adjusted on the selected beneficiaries by enforcing URS for achieving technical minimum (in the order of the merit order of fuel-types based on configuration) *.

The technical minimum shall be for complete Gas Plant, segregated into Open cycle and closed cycle and not fuel type. The violation of plant Tech min to be fixed in the merit order of fuel type which is configurable (starting with least cost fuel first) and fixation to be done only if the plant technical minimum is violated.

iii.   Ramp Up Down Check: Gas Plant have separate Ramp Check for Open Cycle and Closed Cycle.   There shall not be any fuel type merit order in Ramp correction. Subsequent to above Technical Minimum check. The revised sum excluding RRAS, SCED will be checked for ramp violation. The sum shall be checked for violation of ramp rates down/up value for each time block. Each beneficiary is eligible for share percentage multiplied by station ramp rates down/up. In case of ramp violation, the same shall be jacked up /down on the violators to fix the Plant ramp for Open Cycle and Plant ramp of Closed Cycle, to the extent possible in the ratio of their violation w.r.t eligible ramp rates. If the ramp violation is due to change in share allocation, then the same shall not be treated as ramp violation.

Jacking up/down for ramp violation in case of Regulation of Power supply: The ramp violation fixation for the regulated entity shall be maximum up to the regulated entitlement for the regulated entity.

*The ramp up /down shall be check separately for Open cycle and Closed Cycle for the complete Gas station. The violation to be fixed on the quantum it is violating the CC/OC Ramp, and there shall not be any merit order in Ramp correction. Further, fixation to be done separately at the plant level for open cycle and Closed cycle, and fixation shall only if the ramp up/down is violated.

Further, the program should check for violation of schedule exceeding normative installed capacity and facilitate a pop-up alert for this.

iv.   The schedule of the beneficiary during fixation shall not exceed the restricted entitlement viz On bar entitlement minus (sum of Market Sold, Regulated Quantum & Curtailment)

v.   There may be violations getting unfixed to some extent in the following situations and is acceptable

- Ramp rates violation unfixed due to sudden change in Px sale.

    i.   Power Supply Regulation: The buyer/beneficiary – seller/ISGS combination on whom constraint is put shall not be scheduled more than the allowed value while finalizing the schedule. Further adjustment is done on other beneficiary up to the entitlement if required as above.

- Curtailment case: buyer-seller (ISGS) combination on whom curtailment has been imposed. In case of violation (tech min or ramping), the violation amount is not being adjusted in other buyer of that ISGS, that amount to be unfixed.

vi. There shall be a provision to send the Plant Tech min value to NLDC for RRAS / SCED, even though the tech min is not imposed on the Plant both for the Open Cycle and Closed Cycle.

vii. User shall have a provision to change the Merit order fuel type, from the 4th Time block to accommodate any special treatment for any fuel type.

Common Features

a. The Gas Plant shall have schedule for plant and for each fuel type. The Gas schedule shall clearly show the Open Cycle and Closed Cycle schedule against each beneficiary, and similarly Open Cycle and Closed Cycle under the URS, RRAS, PX, RTM, SCED , MBED, TRAS, SRAS and all the components of schedule.

b. The injection/Despatch schedule and Drawal Schedule as arrived shall be displayed in the reports as below. The following reports shall be available and downloadable in pdf, xlsx, csv etc... with the following filters and provision for seeing the data in charts.
Net schedule is the Total which is split up of ISGS, LTA, MTOA, STOA, IEX, URS, RRAS, SCED and RTM for each of the blocks for each of the revision

    a. Date

    b. Revision No, by default latest revision number to be shown for the selected date.

    c. Utility Selection

Based on the login the filters will be applied as below

i. Beneficiary login: Specific Beneficiary will be listed in the Utility Selection

ii. Generator: Specific Generator will be listed in the Utility Selection

iii. RLDC: All the generators and Beneficiaries of respective region will be listed.

iv. NLDC: All the generators and Beneficiaries of respective all regions will be listed

Implemented Schedule: The implemented schedule is the post facto schedule correction after the day of operation (delivery) is over. The following features shall be provided for schedule correction in post facto

a) The postfacto schedule correction of any beneficiary or Generator shall be corrected by the concern RLDCs only.

b) There shall be an edit page for manually correcting the schedule data for seller and buyer. The schedule data entered shall be saved directly in the database with increase schedule revision nos.

c) The postfacto manual schedule creation shall have an option to skip the Ramp violation, Tech Min violation or any other violation / validation provided during schedule creation.

d) The postfacto manually schedule created shall be published at a defined time of the day as per the config page. All the manually created schedule revision by any of the RLDCs, before the published time, will be included in a single revision at the time of schedule publishing.

e) The Schedule in post-facto, for any date, will be auto published with increased revision number, at define time in config page, if any of the RLDCs have manually created the schedule revision.

22 Ancillary Services

A. Data

Generator-wise RRAS quantum would be passed to WBES from the relevant software through an API and it would be automatically incorporated in the injection schedule and VAE schedule with appropriate losses. As a fallback option in case of failure of communication/software issues, there shall be the option to upload RRAS data through a csv/xls/xml file. The RRAS request shall be limited to the URS available at that point of time. The following provisions shall be available.

a. There shall be following input methods limiting the RRAS request to available URS and for post-facto corrections

   i.   Fetch for transferring the data from Ancillary table to Main scheduling process

   ii.   There shall be a file upload with similar validation as agreed during development.

   iii. There shall be an input web page for manual editing in case of requirement

b. The up and down instruction shall be displayed separately

c. There shall be a remarks column, mandatory before saving in case of manual upload/edit.

B. RRAS finance calculation and Report

a. **RRAS Providers details:** There shall be an option to view and download all the details of RRAS providers with following filters like Region, Bid area, Variable cost From date To date. Report shall be contain Date wise, Block wise, ISGS name, Region, Bid area Installed capacity, Variable cost, Fixed cost, Ramp up, Ramp down, Technical minimum, Emil id.

b. **Total /Available URS:** There shall be an option to view and download Total and Available URS with following filters like date, Region, Bid area, Report shall be contain information like Date, Block wise, ISGS name, Region, Bid area, Total and Available URS.

c. **Actual applied:** The software shall display the block wise date wise plant wise/region wise/All India regulation up, regulation down and Net details and block wise cost of despatch with break of fixed, variable, mark up cost.

d. **Applied vs Scheduled:** The software shall display the details of applied and schedule RRAS details. It shall show the marginal cost for the RRAS despatch.

e. **Reserves monitoring:** Software shall have the facility to monitor the reserves for current day or any selected day through charts/graphs

f. **Cost of RRAS despatch**: Software shall calculate the net out flow in flow in DSM pool for RRAS applied. The details shall be Plant, region and all India basis. The calculation shall be in line with Ancillary Services regulation and its subsequent amendment and Ancillary Services detailed procedure.

g. **Merit Order Report:** The Report for Summary of all stations with details of Fixed Charges per unit, Energy Charges per Unit, Ramp Up, Ramp down, Technical Minimum for a selected date.

    i. User shall be able to filter by seller or beneficiary wise.

    ii. If Seller/ ISGS Option 1 are selected then the programme shall list all ISGS pertaining to our Region and other Region ISGS where our beneficiaries are having share.

    iii. If Buyer / Beneficiary Option 2 is selected then the programme Shall Show a Drop down list consisting of all buyers/ Beneficiaries of our region and user can select

the buyer / beneficiary. The list of all ISGS where the selected beneficiary are having share shall be listed.

23 SCED

a. **SCED – WBES communication Summary**: A report to view the communication status summary showing the details of version and time of data fetching

b. **Daywise SCED details:** A report to view Day wise, Seller wise, Revision wise with the details of Increment due to SCED (MWhr),   Decrement due to SCED (MWhr),   Variable Cost of Generator (Paise/Unit), Charges to be paid to SCED Generator (Rs) (A)   Charges   to   be refunded by SCED Generator (Rs) (B)   Net Charges Payable (+) / Receivable (-) (C) = (A)-(B)

c. **Blockwise SCED details:** A report to view Day wise, Seller wise, Revision wise with the Block wise details of Increment due to SCED (MWhr),   Decrement due to SCED (MWhr),   Variable Cost of Generator (Paise/Unit), Charges to be paid to SCED Generator (Rs) (A)   Charges to be refunded by SCED Generator (Rs) (B)Net Charges Payable (+) / Receivable (-) (C) = (A)-(B)

d. There shall be report to download the scheduled energy from the SCED generator to SCED beneficiary with option 'From Date' and 'To Date' along with the STOA (Bilateral/Collective) details if any

e. The Gas Plant, SCED will have separate for each Fuel Type. Further there will be separate treatment for Open Cycle and Closed Cycle for each fuel type.

f. The following minimum trends shall be available for which exact details shall be discussed at the time of implementation. Apart from the below another set of 20 trends would be discussed and finalized

   o Shift Report

   o Cumulative Reserves

   o Interregional

   o Schedule without SCED and optimised schedule

   o Highest Cost Generators

   o DC off bar Requisition

   o Spinning Reserve

   o Variable cost of generation before and after SCED

- o Spatial distribution of variable cost of generators on All India Map

- o Up-reserve: On bar installed capacity – Schedule

- o Down-reserve: Schedule – Technical Minimum

- o Cold reserve: DC – DC on bar

- o Hot spinning reserve: DC on bar – Schedule

24 Un Requisitioned Surplus (URS) Power Sale & PSM Power sale in Market

1. **Consent of the beneficiary for sale from a particular generator from the beneficiary**

a. User shall be able to enter URS by respective login only for Current day, Day-Ahead and Post facto depending upon the roles.

b. There shall be an input page for the user to submit consent for sale of UnRegulated URS. The web page shall have two columns viz On Bar Entitlement (read only) along with one more column for submitting / viewing consent for each of the seller buyer combination

   ➢ Date

   ➢ Region which includes 'All' option also

   ➢ Seller which includes 'All' option also

   ➢ Beneficiary which includes 'All' option also

   Based on the login the filters will be applied as below

   i. Beneficiary login: All sellers sorted by merit order where the beneficiary is having share will be filtered with input column editable

   ii. Generator: All Beneficiaries for whom the share is allocated from that generator will be filtered with input column Read only.

   iii. RLDC: All the generators of respective region sorted by merit order will be filtered with input column editable

c. All the above filters except date filter shall have "All" Option as well as facility for selecting Multiple options

d. The maximum input consent in MW block wise provided by the user shall be restricted to the on-bar entitlement.

e. There shall be a file upload option for uploading the consent in MW. All the validations check explained above shall also be checked while uploading the file.

f. The Consent Report shall be available and downloadable in pdf, xlsx, csv etc with the following filters and provision for seeing the data in charts. The web page shall have two read-only columns viz On Bar Entitlement & consent for each of the seller-buyer combination. This information shall be available for all the blocks.

   ➢ Date

   ➢ Region which includes 'All' option also

   ➢ Seller which includes 'All' option also

   ➢ Beneficiary which includes 'All' option also

Based on the login the filters will be applied as below

   i. Beneficiary login: All sellers sorted by merit order where the beneficiary is having share will be filtered

   ii. Generator: All Beneficiary for whom the share is allocated from that generator will be filtered

   iii. RLDC: All the generators of respective region sorted by merit order will be filtered.

g. Based on login of ISGS all beneficiaries having share from the ISGS shall be listed with total quantum actual bid for all the blocks-based selection of above filters.

h. ISGS/User shall able to enter/upload quantum of power sold at various peripheries viz Ex bus, regional periphery by state wise based of selection of market viz PX, IEX and STOA.

i. There shall be a check for total quantum entered by ISGS should be equal to quantum sold under markets at various peripheries.

j. There shall be a check and notification with the revision of regional loss, different market products curtailment to revise the Quantum of power sold.

2. <u>Beneficiary wise split up of actual power sold from the generator.</u>

On receipt of the consent, the ISGS may sell the power in the market viz STOA(Bilateral) or Power exchange Day ahead and RTM. The Total URS power sold by ISGS through STOA is available with RLDC. However, the URS Power sold by ISGS through Power exchange is intimated by NLDC

through NOAR. Although the seller wise information of total seller wise URS power sold through market is available with RLDC, the details of further split among the beneficiaries is not available with RLDC. To facilitate the same to be provided by ISGS, the following features are envisaged.

a. User (ISGS or RLDCs) shall be able to enter actual URS sold by respective login only for Current day, Day-Ahead and Post facto depending upon the roles.

b. ISGS / RLDCs shall be able to enter/upload URS power viz regulated, PSM and un-regulated URS power sold in different markets PX day ahead and STOA Bilateral. There shall be a provision to enter quantum of power sold in different markets at different boundaries a like Ex-bus and Regional periphery.

c. There shall be an input page with the following filters. All the above filters except date filter shall have "All" Option as well as facility for selecting Multiple options

> ➢ Date

> ➢ Revision No

> ➢ Region which includes 'All' option also

> ➢ Seller which includes 'All' option also

> ➢ Beneficiary which includes 'All' option also

> ➢ Type of Market: User shall select a single type of market viz PX, IEX, STOA

> ➢ Type of PX day ahead and RTM: User shall select a single type of market viz PXI, IEX, wise Day Ahead (DAM) and RTM Type of URS: User shall able to select URS type Regulated, PSM and Un-regulated URS

> ➢ Boundary: Exbus or Regional

d. The web page shall have shall have the following columns for input by ISGS/RLDC

    i. Total Power Sold: Depending on the selection in the type of market, the following is expected

- Power Exchange IEX Day ahead and RTM: Seller wise Power sold through IEX will be shown

- Power Exchange PXI Day ahead and RTM: Seller wise Power sold through PXI will be shown

- STOA (Bilateral): All the STOAs (Bilateral) for the said date and Seller shall get listed. User shall have the option to group STOA transaction or provide

information on individual STOAs wise. Accordingly, the summation of total STOA or individual STOA sold by a particular plant will be shown.

    ii. Difference Column: Difference between Sl No 'i' and sum of all beneficiary wise split of Power sold through Power Exchange & STOA-Bilateral.

    iii. Multiple input columns: One Input Column for each of the Beneficiary for entering the actual share of power sold through the respective type of market selected.

e. There shall be a check for total quantum entered by ISGS should be equal to quantum sold under markets at various peripheries

f. There shall be a check for change of regional loss, Px values, addition of new STOAs sale subsequent to entry of the URS power sold in the market. In such case, notification shall be issued in the process management for getting the revised split.

g. The Power Sold Distribution Report shall be available and downloadable in pdf, xlsx, csv etc with the filters similar to input page and provision for seeing the data in charts but with view rights only. The values will be shown based on the filters selected. The values shown will be at Exbus or regional value based on the selection of the filter.

    i. Beneficiary login: All sellers sorted by merit order where the beneficiary have share will be filtered

    ii. Generator: All Beneficiary for whom the share is allocated from that generator will be filtered

    iii. RLDC: All the generators of respective region sorted by merit order will be filtered.

25 Available Transfer Capacity ATC

1. ATC module shall have feature to store the TTC, RM, and ATC in a block-wise fashion for each of the corridors and paths along with various revisions of ATC.

2. The latest updated revision for a particular day shall be used for computation of margin.

3. The user shall have feature to store block wise details with option of from date and to date.

4. In case ATC has not been uploaded/updated for a particular day, then the software shall give visual alarm one day in advance for entering the ATC data.

5. If ATC is not available for a specific date, then the latest available data shall be used for further calculation.

6. The software shall have the provision to import/export block-wise ATC, RM and TTC data for all corridors / Path / Flow Area in CSV file format. The software shall also provide user interface for editing the ATC manually.

7. All revisions of ATC shall be stored with a unique revision number and the latest revision shall be used for calculations.

8. The software shall also have the ability to interface with an external TTC/ATC management software/database at NLDC to obtain the latest ATC data.

9. ATC Margin computation as per requirement: This web page shall facilitate the user to compute ATC margin as per the requirement based on various user filter selection. The web page shall have the following filters

   i.   Date

   ii.   Revision no

   iii. Link/Path/flow area/flow gate

   iv.   Link/Path/flow area/flow gate details: Based on the selection at sl no (iii), List of Link/Path/flow area/flow gate shall be displayed.

   v.   Counter flow Percentage: Text box for entering the percentage (ISGS/LTA/MTOA/STPA/Wind/Solar) of counter flow to be considered while computing ATC margin.

   vi.   Open Access Requisition/Contract Quantum/Schedule: This option button confirms whether to consider LTA/MTOA requisition or contract quantum or schedule while computing ATC margin

   vii. IslossTobeConsidered : This option button confirms whether to consider Ex-bus values or values at the specified link/flow gate boundary after applying loss while computing ATC margin

   viii. IsPxTobeConsidered : This option button confirms whether PX trades are to be considered or not while computing ATC margin. This feature is helpful for both real time as well as day ahead margin release of ATC to PX

On selection of date along with the above filters, the programme shall compute the ATC margins and display the following each block wise with following fields viz ATC forward, ATC Reverse, ISGS Forward, ISGS Reverse, LTA Forward, LTA Reverse, MTOA Forward, MTOA Reverse, STOA

On selection of date along with the above filters, the programme shall compute the ATC margins and display the following each block wise with following fields viz ATC forward, ATC Reverse, ISGS Forward, ISGS Reverse, LTA Forward, LTA Reverse, MTOA Forward, MTOA Reverse, STOA Forward, STOA Reverse, PX Forward, PX Reverse, ATC Margin Forward, ATC Margin Reverse.

10. The software/WBES shall able to provide ATC margin details to NOAR through web API for processing the STOA transactions. Further it shall have the option to download the ATC margin details in desired format acceptable to NOAR system for processing the transaction in case of any issues in WEB API data transfer. The format shall be finalize at the time of development.

11. Normally, the schedules approved in Power Exchanges shall get incorporated in scheduling software through API. User shall also have the provision to upload the Power Exchange file (file formats like csv,.xls,.xlsx etc) manually.

    a. Every link/Path/flow area/flow gate registered in WBES is assigned a unique acronym. While uploading the file/importing data over API, the software shall check the available code in the file with the database for link/Path/flow area/flow gate matching and accept the data only if it exists. An error message with clear details shall be displayed in case any link/Path/flow area/flow gate is not matching and the software shall not accept the file upload, i.e. partial information shall not be incorporated.

12. ATC Margin computation for every schedule Revision: ATC margins are automatically calculated whenever schedule is created. The scheduled values for each of the transaction at each of the respective link are considered for computing the ATC margin. The reverse percentage considered shall be as per the percentage set in the configuration module which is time varying. A Report for viewing and downloading the same is to be provided with the following filters

    i.   Date

    ii. Revision no

    iii. Link/Path/flow area/flow gate

    iv. Link/Path/flow area/flow gate details: Based on the selection of sl no (c), List of Link/Path/flow area/flow gate shall be displayed.

On selection of date along with the above filters, the programme shall display the ATC margins for each block with following fields viz ATC forward, ATC Reverse, ISGS Forward, ISGS

Reverse, LTA Forward, LTA Reverse, MTOA Forward, MTOA Reverse, STOA Forward, STOA Reverse, PX Forward, PX Reverse, ATC Margin Forward, ATC Margin Reverse.

13. At the time of schedule preparation ATC violation check shall be done and highlighted in the schedule section. This part shall be separately mentioned in the schedule preparation section.

26 Regulation of Power Supply

a. Programme shall have a feature to create Regulation of power supply from an ISGS to Beneficiaries by block wise for specified time period. Regulation shall be entered in % and or MW value in block wise. Accordingly following fields may be made available viz Buyer, Seller, From Date, From Block, To Date, To Block, Value Type ("By Percentage" or "By MW), Block wise %/MW Regulation. For hydro ISGS, there shall be provision to create regulation on day energy entitlement of the beneficiaries.

b. Free Power allocated to regulated beneficiaries from hydro ISGS shall not be regulated. Free power percentage will be available in utility definition of configuration module.

c. Provision for uploading of documents like regulation notice by ISGS/Transmission entities, request letter to RLDCs, indemnification bond, regulation implementation plan by RLDCs, etc shall be available while creating a regulation.

d. The reduced entitlement shall be calculated as percentage of original entitlement of the beneficiary from the ISGS specified in (a) above if the regulation is entered in percentage. If it is entered in value (MW), then the reduced entitlement shall be equal to entered MW quantum.

e. Provision for application of multiple regulations on the same beneficiary from same generator by various regulating entities shall be available. The regulation applied on a beneficiary shall be sum of the individual regulations applied on the same beneficiary subject to the maximum of 100% of entitlement of the beneficiary.

f. Regulated Entitlement of the regulated beneficiary from the regulating ISGS shown in "Entitlement module" shall be equal to original entitlement minus the reduced entitlement mentioned in d above. Further original entitlement and reduced entitlement shall be shown as separate page in Entitlement module for viewing the block wise reduced entitlement of any Beneficiary from any ISGS.

g. A notification shall be triggered in the process management with "Regulated" tag for intimation to the user for making fresh entitlements.

h. The regulated power can be sold in the market and as real time URS to other beneficiaries through the URS module.

i. The regulated URS shall be shown separately in the URS module.

j. In case of selling regulated power through STOA/PX, the regulated power shall be separately shown in STOA/ PX module with properly tagged as regulated power.

k. Regulated entity shall not be allowed to take URS from the same regulating ISGS during regulation period. Provision for blocking/unblocking URS application for the regulated entity from the regulating ISGS shall be made configurable by the administrator.

l. The Schedule of Regulated entity shall not exceed the regulated entitlement mentioned in (f) from the specified ISGS for the specified blocks.

m. The details of power sold in the market shall be considered while finalizing the schedules. Similarly, facility to store details of regulated power sold in STOA shall be available in STOA sold module. The provision for uploading the split of power sold w.r.t regulated power, shall be, as explained in URS power sale and PSM power sale in market.

n. Regulated entitlement of a regulated beneficiary shall be considered in place of original entitlement for all adjustments of ramp and technical minimum during preparation of schedule. During such adjustments it must be taken care that the schedule of the regulated beneficiaries does not exceed their modified entitlement. This shall be taken care in the logic of Technical minimum and ramp adjustment.

o. The finer details apart from the above point's w.r.t impact of regulation on entitlement, URS and schedule are explained in the respective modules.

p. Similarly, the provision for putting regulation on Regional entities shall be there so that respective LTA, MTOA will be restricted.

q. There shall be a provision for blocking/unblocking of regulated beneficiary wise STOA schedule in case of power supply regulation as buyer/seller with a range of dates. This shall be configurable as per changes in CERC regulations.

r. The module shall have provision to withdraw any applied regulation from a specified date and time block. This shall remove the restrictions put in place while creating the specific regulation. Prior to removing the regulation, a warning message shall show all the restrictions that shall be removed on withdrawal of the regulation.

s. A Complete summary report of regulation with details of regulation viz. effective period, constituent/constituents on which regulation has been affected, ISGSs from which affected,

quantum of power reduced block wise, quantum diverted through URS and Power sold through market. The report shall be downloadable in xls, csv and pdf.

27 Payment Security Mechanism

j. A mapping table of Buyers/Sellers for all ISGS, LTA, MTOA and intrastate LTA/MTOA shall be created. Provision to input availability of PSM in the form of "Yes"/ "No" against each transaction of the Buyer and Seller shall be Mandatory and assigned to both buyer and seller with log in credentials to update PSM status on day ahead basis. Similar options shall be available against LTA/MTOA inter and intra state transactions. There also shall be a non-mandatory field against each beneficiary/LTA/MTOA for entering remarks. The "Yes"/ "No" entry against each beneficiary for each time block or day shall be mandatory. By default, "Yes" shall be selected. The page will have a save button to save the data entered with revision number. Also, the Programme shall have a feature to upload PSM information in agreed format.

k. Configuration module shall have option to give rights for entry of the "Yes"/ "No" option mentioned in (a) above by buyer/seller/both.

l. The "Yes"/ "No" option entry can be made for a time block range and a date range to be entered by the entity providing the option.

m. Timeline for declaration of the PSM status by the Generator/Buyer shall be fixed by the administrator. It shall be made configurable

n. Entry can be modified by the same utility that has entered it till a particular end time of the day for the next day. This end time shall be configurable in configuration page.

o. A notification shall be triggered in the process management with "PSM" tag for intimation to the user for making fresh entitlements.

p. Regulation of 100% will be applied on beneficiaries from those ISGS which have mentioned "No" as the PSM availability status in (a) above. by default. Generator shall have the option to change regulated percentage value for each block before publish

q. The PSM module will act as an input to the regulation module and in general all features of the regulation of power supply module will be applied in this case also but if any of the features of the regulation module is not to be applied the same may be bypassed through configuration module.

r. There shall be a provision for blocking/unblocking of regulated beneficiary wise STOA schedule in case of selection of "No" option for the beneficiary as buyer/seller with a range of dates. This shall be configurable as per changes in CERC regulations.

s. There shall be a provision to administrator to update PSM status of any beneficiary overriding the status declared by the generator/buyer.

t. PSM (Payment Security Mechanism) module shall interact with REMC scheduling module also for REMC LTA transactions through Web API.

u. A Complete summary report of PSM with details of PSM viz. effective period, constituent/constituents on which regulation has been affected, ISGSs from which affected, quantum of power reduced block wise, quantum diverted through URS and Power sold through market. The report shall be downloadable in xls, csv and pdf.

v. An email shall be automatically generated and sent to specific email ids with list of beneficiaries being regulated from all ISGSs due to unavailability of PSM along with some of other details mentioned in (h) above after the PSM module closes at a specific time as per the defined configuration.

w. Similarly, the PSM provision for Regional entities, for restricting LTA, MTOA transactions. If an LTA/MTOA transaction has several beneficiaries, PSM module shall have a provision for entry of beneficiary wise list for such LTA transactions. The percentage or MW wise share of each beneficiary for an LTA shall be also entered in the same. These may be revised as and when any changes occur with a new revision number and date/time stamping.

x. The "Yes"/ "No" option shall be available as described in (a) above against each of the beneficiaries mentioned for LTA having multiple beneficiaries. The list of such beneficiaries will be made taking input from the page mentioned in (l) above.

y. The user shall have the provision to roll back/revise the applied regulation through appropriate revised entitlements and schedule revision.

z. There shall be a provision for blocking of STOA schedule in case of PSM as buyer/seller with a range of dates.

aa. A Complete summary report of PSM with details of PSM viz. effective period, constituent/constituents on which regulation has been affected, ISGSs from which affected, quantum of power reduced block wise, quantum diverted through URS and Power sold through market. The report shall be downloadable in xls, csv and pdf
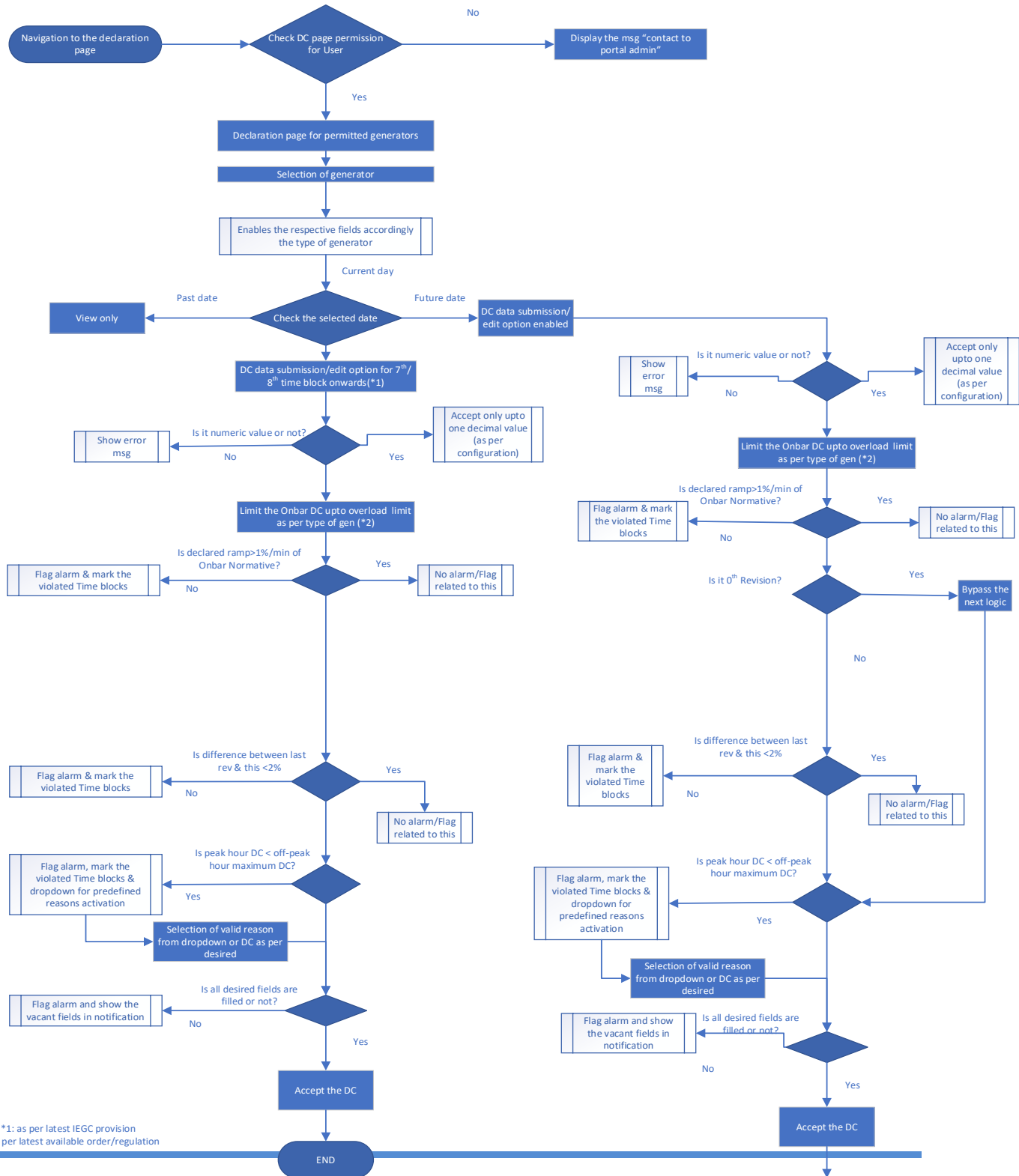
28 Flow Chart

28.1. Declaration Capacity

Navigation to the declaration page

Check DC page permission for User — No → Display the msg "contact to portal admin"

Yes

Declaration page for permitted generators

Selection of generator

Enables the respective fields accordingly the type of generator

Current day

Check the selected date
- Past date → View only
- Future date → DC data submission/edit option enabled

DC data submission/edit option for 7th/8th time block onwards(*1)

Is it numeric value or not? — No → Show error msg / Yes → Accept only upto one decimal value (as per configuration)

Show error msg — No ← Is it numeric value or not? → Yes → Accept only upto one decimal value (as per configuration)

Limit the Onbar DC upto overload limit as per type of gen (*2)

Limit the Onbar DC upto overload limit as per type of gen (*2)

Is declared ramp>1%/min of Onbar Normative? — No → Flag alarm & mark the violated Time blocks / Yes → No alarm/Flag related to this

Flag alarm & mark the violated Time blocks — No ← Is declared ramp>1%/min of Onbar Normative? → Yes → No alarm/Flag related to this

Is it 0th Revision? — Yes → Bypass the next logic / No

Is difference between last rev & this <2% — No → Flag alarm & mark the violated Time blocks / Yes → No alarm/Flag related to this

Flag alarm & mark the violated Time blocks — No ← Is difference between last rev & this <2% → Yes → No alarm/Flag related to this

Is peak hour DC < off-peak hour maximum DC? — Yes → Flag alarm, mark the violated Time blocks & dropdown for predefined reasons activation → Selection of valid reason from dropdown or DC as per desired

Flag alarm, mark the violated Time blocks & dropdown for predefined reasons activation ← Is peak hour DC < off-peak hour maximum DC? → Yes → Selection of valid reason from dropdown or DC as per desired

Is all desired fields are filled or not? — No → Flag alarm and show the vacant fields in notification / Yes

Flag alarm and show the vacant fields in notification ← Is all desired fields are filled or not? — No / Yes

Accept the DC

Accept the DC

*1: as per latest IEGC provision
*2 as per latest available order/regulation

END

END

28.2. Thermal Declaration Capacity

Navigation to the declaration page

Check DC page permission for User

No → Display the msg "contact to portal admin"

Yes

Declaration page for permitted generators

Selection of generator

Is it thermal/hydro/gas

Display the page of thermal DC

Current day

Check the selected date

Past date → View only

Future date → DC data submission/edit option enabled

DC data submission/edit option for 7th/8th time block onwards(*1)

Is it numeric value or not?
No → Show error msg
Yes → Accept only upto one decimal value (as per configuration)

Limit the Onbar DC upto overload limit as per type of gen (*2)

Is declared ramp>1%/min of Onbar Normative?
No → Flag alarm & mark the violated Time blocks
Yes → No alarm/ Flag related to this

Is difference between last rev & this <2%
No → Flag alarm & mark the violated Time blocks
Yes → No alarm/ Flag related to this

Is peak hour DC < off-peak hour maximum DC?
No → Flag alarm, mark the violated Time blocks & dropdown for predefined reasons activation
Yes → Selection of valid reason from dropdown or DC as per desired

Is all desired fields are filled or not?
No → Flag alarm and show the vacant fields in notification
Yes

Accept the DC

END

*1: as per latest IEGC provision
*2 as per latest available order/regulation

Is it numeric value or not?
No → Show error msg
Yes → Accept only upto one decimal value (as per configuration)

Limit the Onbar DC upto overload limit as per type of gen (*2)

Is declared ramp>1%/min of Onbar Normative?
No → Flag alarm & mark the violated Time blocks
Yes → No alarm/ Flag related to this

Is it 0th Revision?
Yes → Bypass the next logic
No

Is difference between last rev & this <2%
No → Flag alarm & mark the violated Time blocks
Yes → No alarm/ Flag related to this

Is peak hour DC < off-peak hour maximum DC?
Yes → Flag alarm, mark the violated Time blocks & dropdown for predefined reasons activation → Selection of valid reason from dropdown or DC as per desired

Is all desired fields are filled or not?
No → Flag alarm and show the vacant fields in notification
Yes → Accept the DC

END

28.3. Hydro Declaration Capacity:

28.4. Gas Declaration Capacity

28.5.   Entitlement

28.6.   Thermal and Gas Requisition

28.7. Hydro Requisition

Requisition logic for requisition entry page

Start

Navigation to requisition page by User

Is it conventional or requisition based HEP method?

requisition based HEP

Conventional

No requisition option

Is User authorized for requisition submission for any Beneficiary?

Yes

No

Msg: "contact with admin"

Date selection by user

Check the Date

Past date

Current date

Future date

Only view option for Requisition page

Msg: Entitlement yet not prepared

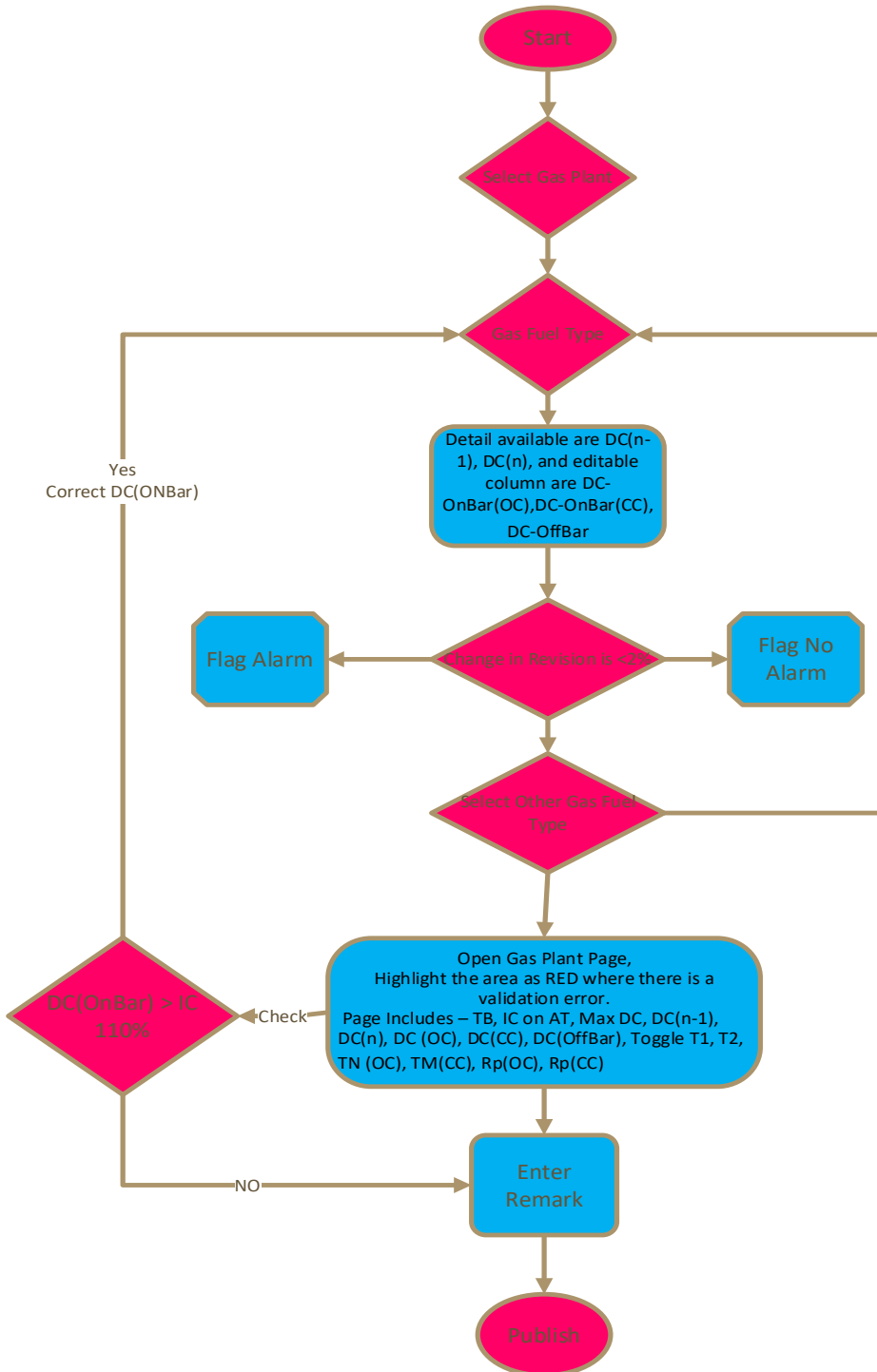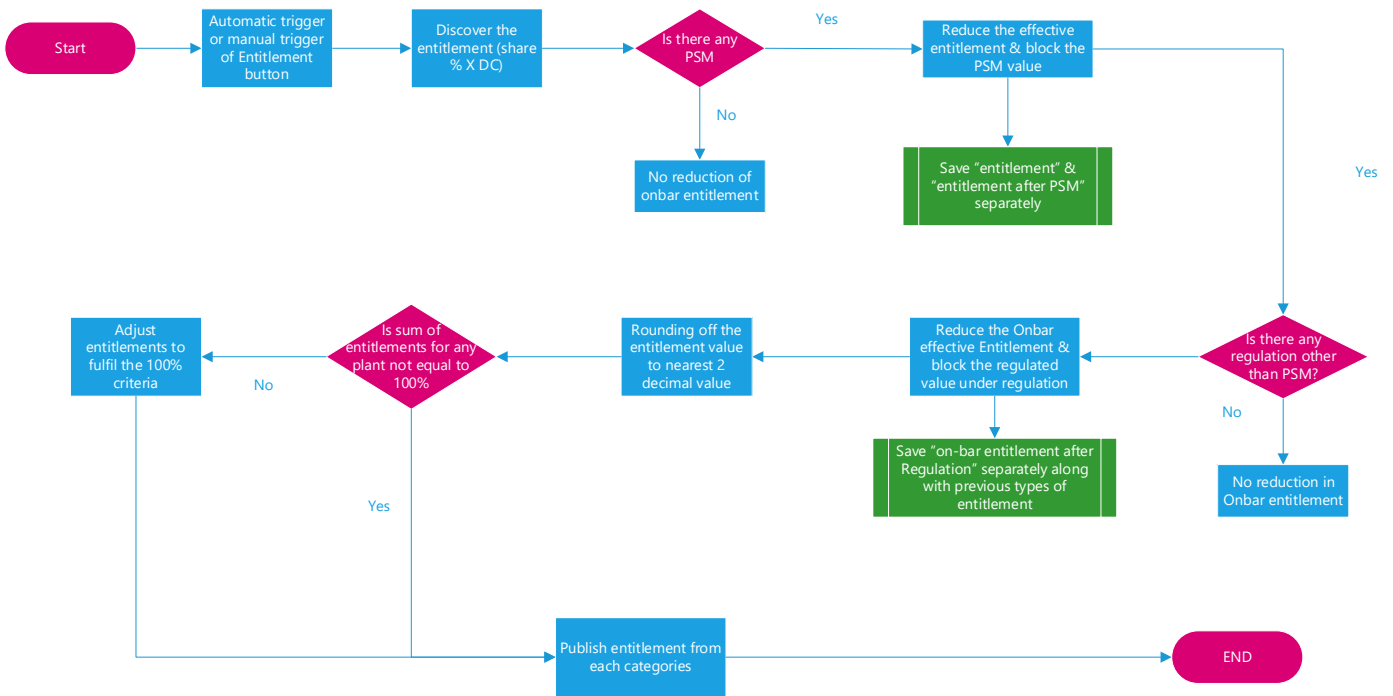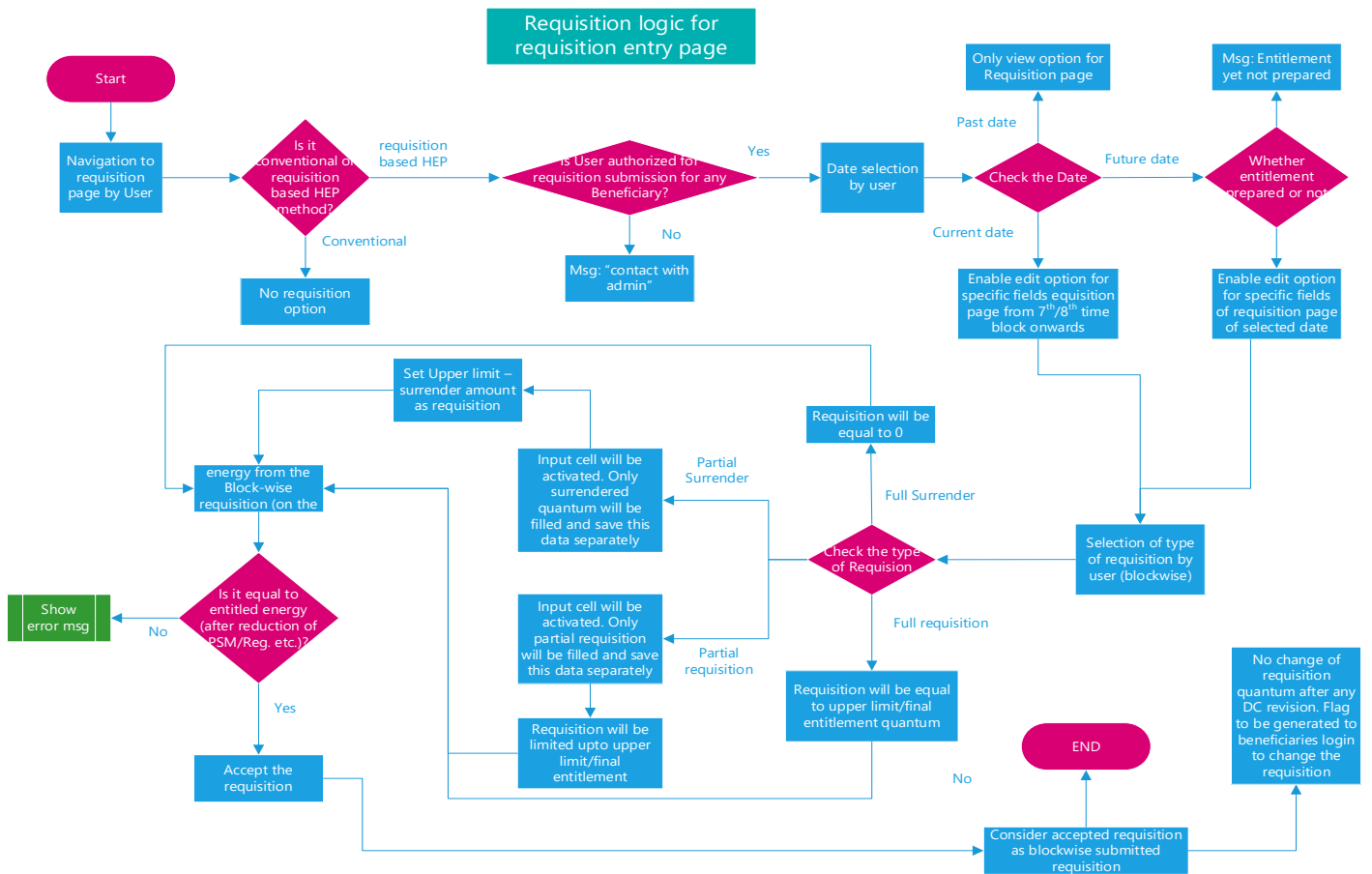Whether entitlement prepared or not

Enable edit option for specific fields equisition page from 7th/8th time block onwards

Enable edit option for specific fields of requisition page of selected date

Selection of type of requisition by user (blockwise)

Set Upper limit – surrender amount as requisition

Input cell will be activated. Only surrendered quantum will be filled and save this data separately

Partial Surrender

Requisition will be equal to 0

Full Surrender

Check the type of Requision

energy from the Block-wise requisition (on the

Input cell will be activated. Only partial requisition will be filled and save this data separately

Partial requisition

Full requisition

Is it equal to entitled energy (after reduction of PSM/Reg. etc.)?

Requisition will be limited upto upper limit/final entitlement

Requisition will be equal to upper limit/final entitlement quantum

No change of requisition quantum after any DC revision. Flag to be generated to beneficiaries login to change the requisition

Show error msg

No

Yes

Accept the requisition

END

No

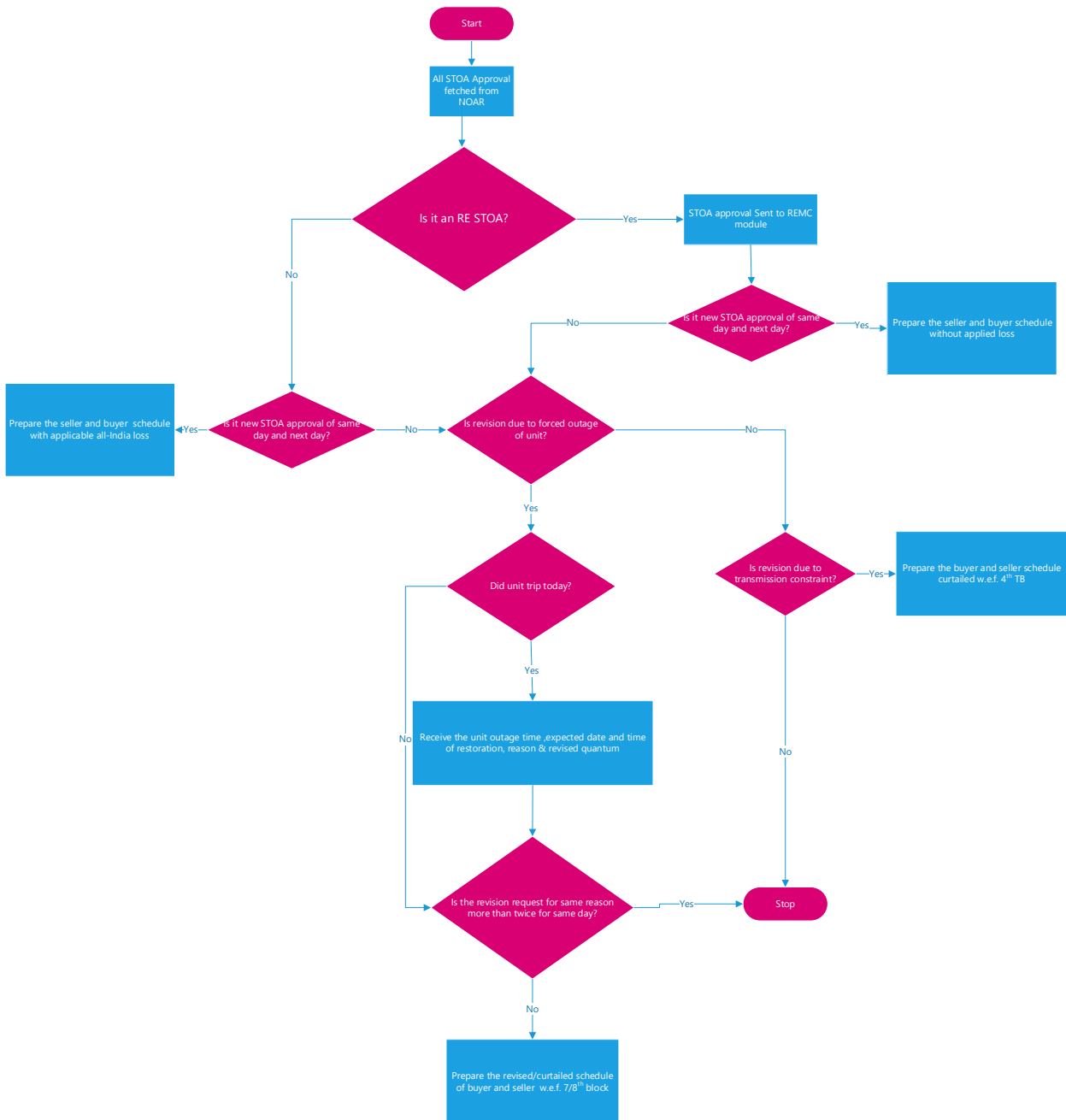Consider accepted requisition as blockwise submitted requisition

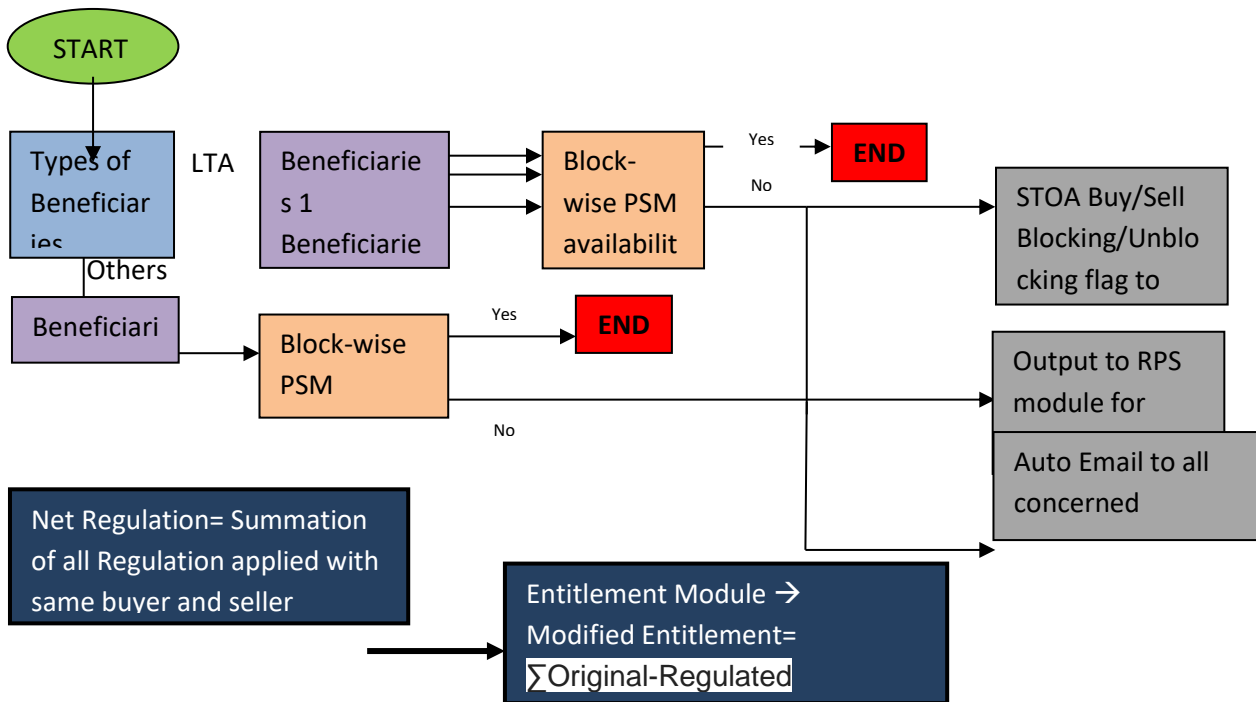(*1): Input value & accepted value are to be stored separatly
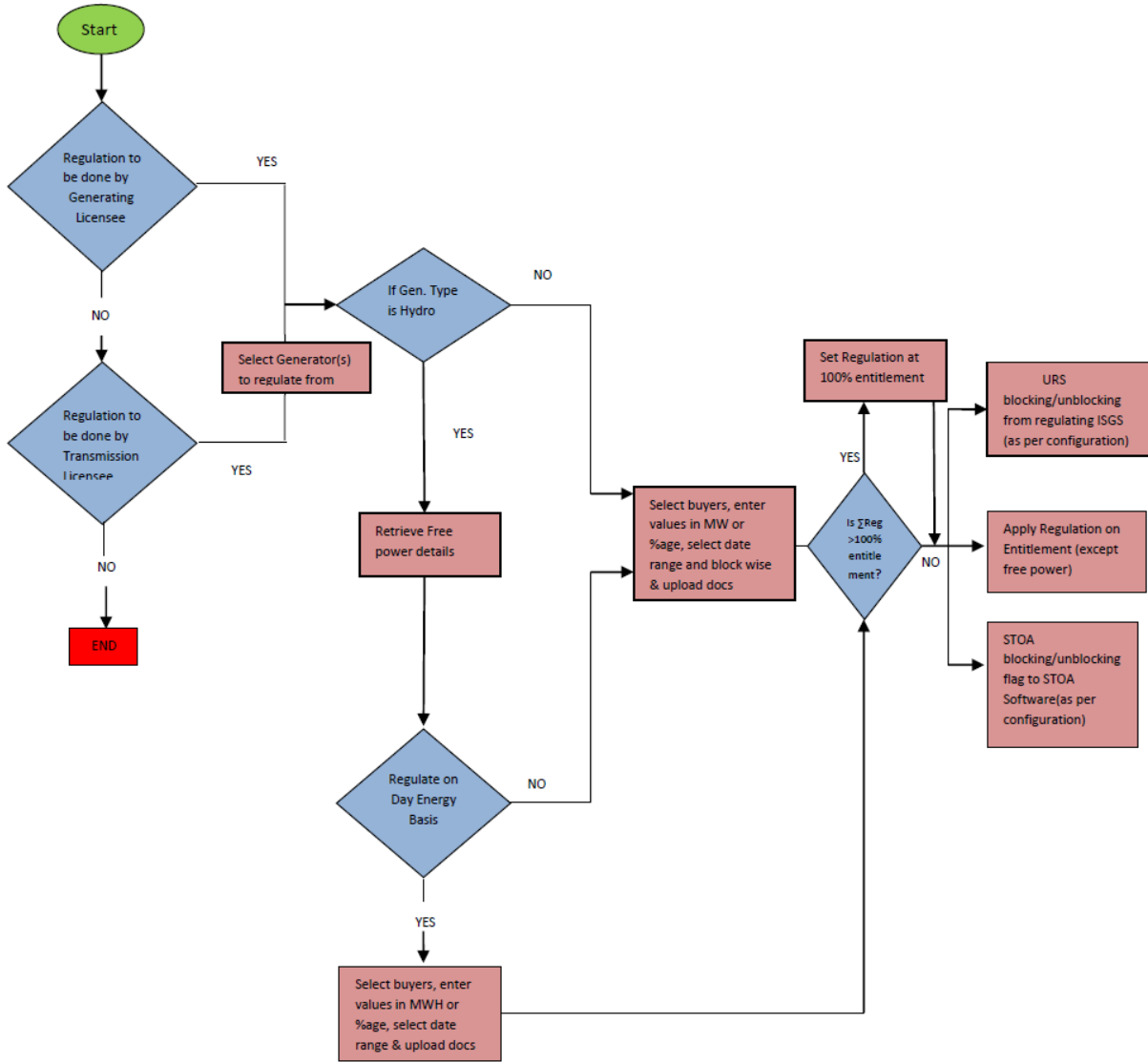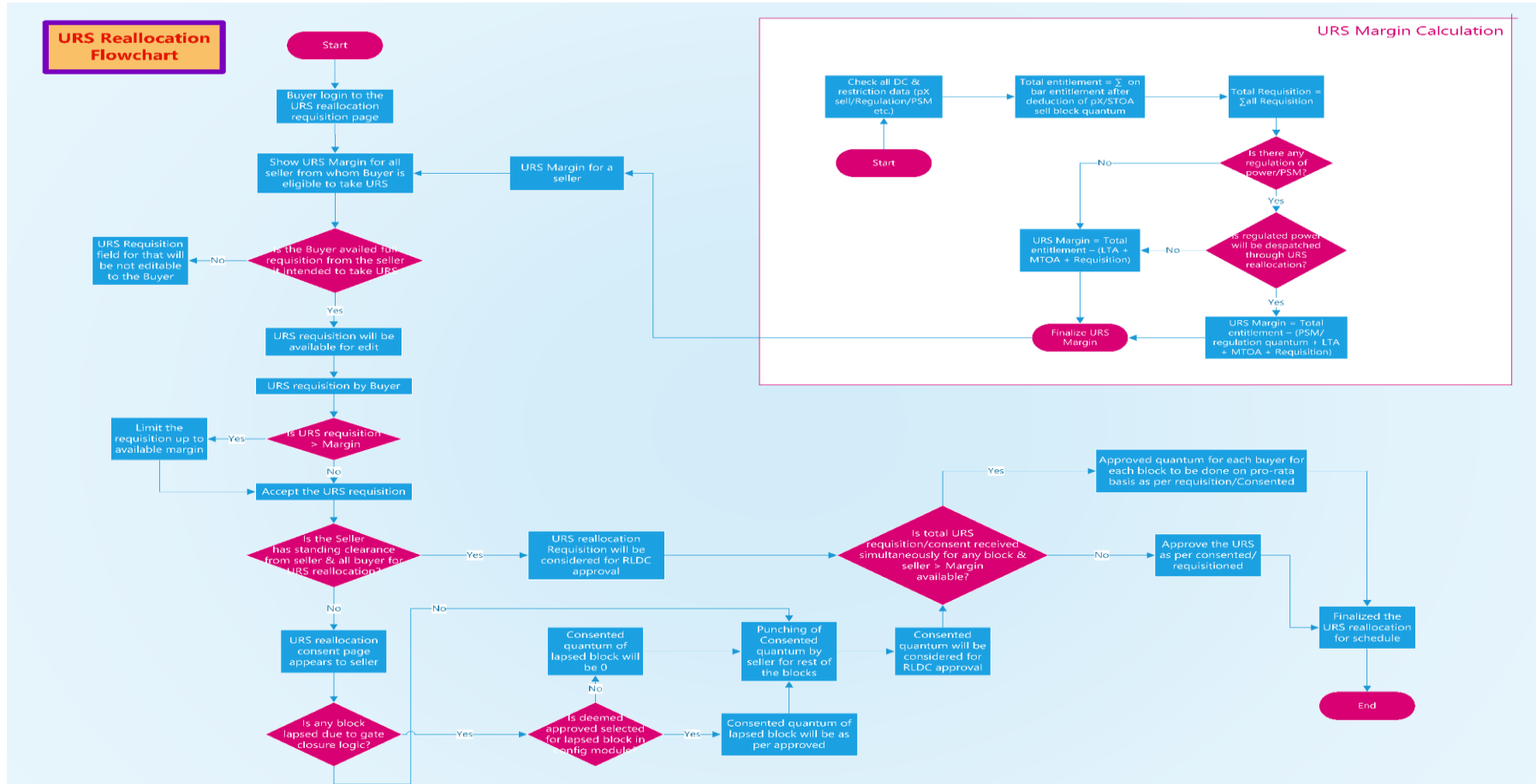
28.8. LTA and MTOA
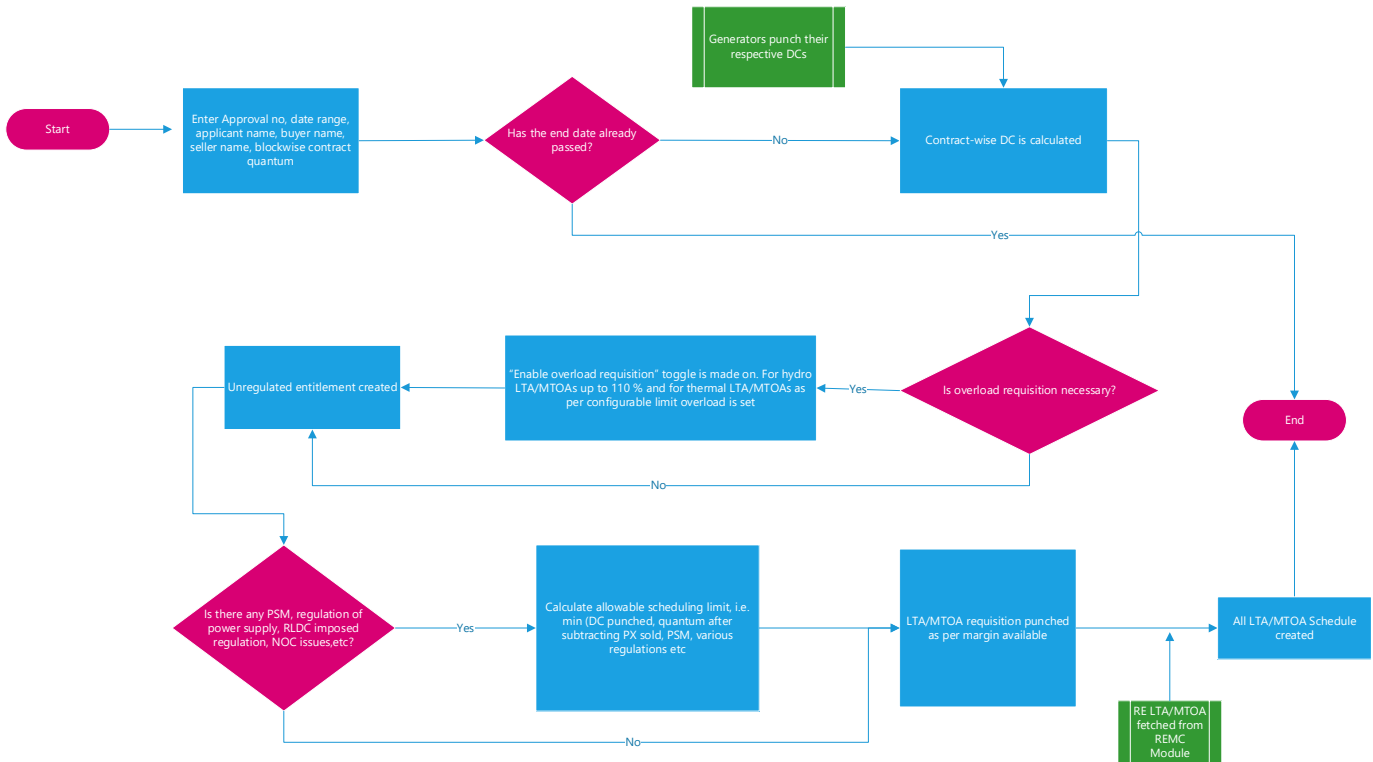
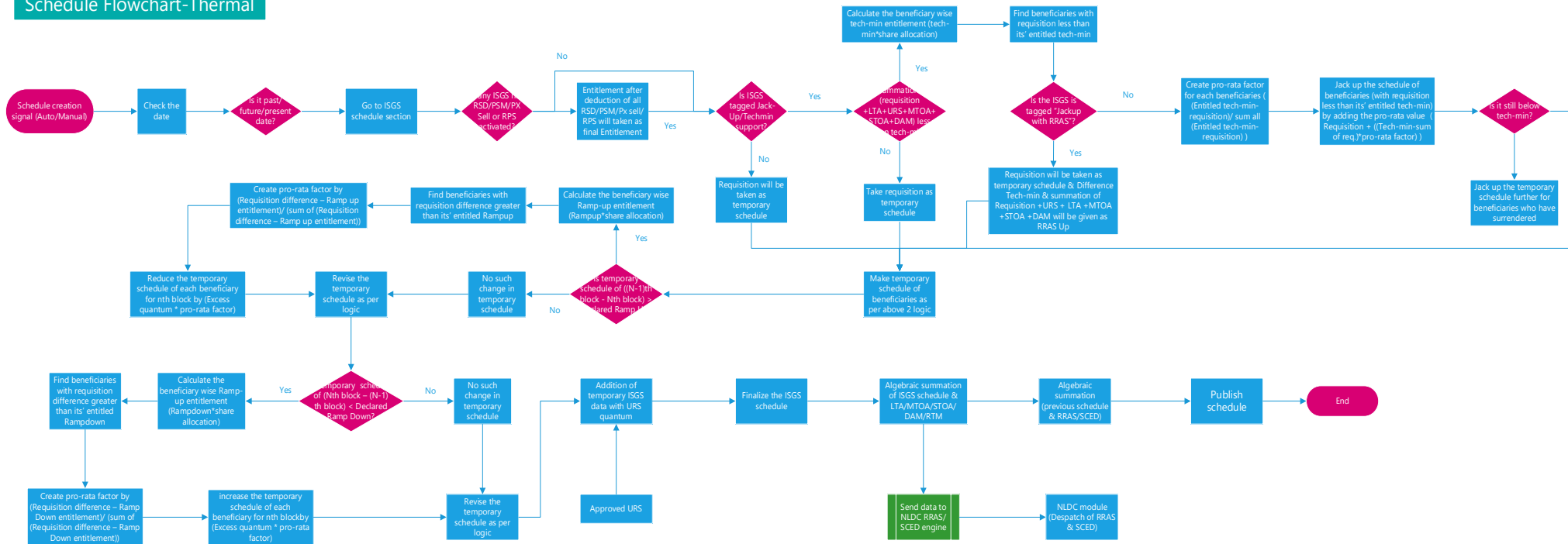## 28.9. STOA

28.10. PSM Regulation

28.11. RPS

28.12. URS

28.13. Scheduling Creation:

Schedule Flowchart-Thermal

28.14. RSD Logics

Variables/Properties

Input

- MoP Entitlement - Ministry of Power Entitlement(Which Changes often)
- Surrender Qunatum
- Requisition Quantum
- PSM Quantum

Output

- Onbar Entitlement
- Offbar Entitlement

Entitlements are for each benefeciary to each Generator

Generator Unit Status can be any one of the following:

- New RSD
- Old RSD
- New Running
- Old Running

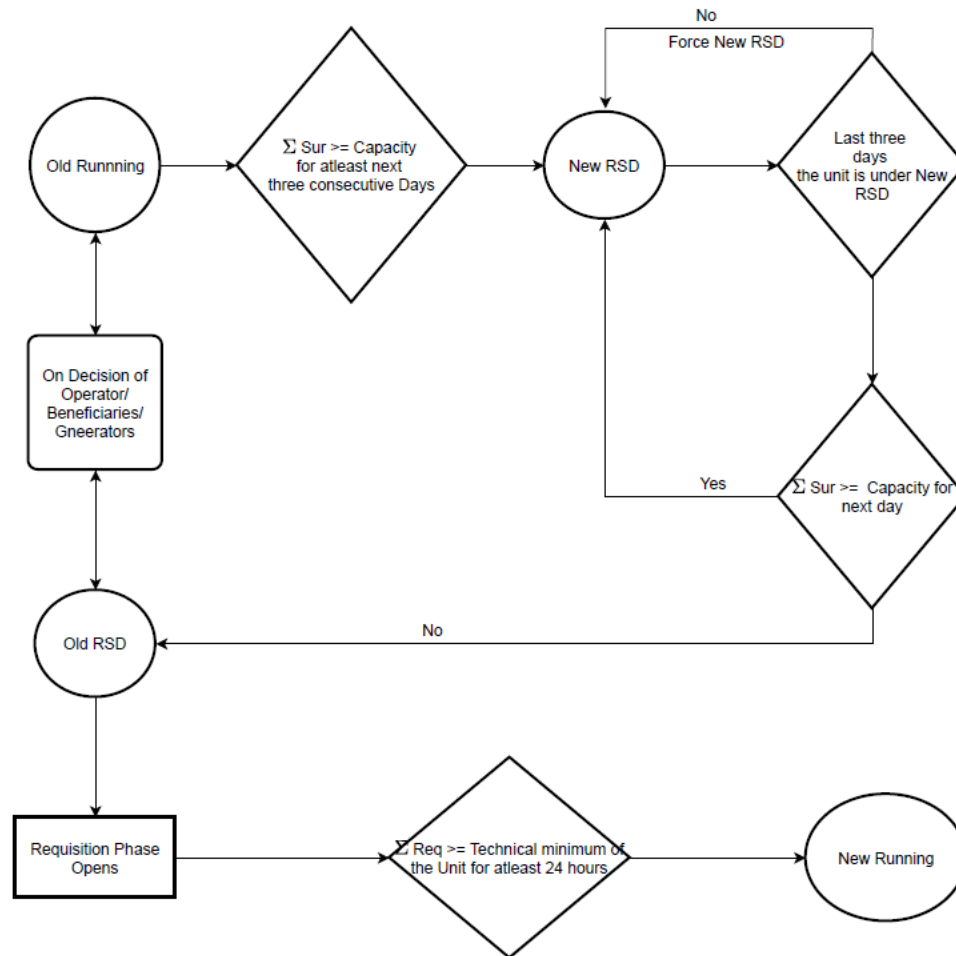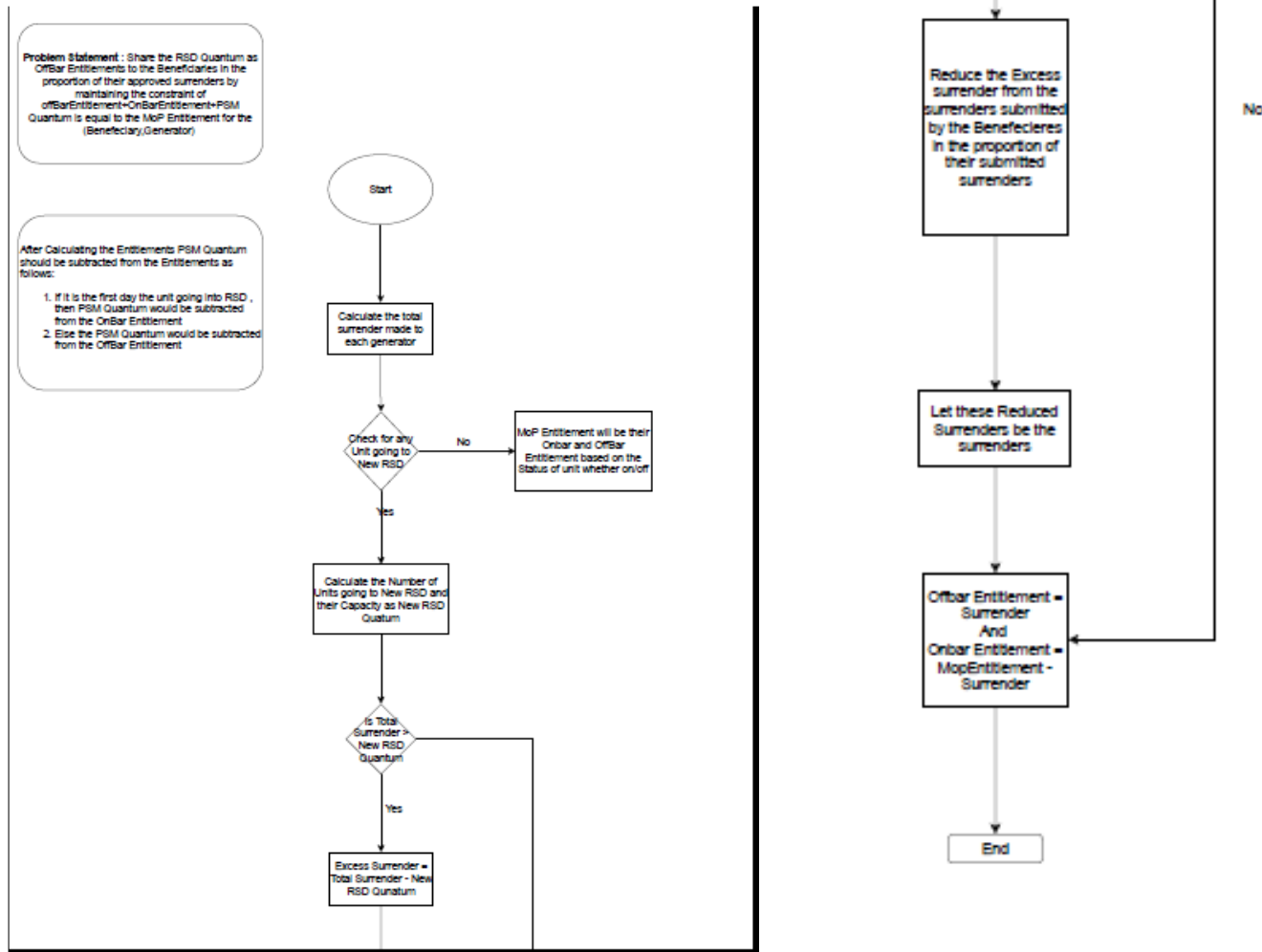| Beneficiaries	Benef
Generator	Gen
Generator Unit	GenUnit
MoP Entitlement (MW)	Ent
OnBar Entitlement (MW)	OnBar_Ent
OffBar Entitlement (MW)	OffBar_Ent
MoP Entitlement(Percent)	Ent_Per
OnBar Entitlement(Percent)	OnBar_Ent_Per
Off Bar Entitlement(Percent)	OffBar_Ent_Per
Surrender	Sur
Requisition	Req
PSM for entire Generator	PSM_Gen
PSM of each Benefeciary to each Generator(Quantum in MW)	PSM_Benef

Eligible to go into RSD

Σ Sur >= Full OnBar Capacity of one or more units of generator for atleast 3 consecutive days

- Surrender (Sur) = (Ent_Per(%) * OnBar Capacity) - PSM (psm_per * onbar_capacity)

Conditions :

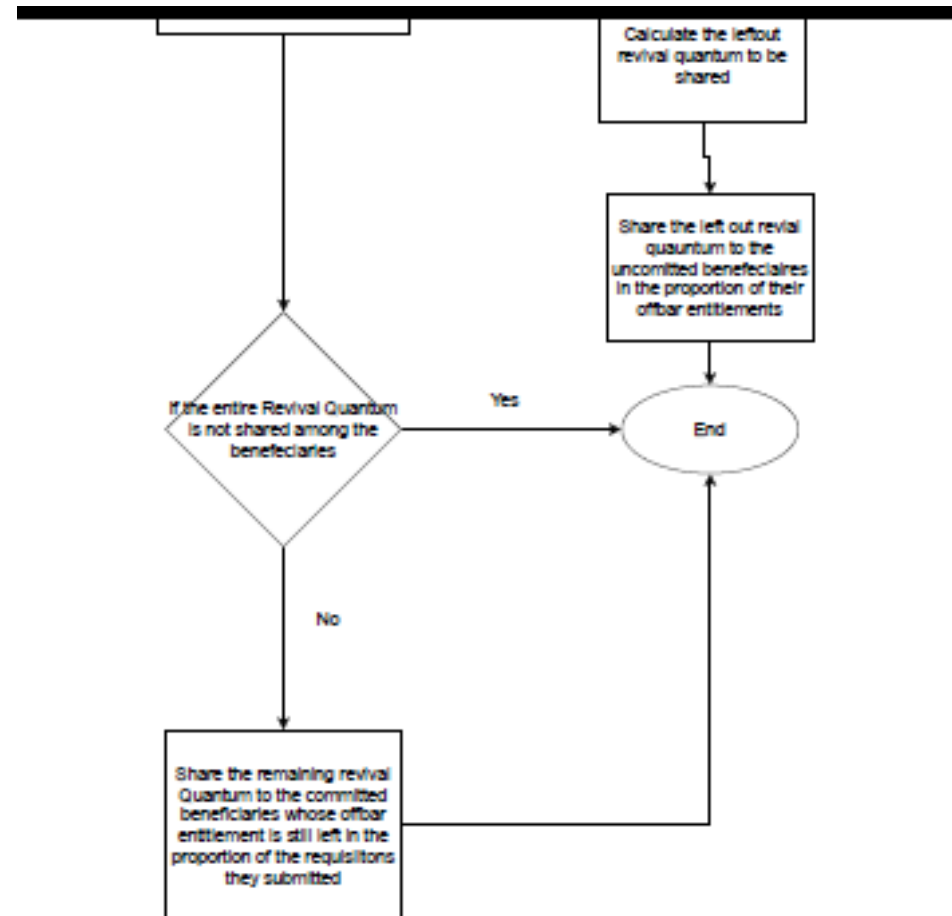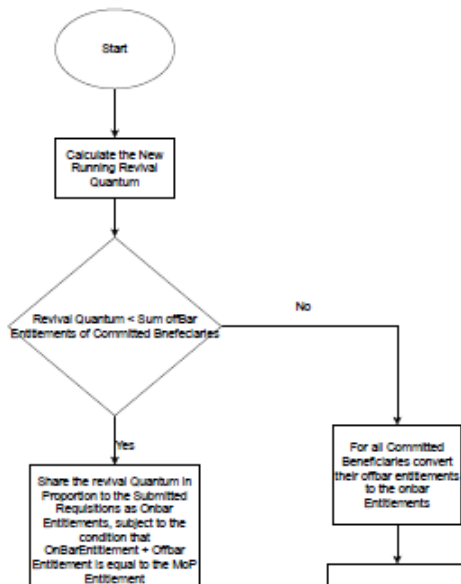1. If one unit of generator is in New RSD , then no other unit should be in the status of New Running/Old RSD

Problem Statement:
Beneficiaries give their requisitions for bringing the unit under new running subjected to condition that heir requisitions cannot exceed their OffBar Entitlements

Beneficiaries who submitted requisitions for bringing the unit OnBar are called Committed Beneficiaries

Share the New Running Quantum of the Generator to the Beneficiaries as OnBar Entitlements in proportion to the Requisitions they submitted.
As the unit will be brought Onbar if the requisitions match the technical minimum of the unit and the entitlements should be calculated to match the installed capacity of the Generator, the sum of requisitions may be less or equal to the new running revival quantum , so to match up to the new running revival quantum, following methods may be used:

1. Convert the entire offbar entitlements to onbar entitlements
2. Even if it does not match then convert the offbar entitlements of uncommitted Beneficiaries to onbar entitlements in proportion to their offbar entitlements in the generator

Start

Calculate the New Running Revival Quantum

Revival Quantum < Sum offBar Entitlements of Committed Bnefeciaries — No

Yes → Share the revival Quantum in Proportion to the Submitted Requisitions as Onbar Entitlements, subject to the condition that OnBarEntitlement + Offbar Entitlement is equal to the MoP Entitlement

For all Committed Beneficiaries convert their offbar entitlements to the onbar Entitlements

Calculate the leftout revival quantum to be shared

Share the left out revial quauntum to the uncomitted benefeciaires in the proportion of their offbar entitlements

If the entire Revival Quantum is not shared among the benefeciaries — Yes → End

No

Share the remaining revival Quantum to the committed beneficiaries whose offbar entitlement is still left in the proportion of the requisitions they submitted

VOLUME - II

TECHNICAL SPECIFICATION FOR SUPPORT SERVICES

Technical Specification for Support Services

1. Introduction

The application shall be developed in **Centralized WBES architecture**. WBES applications shall encompasses the existing functionality of all RLDCs and NLDC and integration with external applications through a Web API and ftp. The new proposed application is envisaged with advance features to include future integration. The detail functional Specification is given in Volume-I.

The application will be developed in the bidder environment, during development phase including testing, Licenses, security and creation of DevOps environment for application development, and then after successful UAT (User Acceptance Test) at bidder environment, the application shall be migrated on the production environment of the existing NLDC IT Infrastructure at Delhi. The application shall be developed on enterprise level, with support in India. The applications, workload and its services shall be flexible, robust, versatile and compatible to easily host on the existing DC- DR environment at NLDC, with both the Full and incremental backup at DC, Delhi. The DC (Data Centre) is hosted at NLDC, Delhi and DR (Disaster Recovery) is hosted on Backup NLDC infrastructure at ERLDC, Kolkata. The separate set of VM's will be allocated in HCI system, with required computing resources, logically separated, for the application and the required database at both DC and DR location. The DC and the DR will be asynchronously connected, with defined RTO and RPO.

The bidder shall be responsible for development of the application as per the given functionality. The UAT (User Acceptance Test) will be done at the developer environment and the SAT (Site Acceptance Test) shall be done at NLDC, Delhi on the DC-DR environment. The application shall be developed within nine months from the date of award of the contract. After successful SAT, the application will Go-Live after issue of / obtaining Clearance certificate from the Engineer-In-charge. The application shall be under one-year warranty and four-years maintenance, with the optional provision of two-years extension.

2. General Guideline:

1) The application shall be developed within nine months from the date of award of the contract.
2) The application shall be developed in the bidder environment, during development phase including testing, security and DevOps environment for application development, and after successful UAT (User Acceptance Test), bidder environment, the application shall be migrated on the production environment, provided by POSOCO in the existing NLDC IT Infrastructure.
3) The UAT (User Acceptance Test) shall be done in bidder environment, after successful UAT, the SAT (Site Acceptance Test) shall be conducted at NLDC IT infrastructure on DC-DR environment. After successful SAT the application will Go-Live after Clearance certificate from the Engineer-In-charge.

4) The WBES application shall be developed in Centralised Architecture, wherein it shall encompass the existing functionality of WBES in all five RLDCs and NLDC and integration with external applications through a Web API, REST, JSON, SOAP, FTP etc. The detail Functionality requirement is given in Volume-I.

5) The WBES frontend application shall have modular architecture and should be implemented in the progressive web app (PWA) using platform like React JS / Angular / similar capabilities.

6) The Operating system for the application shall be either Window or Linux. The bidder shall provide the Operating system licenses with OEM support with regular patch updates, till the duration of the contract.

7) The bidder shall provide the real time, application performance monitoring tools with visualization layer. The detail is given in section '**The Application Performance Monitoring Tool**'.

8) The bidder is required to develop application in their own environment and show case all technologies during UAT ie. IDE, Source Code Management, Build process, Continuous integration / continuous delivery (CI/CD) pipeline, bug tracking, continuous integration and deployment.

9) Bidders are expected to propose the Database as per their proposed Application architecture keeping in mind the complexity of the processes and time-bounded activities. The proposed database shall meet transaction performance requirements, Scalability, Reliability, Integrity and consistency of data across the system, replicability across DC-DR infra. The detail is given in section '**Database'**.

10) The Application shall be compatible to handle 250-300 concurrent users. The Concurrent users may increase to 1000 user in next 5 years.

11) A reasonable set of practical **(Service level Agreement) SLA** shall be demonstrated by the bidder during SAT (Site Acceptance Test) on production environment. There are different components in the applications such as Declare Capacity, Entitlement, Requisition, Create Schedule, Curtailment, URS, exchange of data through API etc. The functional areas of each will have their required SLA which should be met during SAT and same shall be maintained during the contract period. The bidder shall be fully responsible for the specified SLA for the complete duration of the contract, including the warranty and AMC period.

S No	Description	Required	SLA Time / Percentage
1	Application Availability	Availability Per Quarter Yearly	99.99%
2	API response time at the client site, for Web Page for Declaration Capacity, Entitlement, Requisition, Curtailment, URS, Net Schedule, Full Schedule, Schedule Summary etc Every web page, part of the application	Page load time (any date)	1 sec

3	Declaration Capacity, Entitlement, Requisition, Curtailment, URS, Net Schedule, Full Schedule, Schedule Summary etc	Revision update time (any date)	1 Sec
4	Scheduling Creation with Rerouting of LTA, MTOA among available Link and Path	Schedule Creation with Rerouting, Display of rerouted Transaction time	15 Sec
5	Successful Full Schedule Creation	Create new Schedule time	10 Sec
6	Web Page for Report Opening for any Day, even for Download in any format.	Viewing report (Both Past date and Real time)	1 Sec
7	Web Page for Process Management	Status Update	1 Sec
8	All concurrent API data exchange, API load time, summary (push and pull)	Both Internal and external	1 Sec
9	Notifications / Snapshot	Update in every Second	1 Sec
10	Web for reports Opening for last One Year, download in any format	Viewing report (Both Past date and Real time)	5 sec
11	Visualization of Real-Time Interactive Dash Board	Viewing report (Both Past date and Real time)	1 Sec
12	Offline Visualization for different parameter of last one Year	Viewing report (Both Past date and Real time)	5 Sec
13	Preparation of weekly implemented Schedule for DSM Reports for each RLDCs	View and Download	5 minutes
14	Preparation of monthly implemented Schedule for REA account for each RLDCs	View and Download	30 minutes

12) Reporting and Visualization shall provide for reports, interactive dashboards and offline visualization as defined in the functional RFP (Volume-I).

13) User specific content shall be visible to the concern users. The web pages shall be enabled for different users based on their roles and permissions within the WBES Administration, and they can be easily customized for specific use.

14) The application shall be IPv4 and IPv6 compliant.

15) **License**: All possible licenses procured for this project shall be in the name of POSOCO for the complete duration of the contract.

16) All the possible licenses required for the smooth operation of the application and its services / supports, as defined in the RFP, should be clearly listed during the time of bidding. The cost of the licenses / support / yearly subscriptions, for complete duration of the contract, shall be included during the price evaluation of the bidder. The licenses cost and Enterprise support provided may be scrutinized/verified by POSOCO.

17) The cost of licenses for product updates and supports, for the duration of the contract, may be one-time payment / yearly subscription shall be included in the offered cost, for Warranty and Comprehensive AMC.

18) The bidder shall provide the development environment, along with all the license, during the development phase.

19) The bidder shall provide all the license for the production environment only. The environment and the Licenses for the staging, Testing and development after the system has Go-Live will be provided by the POSOCO.

20) The bidder shall report any exceptions to license terms and conditions to POSOCO. The responsibility of license compliance solely lies with the bidder. Any financial penalty imposed on POSOCO during the contract period due to license non-compliance shall be borne by the bidder.

21) The bidder shall handover all source codes of custom developed software to POSOCO. POSOCO shall have all legal rights over the code and applications. POSOCO shall have all the IP rights, of all the custom software module developed as part of this solution.

22) The Bidder shall not propose any freeware / open-source Software, without Enterprise level support / OEM support, from the authentic/secure software supplier, and the same shall be confirmed and approved by Engineer-In-Charge.

23) **Compliance**: The bidder shall insure that application shall comply with data security policies and standards, guidelines and notification published by the Government of India, MoP, CERC, CEA, MeitY etc for development of WBES Applications, and as suggested in http://egovstandards.gov.in, https://web.guidelines.gov.in , GIGW-manual, NDSAP-2012 and ISO 27001 standard etc. and shall comply with all requirements of POSOCO Information Security Policy.

24) The platforms selected for development as well as all necessary plug-ins, devices, software/hardware and tools & packages to be used for development, testing, deployment, operation and future patch management, upgradation and maintenance processes should adhere to POSOCO Information Security Policy and should conform to POSOCO Standard requirements and benchmarking

25) The bidder shall also provide a Mobile App with the features of the WBES applications reports, visualisations to visualise all custom based, pre-formatted and pre-stored reports

26) The developed WBES applications shall be accessible through multiple channels such as desktops, laptops, smartphones and tablet etc.

27) The bidder shall maintain the confidentiality of all the data that he might come to know pertaining to POSOCO during the implementation and maintenance period (NDA to be signed with POSOCO).

28) **Old Data Migration:** The current WBES RDBMS data is scattered across five RLDCs and NLDC. The bidder shall be responsible for migration of existing WBES data of last 6 years, to NLDC IT infrastructure. The old data shall be available till the Go-Live of the system. The old data shall be easily extracted and downloaded in csv, excel format for all the parameter with features of 'From' and 'To' date and Time-block wise.

29) **Go-Live:** POSOCO shall issue an acceptance certificate/completion certificate after successful completion of SAT at NLDC IT environment, and includes, admin/user level training, user level documentation, sharing of database architecture, source code of WBES application, VAPT and migration of old WBES data to NLDC IT infrastructure. Thereafter the system will Go-live.

Design Principle for Application

30) **Agile and DevSecOps Methodology:** The bidder shall design, develop, implement, operate and maintain WBES solution using Agile methodology. The bidder shall also follow DevSecOps which must use CI/CD (Continuous Integration and continuous deploy) methodology with a view to enhance collaboration during the project design, development, implementation and maintenance. bidder should mature the Secure DevOps Agile delivery with measurable milestones. The key activities should include - secure code development practices, regression testing, performance testing, secure code review, penetration testing, CICD, monitoring with auto scale and auto recovery capabilities, SLA measurement/reporting and any additional best practices to achieve the maturity level of secure DevOps delivery. All the above activities must be automated as a norm and anything that is not automatable shall be mutually agreed for exception process.

31) Every development sprint outcome has to be approved by POSOCO designated official in collaboration with Bidder's development team till application has Go-live. A separate view user access shall be provided to POSOCO to monitor the development progress. It will ensure Bidder's development team to understand the functional requirement and reduce the effort of rework.

32) The domain expert from POSOCO, will be involved during application development phase, so that application development is a collaborative process, for better understanding of WBES functionality. The application development progress shall be reviewed in every 15 days.

33) **DevOps**- DevOps includes a combination of development and operational processes that expedite the delivery process for better quality software through automation. DevOps best practices include Continuous Integration (CI) & Continuous Delivery (CD), Test Automation and include-

   a) **CI/ CD–** create deployment-ready software by enabling automated builds, at regular frequency, after check-ins and executing automated tests on the build, through CI/CD pipelines, in the test environment. CI/CD pipelines for different stages include Regression Testing, Benchmarking, Vulnerability Assessment & Penetration testing, etc. that are generally deployed in modular units such as containers.

   b) **Test Automation–** Develop & maintain test harnesses for regression testing for all client-side and server-side functionality.

34) **Micro-Services Architecture:** WBES shall be developed on a micro-services architecture that structures the components/ applications as a collection of loosely coupled services which are independently deployable. The bidder shall ensure that all logics are broken into small components and wired through an asynchronous workflow to facilitate quick execution. The solution must be developed so as to facilitate the release of resources and handling of failures

at a micro level, allowing for each of components to be run across a cluster of virtual machines which should allow seamless scaling based on usage. It shall be easy to introduce modifications or increments at later stages to its technology stack within a microservices environment. Real-time data exchange through open APIs between applications/ micro-services should be enabled. Microservices should leverage appropriate framework such as containers, container orchestration, open tracing, secure services communication between microservices, advance deployment topology etc. The application to support containerization and container orchestration of enterprise level (similar to Docker and Kubernetes), thereby offer scalability on demand, reliability and serviceability of applications.

35) **Stress load Test:** During UAT and then during SAT bidder must demonstrate run-time operations under performance and stress testing environment capable to simulate 2.5 times the peak designed workload, thereby demonstrating the capabilities of Containerized Microservices, Managed Platform (similar to Docker and Kubernetes) and visibility of Microservices using Dashboard. It shall also validate that the application/hardware/ configuration deployed in production environment can support the envisaged projected load for the next 5 years post Go-Live. Ensure that the performance of the solution shall be in line with the SLA and acceptable to the Engineer-In-Change.

36) **API-base Integration Architecture**: The bidders are required to adopt an API-based Integration Architecture to enable multiple stakeholders interoperate with ease, subject to necessary permissions, privileges and consents. The application shall support, more than 250 concurrent API. API component should allow mapping of APIs to domain names. All traffic to APIs should be SSL/TLS encrypted. The detail about the API features is given under section "API Management".

37) API component should log all the transactions. Logging dashboard should show metrics of successful and failed API calls. API component should trigger the workflow in API backend.

38) All the integrations should follow industry standards and should be capable of integrating with current and future requirements of WBES applications. Integration layer should have built in capability to integrate with other systems by means of open APIs and Web Services. The application servers should be encrypted Secure Socket Layer (SSL) and authenticated prior to sending any information.

39) The application shall have flexible integrations along with centralized management (Configuration), that allowing varied external applications to connect without requirement of any custom coding.

40) Caching may be implemented to reduce application response time.

Additional Responsibility

41) The application should be modular and Agile so as to have ease of maintenance and quick adaption to business changes. The bidder shall design the application, keep in view, the regular future changes expected from CERC/SERC/RPC regulation/order. According the application shall be robust and Agile to process growing data volume.

42) The bidder shall provide the detail requirement for hosting its application. So, that POSOCO allocate a required resource, in its existing IT infrastructure, for hosting the application.

43) The bidder shall be responsible for successful installation, configuration and commissioning of the application in production environment of NLDC IT DC-DR infrastructure.

44) Bidder must present their plan for ensuring reliability, availability, consistency and serviceability of application against the given IT infrastructure, so as to meet the required SLA and meeting the mentioned RTO/RPO of the DC-DR infrastructure.

45) The bidder shall share the required tools and services to meet the entire system SLA. The audit trails, logging and notification for each web page to monitor the user activities.

46) The bidder must ensure that the SLAs are met at all times, till the end of the contract, in case these SLAs are not met, the bidder shall do the required optimization in the application code to meet the defined SLA. The cost for additional licenses, if required to meet the required SLA, shall be borne by the bidder, without any additional cost implication to owner.

47) In case of critical issues or breakdown maintenance, deputation of suitably skilled manpower at site to resolve the issue. There shall be deputation of domain experts to resolve specific issues, shall be in the scope of the bidder, without any additional cost.

48) The application bidder may review and advise on the monthly audit / check-up of all equipment and facilities carried out for the infrastructure.

49) The bidder shall be responsible for any future integration/modification and shall provide necessary technical assistance and service for such integration / modification.

50) The bidder shall review the Periodic check-up of the schedule backup of all servers/applications and need based restoration (DBA role).

51) The bidder shall assist and coordinate with POSOCO engineer-in-charge during the DR activation and restoration, including DR mock drill.

52) The bidder should ensure the following: a) Any record once created cannot be deleted or modified without following due process. b) All created records must be traceable to its creator unambiguously. c) Data should be reliable and verifiable d) The system must support explain ability of decisions.

53) The application shall be covered under Warranty of one year. Post completion of warranty, AMC shall be for a period of Four (04) Years, with a provision for extension of AMC by further two (02) years. The rate quoted against the AMC for the extended two-year period, including the License cost, shall be considered during bid evaluation.

54) The bidder shall provide an escalation matrix for problem resolution as per the defined severity.

55) **Integration of SMS and Email service**: The SMS and Email Services are available at POSOCO, the same shall be integrated with the applications services. The bidder needs to integrate with SMS / Email services that can be used for OTP authentication and notifications. The SMS service cost will be borne by the POSOCO.

56) The bidder shall ensure that the developed application shall be audited and clearance certified by CERT-In auditor, during the SAT period and before the application Go-Live. Further, POSOCO will conduct VAPT for the WBES application, twice every year, by certified CERT-In auditor. Any security vulnerabilities detected by the auditor shall be fixed, and it shall be the

responsibility of the bidder. Further, the application shall comply with all the Cyber-Security advisory received from NCIIPC, Cert-In, Cert-GO etc.

57) During maintenance phase regular patch management, updates, version control of tools and platforms used should be done on regular basis. Any product / Licenses if declared end-of-support by the OEM should be replaced immediately with recommended alternative, without any cost to the POSOCO.

58) Bidder shall ensure that, any regulatory changes / Order issued from CERC/SERC/RPC, related to the scheduling process, till the system Go-Live shall be incorporated during development period, without any cost implication to POSOCO.

59) **Future Modifications:** WBES application is subject to the government regulation and guidelines issued by CERC / RPC / SERC from time to time. Thus, modification in the existing envisaged logic of the WBES system could arise during Warranty and AMC period. Modification of the application as per such requirement in time bound manner shall be in the scope of the bidder. The modification requirement during Warranty and AMC, shall be assessed, developed, tested and made live within mutually agreed time period by the bidder at the defined man-day rate. The man-day rate for any modification due to the change in Government regulation and guidelines issued by CERC / RPC / SERC/ MOP time to time shall be worked out as per the prevailing Man-Month rate of NICSI empanelled resources, with experience of above 10 Years, considering month to be of 26 days. However, any other modification to cater and resolve bugs, small issues, vulnerabilities, security enhancements, integration requirements etc shall be in the scope of the vendors, without any additional cost implication to POSOCO.

60) **Documentation**: Complete documentation required to support system setup, operation and maintenance shall be in the scope of the vendor. The bidder shall prepare all required manuals/documents for smooth operation and knowledge transfer of the WBES and associated systems. The documents include the user level manual, the database architecture and the application source code.

61) Maintaining exhaustive documentation (solution & trouble shooting procedures/manuals/records maintenance activities etc.) online or off-line relevant for monitoring, administering and maintenance of the system as well as conforming to the requirement of IMS & ISMS standards and to be reported from time to time to Engineer-in-charge

62) **Training:** The bidder shall have two administrator level training, to share the application architecture and explain the code workflow. Further, there shall be two user level training to share the detailed application functionalities with different users' rights.

63) The bidder shall share the training man-days rate for the trainers for the administrative trailing and the User level trailing, of batch size of 15 person. The number of additional trainings may be decided by the POSOCO at the time of implementation.

3. Application Sizing:

a) Current Sizing

1) Bidder may do the System study of current WBES application installed at 5 RLDCs and at NLDC, so that the bidder is aware of the complexity of the applications and expected growth of data in future.

2) The bidder may consider the expected change of regulation from current 15 Minute Time Block to 5 Minute Time Block, which may triple the database requirement. The application shall support growing data volumes.

3) The bidder shall be responsible to migrate the old data from existing WBES of last 6 years, distributed across five RLDCs. The old data shall be compiled, easy extracted and hosted centrally at NLDC IT infrastructure, before the proposed application has Go- Live. The old data shall be easy downloaded in excel, csv file format with feature of data extraction 'From Date' to 'To Date' for all the parameters.

    The migration of data shall be upto the date, when the proposed application has Go-Live.

4) The details of existing system are provided to give an insight of the sizing and technical requirement for the proposed WBES software.

(To provide an insight of the sizing and technical requirement)

S.N	Requirements	Response
Details of existing system (To provide an insight of the sizing and technical requirement)		
1	List /complete details of **Existing applications** currently installed in POSOCO.	The existing Web based Energy Scheduling system (whose past data need to be migrated to new system) is presently implemented and operational in **Decentralised manner** in 5 different RLDCs at Mumbai, Delhi, Kolkata, Bengaluru and Shillong and at NLDC, Delhi. Each RLDC is having an Application Server (mostly 4-6 Core Server with approx 64GB RAM per node in redundant setup) either in VM or as Physical system. Size - 4-6 Core, 256GB RAM x 2 for Application Server The Database is presently running at individual RLDC on Oracle 12c Enterprise on Approx 8 Core Machine with 128GB RAM having dual server setup to maintain redundancy on Oracle DataGuard. Oracle DB Server Size - 6-8 Core, 128GB RAM x 2 Server on Oracle Dataguard Total DB Capacity, each RLDCs (as on date with approx 5 years Data) - approx 10TB with monthly increment of approx 30-40GB Data The application is exchanging data across other RLDCs (Five RLDCs) and NLDC using 20MBPS Dedicated Data Link with backup failover link through available Internet bandwidth using API exposures as follows: a) With other RLDCs - for preparation of Inter-Regional Schedule b) With NLDC for RRAS, SCED, PX, RTM and other data c) with STOA application (local) for STOA Data etc.

S.N	Requirements	Response
2	Details of existing design/architecture/ deployment schema of WBES Regional implementation (**The existing system however will be discontinued after implementation of the new Application and migration of the old data**)	Presently in each RLDCs the following architecture is followed: The application servers are on VM platform using VMWare Enterprise Plus implementation on HA (High Availability). Oracle DB is on dual Server (Intel Hardware) synched using DataGuard There are Gateway Level Firewall on HA Segregation of Critical LAN for DB and DMZ for application (web interface) is there. Data Stored in available SAN (in RAID 1+0) populated with standard SAS Drives (approx 10 TB space allocated at present) Note: the infrastructure largely varies from RLDC to RLDC. While in some RLDC traditional Server storage devices are used, in some HCI is used for Application and DB. In some RLDC ODA is also available.
3	Current RDBMS Version/Release	Presently Oracle 12c Enterprise is used.
4	Existing volumetric data growth along with year-on-year growth that is anticipated?	Presently per RLDC Data growth is approx 30-40 GB per month (depending on no. of constituents of that specific RLDC) On Centralised deployment we envisage the following growth: a) Present sizing and transactions (including all 5 RLDCs WBES): Approx 200GB per month. b) Considering the future growth in market player in coming years this may rise up to : Approx 300-350GB per month c) On implementation of 5 minute scheduling system (which may come in effect in a year or so): Approx 1TB per month However, a lot depends on the normalisation model, DB architecture and various development in Indian Power markets in years to come is present prediction may vary largely accordingly. The data growth is indicative only and may vary.
5	Estimated number of end-users who are accessing the present WBES application and their concurrency.	Presently each RLDC application is having approx 100 end users viz. registered Buyers and Sellers (depending on the size of RLDC). The number of concurrent users varies as follows: a) During Zero Revision process: Approx 50 users work concurrently on the application (other than RLDC control room user) **per RLDC**. b) During other revision process: The number concurrent user per RLDC may vary largely approx 50 depending on the situation. **However as a general practice most of the SLDCs and Sellers remain logged-in with the home dashboards on continuous basis for access of information / logs.**

b) Minimum Sizing:

The Bidder is responsible for arriving at the sizing of the proposed application, based on volume and expected data growth. POSOCO shall not be responsible for any assumption made by the Bidder. If the solution does not meet the performance/service level (SLA) as desired in the RfP, the Bidder will be responsible to suggest for the necessary scale-up of infrastructure. The additional cost of licenses for scaling up the infrastructure, to support the application and its services, shall be borne by the bidder.

POSOCO will provide the adequate computation and storage as per the requirement in virtual environment / Standalone server.

The minimum resource Sizing that should be considered by the bidder is given below

	Description	No. of Cores	RAM (in GB)	Data Storage (in GB)
1	Application Environment	16	128 GB	2000 GB
2	Database Environment	16	128 GB	2000 GB

The bidder shall submit the sizing calculations for its Storage, Compute and Storage as a part of its technical Proposal.

The sizing shall be such that the resource usage shall not cross the 60% of the allocated resources, at any given time during the duration of the contract.

	Description	No. of Cores	RAM (in GB)	Data Storage (in GB)	Archive Storage (in GB)	Operating System
1	Application Environment					
2	Database Environment					

4. API Management:

The WBES application shall have API Management Solution which enables publishing and governing of APIs securely. The solution provides a unified platform to manage both internal and external service assets and APIs.

The tentative list of Internal and External interfacing Application.

S. No	Interfacing Application (Source)	Interfacing Application (Target)	Type (Real Time / Batch)	Current Frequency	Expected Future Frequency
Internal (LAN / WAN Network)					
1	SCED	WBES	Real Time	Every 15 minute	Every 5 minute
2	RTM	WBES	Real Time	Every 15 minute	Every 5 minute
3	NOAR	WBES	Real Time	Every 15 minute	Every 5 minute
4	DAM	WBES	Batch	Twice in a day	Twice in a day

5	RRAS/ Ancillary	WBES	Real Time	Every 15 minute	Every 5 minute
6	PSM	WBES	Batch	Once a Day	Twice a Day
7	Three REMC at RLDCs	WBES	Real Time	Every 15 minute	Every 5 minute
8	WBES	NOAR	Real Time	Every 15 minute	Every 5 minute
9	WBES	SCED	Real Time	Every 15 minute	Every 5 minute
10	WBES	RRAS/ Ancillary	Real Time	Every 15 minute	Every 5 minute
11	WBES	Five RLDCs	Real Time	Every 15 minute	Every 5 minute
12	WBES	RTM	Real Time	Every 15 minute	Every 5 minute
13	WBES	DAM	Batch	Once a Day	Once a Day
14	WBES	Three REMC at RLDCs	Real Time	Every 15 minute	Every 5 minute
15	WBES	Reporting Software	Batch	Once a Day	Once a Day
16	WBES	Five RLDC for DSM	Batch	Once a week	Once a Day
17	WBES	Five RLDC for REA	Batch	Once a Month	Once a Week
18	ATC module	WBES	Batch	Twice a day	5 time a Day
19	Loss Application	WBES	Batch	Once a week	Once a Week
External (Internet)					
1	WBES	To 25 State / Constituents	Real Time	Every 15 minute	Every 5 minute
2	WBES	To 50 Generators	Real Time	Every 15 minute	Every 5 minute
3	From 25 State / Constituents	WBES	Real Time	Every 15 minute	Every 5 minute
4	From 50 Generator	WBES	Real Time	Every 15 minute	Every 5 minute

API Admin Portal: This component manages WBES APIs, to determine (internal + external) application developers have access to API. This portal integrates with API Gateway to generate API Keys and provide view on usage metrics and reports. This portal will be accessible by internal API creator and maintenance team. Admin portal generates API key by triggering service in API Gateway cluster. API keys are included as part of policies in API Gateway and can be viewed by Developers through Developer Portal also.

API Gateway: This component manages the external access to data, including validating the structure of requests payload and headers, access to API requests and providing threat protection Gateway includes policies which defines API (request, response, and error), API Keys, API Security Policies, audit etc. It integrates with access management micro services solution to provide API Authentication and Authorization. Once request is authorized API gateway will route response to Core API Engine cluster and return the response back to client application

It shall store the logs created by the API Admin Portal and the API Gateway.

API Management Solution

The Minimum Specification are
1) The API Shall support REST & SOAP etc.
2) The application shall support more than 250 concurrent API calls
3) API component should allow mapping of APIs to domain names. All traffic to APIs should be SSL/TLS encrypted.
4) Provide centralised web-based user interface to configure, manage and monitor APIs
5) Role based access control to its user interface for configuring and managing the API services
6) Support deployment of instances of API gateways as per requirements
7) Support auto-scalability of API gateways instances
8) Support API authentication using system auto generated API application id & API key combination. The application should be identified via the application ID and authenticated via the application key.
9) Support API authentication using JWT Token / OpenID Connect etc
10) Provide option to regenerate the API keys either by tenant admin or directly by API consumer organization admin / developer.
11) Support all methods for authentication parameters locations as following - headers, query parameters, body parameters, HTTP basic authentication etc.
12) Proposed solution should allow tenant admins should be able to create multiple user plans along with custom features for consumer to subscribe.
13) Support configuring features & access policies based on API versions identified through request URL's.
14) Provide out of the box features / policies / plugins to enable / disable capabilities in API gateway as per requirements.
15) Support customizable access logging per service for auditing purpose through API gateway
16) Support addition, customization, deletion of features / policies / plugins into API gateway.
17) Provide REST API to integrate with any external 3rd Party / Client applications
18) Provide REST API's for API configuration management including but not limited to account management, service management, security, analytics etc
19) API's must be well documented and it shall provide an interface for its own API documentations and testing.
20) Proposed solution should commit 99.9% uptime for API management solution.
21) **The solution shall have 24x7 for enterprise support from the OEM.**

5. **Container Platform**:
1) The platform shall have capability to run both stateful and stateless applications. It should be enterprise Kubernetes based orchestration for managing the platform
2) The platform shall provide container runtime, container orchestration, container management and container monitoring capabilities

3) The container platform shall support deployment and orchestration of multiple containers formats (docker, cri-o etc) for preventing any technology lock in.

4) The platform shall have inbuilt management and monitoring capabilities. It should be offered with suitable container registry capability

5) The platform shall support polyglot technologies as runtime platforms for applications such as – C# Dot net (Including Dot Net Core), Java, PHP, Python, Ruby, Perl, Node.js Etc.,

6) The platform shall provide auto scaling capability for automatically running appropriate number of container instances as per load requirements

7) The platform shall provide auto scaling of application/compute nodes as per load requirement

8) The platform shall provide container instance auto healing capability.

9) The platform shall provide centralized logging capability (including applications logs from container instances) for audit, logs analysis & ease of management purpose

10) The platform shall provide application / container version management, auto build of new application container instance in test environment basis on application code new version commit. Roll back to earlier version

11) The platform shall provide deployment strategies support such as – green / blue, canary etc. for ensuring no/minimum downtime for application updates / upgrades

12) The platform shall support container native persistent storage capabilities

13) The platform shall be deployable using same product on all types of deployment scenarios i.e. – bare-metal servers / Virtualized servers / Public Clouds etc.

14) It should support container scanning capability

15) The offered platform shall be capable to execute in place upgrade to newer versions whenever new upgrades are available.

16) The offered platform/product should have minimum of seven years of lifecycle.

17) It should be offered with suitable IDE for developing container-based applications.

18) The solution should support multiple x6x86 based server OEM for bare metal deployment, Multiple Hypervisor like VMware, Hyper-V, RHV, OpenStack etc. The POSOCO shall not be responsible for operational related tasks for keeping this platform up and running

19) The proposed container platform supports a secure, enterprise-grade orchestration that provides policy-based control and automation for applications. Cluster services, scheduling, and orchestration shall provide load-balancing and auto-scaling capabilities.

20) **The offered software should be open standard/open source/enterprise ready in nature with L1-L3 based 24x7 enterprise support from OEM, updates and upgrades for the project period.**

    a. Container should support Service Mesh for microservices visibility, traffic control, security and observation

    b. Container platform should provide capabilities to run pods without any mandatory minimum resource configuration requirements.

    c. All proposed component of Container platform including monitoring, observability, logging, management should be capable of running on premise without any dependency.

    d. The container platform should prevent containers root access requiring from running by default

21) Multi-tenancy to isolate various users, teams, departments etc.

22) Network Control/Segmentation

    a. Control traffic flows at the IP address or port level, and can be enhanced with cluster ingress and egress traffic controls, logging, and network visualization.

    b. A Software-defined networking (SDN) that provides a programmable, adaptable network fabric to support dynamic networking security requirements.

    c. Provide a network segmentation, network visualization, authentication, and authorization for containerized applications and microservices.

    d. Capture live container network traffic to debug issues in the communication between services.

23) Container Images

    a. The platform should provide certified images for a large number of language runtimes, middleware, databases.

    b. The platform should scan the images for vulnerabilities and continue to track vulnerability status over time for all your approved and deployed images.

    c. RBAC to manage who can pull and push specific container images. Manage content based on metadata about the container, including known vulnerabilities.

24) Audit & Monitoring

    a. Monitoring the containers for malicious activity and providing visibility into the platform logs.

    b. Provides insights into security breaches, provides evidence to support compliance audits, and accelerates recovery efforts.

25) Management & Monitoring

    a. The monitoring solution should include a pre-configured and self-updating monitoring stack that delivers out of the box monitoring best practices.

    b. It should support monitoring at the Application level.

    c. The monitoring solution must provide a very high ingestion rate for the data-metrics which is very common in highly elastic container-based solutions.

26) Data Protection Solution –

    a. Data protection solution should have capability to safely back up, restore a workload cluster's current workloads and persistent volumes state, for entire clusters or specific namespaces. It should work well in an on-premises environment.

    b. It should have the capabilities like configuring scheduled backups, trigger ad-hoc backups, perform restores.

    c. Backups can capture subsets of the cluster's resources, filtering by namespace, resource type, and/or label selector, providing a high degree of flexibility around what's backed up and restored.

    d. The backup solution should provide a mechanism to version the artifacts, and also provide an integration with a datastore (ex- S3 compliant Object store) as per the backup retention policies.

27) Container Registry
    a. Container registry solution should be open source, CNCF Graduated project that delivers compliance, performance, and interoperability.
    b. Container Platform should provide an internal (On-Premises) image registry.
    c. The container image registry should secure images with role-based access control, scans images for vulnerabilities, and signs images as trusted.
    d. The registry should support different AuthN/Z solutions such as LDAP/AD integration and OpenID connect.
    e. The registry should have an efficient and intuitive Web-UI, API to perform various operations, in addition to CLI.
    f. The container registry should also have a support to integrate with other repositories outside the enterprise firewalls, such as Docker-Hub for caching images.
    g. The solution should have a vulnerability (CVE) scanner built into it to be able to identify and remediate OS and App-level vulnerabilities
    ~~h.~~ Container registry solution should secure artifacts with policies.

6. Database

POSOCO is looking for any Enterprise class RDBMS, with OEM level support for subscription and product update, with suitable Presence in India. The proposed database shall meet transaction performance requirements, Scalability, Reliability, Integrity, support API integration, column-store index and consistency of data across the system, replicability across DC-DR infra. It shall also support data backup both the Full and incremental data backup. It shall support partitioning / indexing.

The proposed bidder shall ensure High Availability in a database.

Database should be scalable enough, can handle large scale of data and should be able to support larger concurrency pool to avoid database locking and larger thread pools. It should also not block the database from usage while taking backup since Web Based Energy Scheduling is round-the-clock application. It should also support killing of a blocked query rather than killing the entire database engine. Considering the data volume, the database should also provide data archival ability.

Note: The Database shall be chosen by the bidder. The Database Licenses during application development on bidder environment, will be managed by the bidder. After the system has Go-Live, on the chosen Database. The POSOCO shall provide the required database Licenses, with OEM level support and product update. The bidder shall provide the DBA for 24x7 support, for its chosen database.

7. Mobile Android and IoS based App

The bidder shall also provide a Mobile App with the features of the WBES applications reports, visualisations to visualise all custom based, pre-formatted and pre-stored reports only. All reports and visualization shall be available in real-time in Mobile Apps.

The app should allow user to visualise and use the App features both in Online and Offline mode. All necessary user controls security controls and Data integration should be implemented. The bidder shall be responsible for maintaining the App available in both Andriod and IoS platform for the entire lifecycle of the WBES project.

8. Training:

The bidder shall have two administrator training, to share the application architecture and explain the code workflow. Further, there shall be two user level training to share the detailed application functionalities with different users' rights. The above mentioned training shall not have any additional cost implication to POSOCO and shall be a part of Application development cost.

Any Further, Training, if desired by POSOCO, shall be provided by the bidder at the rate quoted in the BoQ.

9. Scope of work during Warranty and Comprehensive AMC Maintenance:

1) The application shall be in one-year warranty and then Four-Year Comprehensive AMC, with the optional provision of two-years extension.
2) The warranty shall be on-site and comprehensive in nature and back-to-back support from the developer. The bidder shall furnish warranty for the software against bugs and defect arising out of faulty design and any user level changes etc for a period of one Year from the date of Go-Live. Further, during the warranty period atleast one Resident Engineer shall be deputed at site.
3) **Resident Engineer:** The details about the Resident Engineer.
   a. At least one (1) Resident Engineer (BE/B-Tech/MCA), who was involved with WBES application development for minimum 6 months, shall be available during office hours (9:00 am to 17:30 hrs) for 6 days a week. The resident Engineer shall have two Project experience and shall be available on-site at NLDC, Delhi.
   b. The Resident Engineer is required during warranty period. The cost of resident engineer during AMC period shall also be provided, in BoQ, which will be considered during bid evaluation. However, deployment of resident engineer, during the AMC period, will be decided after expiry of the warranty period.
   c. The Resident Engineer shall be at Site during the Working hours, and during the non-Working hours, the support shall be provided from the remotely and if not rectified, the vendor shall assign appropriate resources to reach the site without any cost implication to the POSOCO.

   d. The Resident Engineer deployed at POSOCO site, shall bring their own computing devices. The computing devices (laptops / desktops) should have appropriate security solutions such as (Anti-Virus – Anti Malware etc.) to avoid security breach.

   e. POSOCO does not encourage replacement of resources unless it has been explicitly asked by the POSOCO.

4) The bidder, for contract period, shall also provide an 24x7x365 online support, to ensure healthiness of the mission critical application, SLA compliance and periodic monitoring & reporting of the same. The Technical Lead / Developer allocated (5 resources) for this project shall remotely support the application.

5) The bidder shall also provide the DBA (Data Base Administrator) online support for 24x7x365 period. The Database Administrator (DBA) allocated (2 resources) for this project shall remotely support the application.

6) The bidder must have suitable number of WBES application specialists, who can resolve the Application and Database related issues on-line and On-time.

7) The bidder shall provide an escalation matrix for problem resolution as per the defined severity level.

8) The bidder shall be responsible for operation, maintenance and administration of WBES application along with all its dependencies such as databases, UI system, Containers, API library etc.

9) The application shall be audited and clearance certified by CERT-In auditor, before the application has Go-Live. Further, POSOCO will conduct VAPT for the WBES application, twice every year, by certified CERT-In auditor. Any security vulnerabilities detected by the auditor shall be timely complied, and it shall be the responsibility of the bidder. Further, the application shall comply with all the Cyber-Security advisory received from NCIIPC, Cert-In, Cert-GO etc.

10) The bidder shall assist and coordinate with POSOCO engineer-in-charge during the DR activation and restoration, including DR mock drill.

11) During Warranty and AMC, regular patch management, updates, version control of tools and platforms used should be done on regular basis. Any product / Licenses if declared end-of-support by the OEM should be replaced immediately with recommended alternative, without any cost to the POSOCO.

12) The online support shall be provided on 24x7x365 basis. For problems of urgent nature which are reported during office or non-office hours (night times/holidays) the vendor shall depute his Resident engineer / Online support Engineer, to attend the problem within stipulated time. All the scope of troubleshooting, debugging and problem resolving for failures related to online or off-line processes etc. must be covered within the scope. It is therefore mandatory that the Resident Engineer / Online Support Engineer, deputed for attending the calls is suitably skilled. The Engineers must be capable of attending the emergency calls within short notice to avoid any delay in problem rectification beyond stipulated time frame. The support issues that are identified as critical needs immediate attention. The response time of the Engineer should be immediate and any loss due to delay in response or negligence on part of the Engineer would be borne by the bidder.

13) The bidder must implement suitable single window log system / Ticketing Portal to ensure easy reachability for Resident Engineer / Online Support engineer(s). The persons identified as responsible for attending / resolving any calls logged during day time (office hours) as well as during night times or holidays (non-office hours) must be easily accessible over phone/ Mobile/ WhatsApp / email from POSOCO, so that any problem can be reported and escalated immediately.

14) The bidder shall deploy and maintain ticket logging portal, it shall have the problem log Time, Severity level, Issue Resolution Time. The corresponding penalty imposed, as per the defined time resolution of the issue. The ticketing portal shall be installed at POSOCO infrastructure.

15) **The Role of DBA:**
   a) The bidder shall provide the Certified Database Administrator (DBA) for the chosen RDBMS. The DBA shall be Certificated from the OEM / OEM Approved Provider for the chosen database.
   b) The bidder shall also provide the DBA (Data Base Administrator) online support for 24x7x365 period. The Database Administrator (DBA) allocated (2 resources) for this project shall remotely support the application.
   c) The cost of DBA support shall be included in the Maintenance Support during Warranty period & Comprehensive AMC cost of each year.
   d) Preparatory activities including fresh installation (if felt necessary) of the DB as per required configuration, migration, configuration of necessary backup and coordination with the POSOCO approved vendor responsible for configuration of the system backup system presently available.
   e) Regular routine maintenance activity such as deletion of temporary tablespace, organizing space management, patch management etc.
   f) All activities related to regular and periodic backup, checking successful backup activity and performing periodic restoration test as per agreed terms & schedule
   g) All activities related to breakdown maintenance viz. restoration of system from backup or using any other tool, reconfiguration of the system as per requirement etc. as per agreed SLA.
   h) All activities related to Security of the DB installation.
   i) Performance tuning & monitoring including all activities related to enhancement of DB performance including detecting and analysing root cause affecting the performance of the system, taking corrective measures and ensuring system performance as per desired practice & standard and agreed SLA.
   j) Any other activities though not covered in RFP documents but are required for reliability, safety and fail proof operation of the DB and as per good engineering practice shall be deemed to be included in the scope of work unless specifically excluded in the tender documents.
   k) Configuration, installation of databases in case of release of new versions and required from security perspective, without any additional cost.
   l) The submission of monthly reports, including the regular maintenance, tuning, check-up, monitoring, periodic backup, other activities and DB performance and improvement if any.

16) The Application Performance Monitor tools shall be continuously monitored by the online support team, and shall submit the weekly and monthly application health report and shall clearly highlight its performance against the stated SLA along with recommendation if any. The cost of APM tools shall be included in the Maintenance Support during Warranty period & Comprehensive AMC cost of each year.

17) **The Application Performance Monitor Tool:**

The Installation, Configuration, Management and Support for APM (Application Performance Monitor) tool. This tool shall monitor and provide reports and alerts for assessing the system health. The tools should be integrated with the Microservices and monitored stack. The solution should either be on-premise or cloud based. In case of cloud / SaaS based components, the subscription needs to be procured by the bidder on behalf of POSOCO for the period of entire contract. In case of cloud/SaaS components, MeiTY / Government of India (GOI) guidelines and other applicable statutory laws and regulations shall be adhered.

Following features are the expected.

a) The APM dashboard is required as a part of a solution, and it may be COT/ custom developed solution / SaaS based solution. The bidder shall deploy and maintain the APM during the contract period

b) It shall provide a real-time monitoring system / Dashboard for reporting of all the technical Service Levels Agreement (SLA) defined in the RFP to monitor the performance of the Application. The same shall be accessible to POSOCO.

c) The Real-Time Dashboard shall monitor the Functional Parameter as per the defined SLA. It shall generate alerts via SMS/E-Mail in case, the defined SLA is not met.

d) It shall provide for end user monitoring to get better insights into overall application performance, as well as how the user is using the application

e) It shall provide capabilities to track all the transactions across all layers of the application.

f) It shall provide Key Performance Indicators related to system, application and service Level Agreement (SLA).

g) Provide root cause analysis for the deviations, exceptions and errors occurring in the platform.

h) Perform Integration of Application, Host, CPU, Network, Disk, Virtualization within a single model.

i) User Dashboard - Ability to tailor per user, drill-down into details, and/or perform ad-hoc analysis of performance data.

j) Find full visibility of all runtime vulnerabilities in your environment

k) It shall be able to see all affected process including related services, applications, and host, as well as Kubernetes workload, nodes and clusters.

l) Deploy and configure Full-stack visibility into every process on the monitored host - regardless of the technology

m) It should be able to report application errors and exceptions and threshold deviations. APM has to provide alerts immediately via, Email / SMS to the designated person

n) It should be able to conduct real time performance monitoring of applications, containers, microservices and APIs.

18) **Severity level**

The bidder shall submit an appropriate reporting procedure and escalation matrix to meet the requirement of all severity levels, and same shall be approved by the POSOCO.

The problems shall be categorized as follows:

Table: Severity Levels

Category	Definition
Severity 1 – Urgent/ Emergency	a) Any Show Stopper: The outage of Web System either completely or an essential part is unavailable.
	b) Outage of any Critical Functions as envisaged in Specifications
	c) Serious performance degradation
	d) Failure of any of the Internal and External API / ftp
	e) Erroneous Reports, Visualization
	f) Failure of Schedule Creation / Schedule Rerouting
	g) Erroneous calculation of Entitlement/ Requisition / URS/ Schedule / Curtailment / Notification/
	h) Loss of Internal and external inter-connection.
	i) Failure of any major subsystem or system component such as to cause a significant adverse impact to system availability, performance, or operational capability
	j) The SLA is above 150% of defined SLA
Severity 2 – Serious	a) Not a show stopper but has a potential to prevent a major function of the system and there is no effective work around.
	b) Expiry of Software Licenses or critical functions such as to negatively impact system operation
	c) Non-availability of Man-power at Site, during working hours
	d) Cyber security compliance, patch Management

Category	Definition
	e) Nonavailability of online DBA and Support
	f) Automated Monitoring tool not operating
	g) The Public Reports and Visualization portal not accessible
	h) Delay in Generating the data for DSM and REA account
	i) The Functional parameters are not meeting as per the defined SLA
	j) Alerts from the Automated Monitoring tools
	k) Non-Compliance of VAPT vulnerability for more than 15 days.
	l) The SLA is above 200% of the defined SLA.
Severity 3 – Minor	Minor – With work around – The defect does not have any impact to other modules/functionalities but has the potential to prevent a major function of the system from meeting the SLA requirement. However, there is an effective work around to meet these requirements.
Severity 4 - General / Cosmetic	Cosmetic – The defect is a nice to have or has minimum or cosmetic effect on the system.

The system is not impacted and no functionality impacted

It also includes Request for information, or any technical configuration assistance guidance, and enhancement requests. |

19) **Response and Resolution Time**

This section describes the target times within which the bidder should respond to support requests for each category of severity.

Initial Response Time: The period from the initial receipt of the support request (through approved communications channels like WhatsApp/ Mail/ SMS/ Ticket Portal) and the acknowledgment of the bidder subject to the Maximum time defined in below Table.

Action Resolution Time: The period from the acknowledgement of support request to the bidder delivering a solution subject to the Maximum time defined in below Table. This period includes investigation time and consideration of alternative courses of action to remedy the situation. The Action is defined as a direct solution or a workaround.

Complain logging portal/ ticket portal with auto escalation functionality is essential before start of warranty Period. Detailed reports along with resolution to be available in the portal.

Table: Severity Level Response and Resolution Time

Severity	Initial Response Time	Action Resolution Time	Action
Severity-1 S1	15 Minutes	30 Minutes	An urgent or emergency situation requiring continuous attention from necessary support staff until system operation is restored – may be by workaround.
Severity-2 S2	1 Hour	6 Hours	Attempt to find a solution acceptable to POSOCO (dependent on reproducibility), as quickly as practical.
Severity-3 S3	12 Hours	1 day	Evaluation and action plan. Resolution time is dependent on reproducibility, ability to gather data, and POSOCO prioritization. Resolution may be by workaround.
Severity-4 S4	1 day	5 days	Report on the problem/query is to be furnished.

20) **Availability and Maintenance Charges Payment Calculation**

It is the endeavor of both the bidder and POSOCO to maximize system availability to the extent possible. The bidder shall provide the application availability as per the specified SLA of 99.99%.

The bidder shall deploy and maintain the ticket Portal with full details of each outage, actions taken by bidder to correct the problem, applicable Severity level, time of reporting, allowed Response time as per the Response times defined in above section, actual Resolution time, and approval of Engineer-in-charge as well as the bidder support engineer.

The duration of outages over and above the Action Resolution time, in each of the Severity levels shall be counted for the non- availability computation and shall be clearly brought out in the ticket portal. The resolution may be accepted temporally by a work around, but permanent solution must be provided till then severity will be lowered and such permanent solution shall mark the end of non- availability.

The application Availability computation

Availability computation shall be done on per quarter yearly basis per site. The formula to be used for availability computation shall be as under:

Availability per quarter yearly (per site) = $\underline{\text{THQ- (S1 x 2 + S2 x 0.8 + S3 x 0.5)}}$ x 100%

$$\text{THQ}$$

Where THQ is Total Hours in the Quarter, excluding the downtime approved by the POSOCO Engineer-In-Change.
S1 is the total Non-Available hours in Severity Level -1,
S2 is the total Non-Available hours in Severity Level – 2,
S3 is the total Non-Available hours in Severity Level – 3,

In the event of availability below a certain level, the maintenance charges would be proportionately reduced as follows:

Availability for each quarter (In Percentage)	Penalty (In Percentage of Quarterly Bill)
$\geq$ 99.99%	NIL
>=99.0 to < 99.99	5.0
>=98.00 to < 99.00	10
>=97.00 to < 98.00	15
<97.00	20

10. NLDC Infrastructure (Production Environment)

The production environment for the WBES application will be on the shared IT infrastructure at NLDC, Delhi. The WBES application SAT, Go-Live, Warranty and AMC, will be hosted and maintained in the NLDC IT environment. NLDC IT infra will provide the Production, Testing, and Staging environment, after the system has Go-Live for next five years.

The NLDC IT Infrastructure is On-Premise environment with DC - DR architecture. The Main DC (Data Centre) is located at NLDC, Delhi and DR (Disaster Recovery) hosted on Backup NLDC infrastructure at ERLDC, Kolkata. The DC and DR is located in POSOCO owned premises. The DC and DR is asynchronized and work in Active-Passive mode, connected through a dedicated redundant link of 45Mpbs. Further, there will be a dedicated redundant 10MBPS (1:1) link between DC and all the five RLDCs and between DR and five RLDCs, for transfer of SCADA file in every schedule interval (15min / 5 min).

The NLDC IT, is based on Hyper-Converged Infrastructure, at both DC and DR site, with cluster of 3+1 node, each node having its storage and computing, wherein 3 are active node and one spare node, to provide the redundancy in the system, in case of failure of any node in the cluster.

The NLDC Data Centre and Disaster Recovery locations, both have two HCIs, one for DMZ and another for MZ.

Note: The NLDC infrastructure have multiple application hosted on the above infrastructure on dedicated VMs for each application and its database.

The dedicated VM as per the bidder sizing will be allocated for the WBES, at both the DC and DR location, with incremental backup at NLDC, Delhi.

a) The tentative list of equipment at both the DC and DR location is stated below:

Purpose	Description
The Data Centre at NLDC, Delhi	
Production Environment HCI System for application	Detail as requested by Bidder during bid submission
Production Environment HCI System for DB	Detail as requested by Bidder during bid submission
Test Environment Server	Detail as requested by Bidder
Development Environment Server	Detail as requested by Bidder
Development Environment DB Server	Detail as requested by Bidder
Backup and Archival Media - Backup Hardware & Software	Full Back-up Media and Incremental Backup Media
Firewall Internal (between LAN and DMZ) on HA	NGFW
Firewall (External) - at Gateway Level on HA	NGFW
Core L3 Switch on HA	Redundant 24 port Stacking switch
Access Switch	L2 Switch
Intrusion Prevention System	Anti-APT monitoring
Link Load Balancer on HA	For Load balancing between the redundant communication links
Gateway Router on HA	Connectivity with External Users through ILL, Point-to-point connectivity between DC & NDR
Advance Persistent Threat	Advance Persistent Threat
Web Application Firewall (WAF)	WAF installed for all applications
Centralized AV and Anti-Spam	Centralized AV and Anti-Spam (Trend Micro)
End Point Encryption Solution	End Point Encryption Solution
DDOS	DDOS (Distributed Denial of Service) provided by One ISP
SSL Interceptor	SSL Interceptor
NMS Network Monitoring System	

Oracle DataBase in MZ Zone	Oracle Real Application Cluster is deployed for High Availability for all Critical Applications
The Disaster Recovery (DR) at ERLDC, Kolkata	
Production Environment HCI System for application	Detail as requested by Bidder during bid submission
Production Environment HCI System for DB	Detail as requested by Bidder during bid submission
Test Environment Server	Detail as requested by Bidder
Development Environment Server	Detail as requested by Bidder
Development Environment DB Server	Detail as requested by Bidder
Backup and Archival Media - Backup Hardware & Software	Full Back-up Media and Incremental Backup Media
Firewall Internal (between LAN and DMZ)	NGFW
Firewall (External) - at Gateway Level	NGFW
Core L3 Switch	Redundant 24 port Stacking switch
Access Switch	L2 Switch
Intrusion Prevention System	Anti-APT monitoring
Link Load Balancer	For Load balancing between the redundant communication links
Gateway Router	Connectivity with External Users through ILL, Point-to-point connectivity between DC & DR
Advance Persistent Threat	Advance Persistent Threat
Web Application Firewall (WAF)	WAF installed for all applications
Global Load Balancing (GSLB)	Global Load Balancing at DR for all Applications
Centralized AV and Anti-Spam	Centralized AV and Anti-Spam (Trend Micro)
End Point Encryption Solution	End Point Encryption Solution
SSL Interceptor	SSL Interceptor
Oracle Database	Oracle Stand Alone Database at DR

b) The DC-DR defined RTO/ RPO:

The NLDC IT infrastructure on DC-DR architecture is defined with following RTO and RPO

Data Centre	RPO	RTO
Between DC and DR	15 Minutes	30 Minutes

c) The Network diagram of Data Centre at NLDC, Delhi and Disaster Recovery (DR) at ERLDC, Kolkata