



**Software Requirements Specification for Revamping Power System Engineering Module (PSEM)
of KSEBL**

Version <0.3>

Prepared by:

Functional Committee for Revamping PSEM

Contents

REVISIONS.....	3
1 INTRODUCTION.....	4
1.1 DOCUMENT PURPOSE.....	4
1.2 PRODUCT SCOPE.....	4
1.3 INTENDED AUDIENCE AND DOCUMENT OVERVIEW.....	5
2 OVERALL DESCRIPTION.....	6
2.1 PRODUCT PERSPECTIVE.....	6
2.2 PRODUCT FUNCTIONALITY.....	7
THE MAJOR FUNCTIONS EXPECTED FROM THE SYSTEM:.....	7
3 PRODUCT STRUCTURE.....	9
3.1 BASIC STRUCTURE.....	9
3.2 USER INTERFACES.....	13
3.3 USERS AND CHARACTERISTICS.....	13
3.4 DESIGN AND IMPLEMENTATION CONSTRAINTS.....	17
3.5 ASSUMPTIONS AND DEPENDENCIES.....	18
3.6 USER DOCUMENTATION.....	18
4 OTHER NON-FUNCTIONAL REQUIREMENTS.....	19
4.1 PERFORMANCE REQUIREMENTS.....	19
4.2 Software Quality Attributes.....	21
4.3 Application Requirement description.....	21
4.4 Scalability Requirement description.....	21
4.5 Change requirement Management.....	21
4.6 User Manual.....	21
4.7 Training.....	21
4.8 Application knowledge Transfer.....	21
4.9 Training Materials.....	21
4.10 Project Inception.....	21
4.11 Requirement study.....	21
4.12 Training Materials.....	21
4.13 Project Inception.....	21
4.14 Requirement study.....	21
4.15 System Design & Integration.....	22
4.16 User Acceptance Tests (UAT).....	22
4.17 Source code & Documentation.....	22
4.18 Product Support.....	22
4.19 Data Security.....	22
4.20 Version Control System.....	23
4.21 Time line.....	23
4.22 Other requirements.....	23

Revisions

Version	Primary Author(s)	Description of Version
A 0.0	Asst. Engineer, PSE,O/o D(T&SO)	Consolidation of the comments submitted by the Functional committee members with the requirements implemented in the existing module.
A 0.1	Asst. Executive Engineer, Executive Engineer, PSE,O/o D(T&SO)	Modification and verification regarding the inclusion of all comments submitted
A 0.2	Functional Committee members	Verification and corrections by the Functional committee members.
A 0.3	Functional Committee members	Appended the sample reports expected from the revamped PSE modules

1 Introduction

Web based business modules called **Power System Engineering Modules (PSEM)** are being used for transmission assets and operating statistics management under Transmission SBU(Strategic Business Unit). It was decided to revamp the existing PSE modules into a more functional framework incorporating the work flows in substations, transmission offices and related offices with integration of the Permit Management software, protection and communication applications, SAMAST (under development at SLDC, Kalamassery) and SAMAGRA software. A functional committee has been constituted to coordinate the revamping the PSEM by developing a new **Transmission System Management Modules (TSM Modules)** for the use of all offices in KSEBL.

The functional committee will coordinate the revamping activities by preparing the SRS including the requirements of all stake holders, monitoring the development process of the software keeping in mind the predesigned time line of the project, providing feedback and testing of the software at developmental stages in the context of the SRS and functional requirements.

1.1 Document Purpose

This document is prepared based on the suggestions and requirements reported by the functional committee members after the discussion on the PSEM revamping. The document serves as a general guideline specifying the functionalities / system requirements to be achieved with the revamped PSE modules (TSM Modules) for the developing team (IT dept., KSEBL). The basic requirements and functionalities expected from the PSE modules (TSM Modules) by the target users have been addressed in the document. The SRS in the standard format, including more detailed requirements as on the basic structure, user interface, graphical details, etc may be decided by the IT wing in consultation with the functional committee.

1.2 Product Scope

The revamped PSE modules namely Transmission System Management Modules (TSM Modules) will act as the central database for all Assets and Operational Statistics of Transmission SBU. The modules will provide all critical data and reports on the asset status and performance, operational

aspects of substations, LMS and generating stations with asset-wise maintenance details. The data and reports will be utilised for transmission system performance, system planning and reporting to stakeholders. The module thus will act as a comprehensive representation of all activities of the Transmission, System Operation and Generation offices.

1.3 Intended Audience and Document Overview

The document is intended for communicating to the development team, the end results expected from the module and the various data relationships. The document also serves as a benchmark for the performance achieved by the software during different stages of development including the finished product.

The document is organised as follows:

- Chapter 2: Discusses the overall product perspective with functionalities expected.
- Chapter 3: Presents the product structure expected with user groups and expected inputs and outputs. The constraints and associability with existing software also mentioned.
Presents the detailed specific product requirements with detailed graphical representation of each module requirement.
- Chapter 4: Discusses the various non-functional requirements.

2 Overall Description

2.1 Product Perspective

Power System Engineering Modules are web based business modules used for transmission asset and operating statistics management under Transmission SBU. The module was initially developed in-house based on the time to time requirement from PSE wing and therefore was not based on a defined / pre-written SRS. The modules thus lack organisational structure and have identified issues related to the workflow, data validation, etc.

Considering the same, it is decided to revamp the existing PSE modules into a more functional framework by modifying the software, incorporating the work flows in substations, other transmission offices and other related offices with integration of existing / planned (pipeline) software in KSEBL such as the Permit Management software, Protection and Communication applications, SAMAST and SAMAGRA software.

The major issues identified in the existing module are:

- Modules were developed in-house based on the time to time requirement from PSE wing – **Lack of proper SRS and implementation of work-flow.**
- Methodology adopted - **enforced data entry.** No workflow has being incorporated.
- Data received is incomplete / erroneous due to **improper validation.** Obsolete and stale information is only available due to **lack of timely updating.**
- **Validation and authorization of the data uploaded** – By the hierarchical levels of transmission wing (Sub Division / Division) is required to ensure timely updating and completion of authorised data reporting

The PSE module needs to be revamped to develop the 'Transmission System Management module' implementing the workflow and incorporating other software already in use / planned (in pipeline) for the management and operation of transmission system.

2.2 Product Functionality-

The major functions expected from the system:

- The modules shall act as a central repository of all information (to the possible extent) storage and dissemination related to the various business processes of Transmission wing.
- Asset management – for management of entire life cycle including design, construction, commissioning, operating, maintaining (including warranty management), repairing, modifying, replacing and decommissioning of assets.
- Provision for measurement of performance of the asset (vendor-wise) based on failure frequency and duration, financial matrices such as replacement cost, return on investment, etc.
- Development of analytics and health indices for assets condition assessment, residual life forecasting and asset management prioritisation.

To develop a condition based asset replacement program depending on age while also taking into cognizance their operational and maintenance history.

Condition based asset analytics, data analytics - for Assessing the asset health and performance; based on statistical data and reliability centred maintenance reports;

Provide a comprehensive report on repairs and preventive maintenance performed over the entire lifespan or specified time frame for any asset.

- A system capable of automatic capturing or import of station operational data / parameters for recording the station operations (in lieu of Operators' diary), furnishing detailed monthly report on the interruptions / PSD, FSD, RSD, , operating statistics of all power system equipment, SPS, UFR, df/dt, islanding scheme, status of capacitor banks, energy meters, etc.
- Automatic and/or manual integration of condition monitoring data for a range of assets from a range of sources including IEDs, Sensors, Smart meters and SCADA systems.
- Should have a common reporting and analytics capability for generating reports as per user requirements. Also, configuration and management of alarms indicating deteriorated or impaired assets.

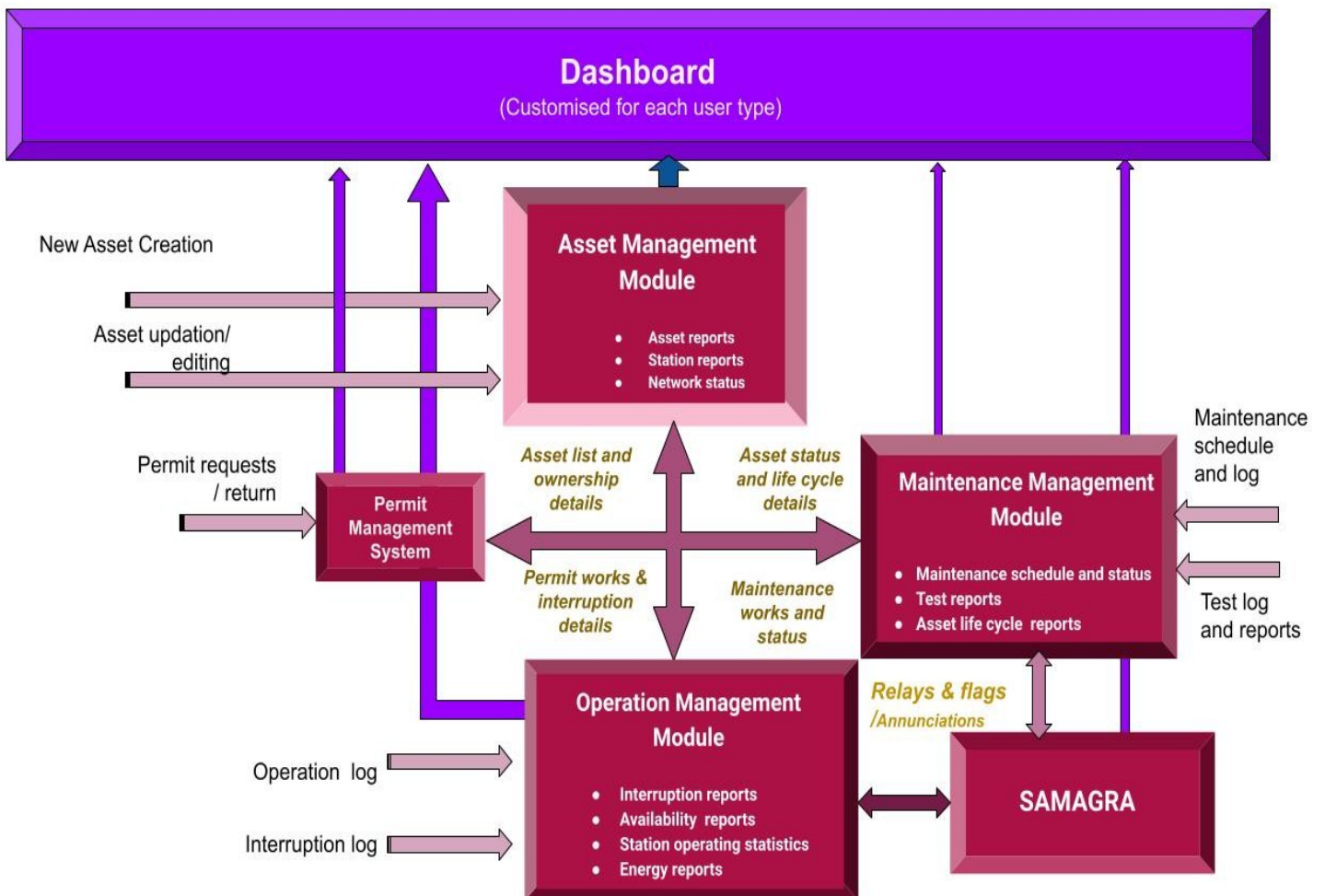
- An interruption analysis system to provide a platform for listing the details of interruptions of all elements in the network. A hierarchical level verification and certification. Provision for uploading the DR,EL,TR from the concerned level.
- Shall have facilities to capture institutional knowledge, acquired by the experienced aging workforce.
- Integrating all the options available in the existing Permit management system with the new module. Provisions for requesting / issuing permit for works on transmission elements.
- A subsidiary module for Generation SBU, including a Generation Asset Management System with all facilities available for transmission asset management, a Generation interruption analysis system for generating Sequence of events, availability and interruptions.

3 Product Structure

3.1 Basic Structure

The basic requirements of the Transmission Management Module can be fulfilled by constituting following individual modules:

1. Asset Management Module: - in association with ISTS & SO management module.
2. Operation Management Module: - in association with Permit Management Software.
3. Maintenance Management Module:
4. Dashboard: with Transmission planning system & Library
 - Integration with SAMAGRA software owned by SLDC.



The modules are common for Transmission, Generation data. The name stations are used in general which can be substations or generating stations. The block diagram representation of each of the module with workflow and common facilities expected is presented in the Figures below:

1. Asset Management Module

The module acts as the centralised database for asset data which will be used across the entire modules.

- New asset data creation through the work completion from billing software on approval of CRCS, etc. with hierarchical approval from finance, sub division and Division officers. With the approval from SLDC for asset addition as part of First Time Charging (FTC) document approval, the asset will be updated to the database. For automatic capture of Asset Movement GRN, MRCI, CRCS, ISTN, ADN are to be linked with this module. The value of assets can be updated after the materials are received at field offices based on the CRCS,
- Unique Financial code & asset code will be assigned as part of the asset addition.
- The changes which will be made in the asset details due to shifting, repair, decommissioning, etc. should be recorded through the module.
- The module should facilitate the spare management, historical asset register, Life cycle report of an asset including movement history, etc.
- The store documents like MRCI, GRN, CRCS, ISTN, AND etc. shall be linked with this module so that automatic capture of Asset movement is possible.
- The asset code/financial code must contain particulars regarding the type of the element, group, technical specification and location. On transfer of the asset, the code needs to be updated with the new location details retaining other particulars. This can help in tracking and listing elements based on the location, type, specification, etc.
- On decommissioning of the assets, the status of the asset needs to be updated. The decommissioning of the assets the status will be updated and approved in SAMAGRA and corresponding change is required to be updated in Revamped PSE module. Until the element is scrapped and the asset value is updated, the status remains as decommissioned and the list of

such elements needs to be updated in Dashboard. Once the element status is changed as Scrap, the details needs to be maintained under Scrap Management System.

- Provision for entering the details of spare equipment kept in stock at each station/ store shall also be provided
- The provision for entering and viewing the availability of special tools to be available. A drop-down selection tab shall be provided to choose the special tools for verifying its availability at substations.

2. Operation Management Module

The module is used for managing the daily operations and reporting outage events in the system.

The module also facilitates the availability calculation based on the log data reported.

- The daily log data of the substation will be submitted by the station operators, which will be verified by the station in charge. This, along with provision for manual entry of other routine operations like station battery monitoring, issue of PTWs, NBC's, Isolation Certificates through a drop-down menu or any other appropriate input method; shall provide a means to record the daily operations in electronic form (e-operator's diary), and thus the possibility of eliminating the conventional operator's diary can be explored.
- The data logging (MW &MVAR etc. readings), are to be collected at an interval of 15 min as against the hourly data entry done now.
- For substations above and upto110kV voltage level, direct data logging through RTUs is available and can be used for data logging avoiding manual data entry.
- Proper flags can be assigned against the data logged for facilitating alert generation, grouping and reporting.

- In stations where IEC-61850 based SAS or RTU based remote data acquisition is available, most of the operation parameters like AC & DC voltages & currents, frequency, power factor, active & reactive power, temperatures, pressure, etc. shall be automatically acquired from the SAS servers/ RTUs. The status of isolators, earth switches, circuit breakers, tap position of transformers and annunciations from relays shall also be acquired automatically.
- The interruptions with related relay flags, annunciations, cause etc needs to be reported by the corresponding operator. For a feeder, the feeder owner (mostly the source station) will be reporting the outage details first, following which the other end can validate and/or edit the submitted data as per individual station conditions.
- The permit management software currently in use needs to be used in association with this module for request/issue of permit works. The permit management software with all its properties needs to be exported to the revamped module. Automatic logging of outage events as part of the permit works needs to be made to this module.
- Notification of very critical operations to be available to all officers concerned. The data can be collected from Permit management software and/or interruption data log. Very critical operation of the network to be intimated to the officers concerned so that substation outages can be planned based on these network constraints. A Dashboard pop up with notification with an SMS or WhatsApp message to the higher officials concerned needs to be issued.
- The module will provide Historical Interruption reports, Energy reports and Historical operating statistics of assets, (max and min values). The peak responses (MOR) to be auto

generated. The printable formats of Operators log Book, MOR register, etc. as required to be maintained in Stations to be made available from the module.

- Feeder re-arrangements undertaken by Distribution Wing shall also be flagged and captured automatically once GIS asset mapping in distribution sector is also completed

3. Maintenance Management Module

The module is used for tracking the maintenance activities on the assets. The maintenance schedule prepared based on CBIP manual will be updated against each asset. The maintenance activities as per the schedule will be performed and the reports will be maintained through the module. The module facilitates the tracking of maintenance activities and the Aging chart of the equipment based on historical test reports. The module should facilitate:

- Early warning for replacement of the assets and warranty expirations, Asset performance report based on failure frequency and duration, restoration time, Report on repairs and preventive maintenances performed over a period, etc.
- Condition based asset analytics, Asset replacement program.
- Asset performance report based on failure frequency and duration, restoration time, etc

4. Dashboard

Each user will have a dedicated dashboard showing the graphics of the system statistics concerned and alerts of any nature. The report generation (general and custom made) and links for accessing other modules will be through the dashboard. Also a library module showing the Transmission Planning module data update, can be incorporated along with.

Additionally, the TSM module will be integrated with the SAMAST module being executed under SLDC for system operation data management. There will be a two way communication between the modules, sharing the protection equipment details and related data.

3.2 User Interfaces

The basic screens expected from the Transmission Management module can be summarised as follows:

1. Log in page: preferably the module can be integrated with the HRIS credentials of the officer and SSO log in
2. Dashboard Screen: Must be custom made to match user requirements. Graphics of the statistics concerned, report generation, links to other modules and screens as required etc. Integration of SAMAGRA and Permit management module need to be made through the dashboard.
3. Asset management screen: Asset data entry, view asset details, Asset editing/updating, etc..
4. Operational management Screen: Options for data logging (daily log data, interruption log data), Availability (real time and monthly) generation and certification, etc.
5. Maintenance Management module: Equipment-wise maintenance schedule and corresponding data logging. The preventive maintenance procedure prescribed for the equipment as per the regulations and standards or by manufacturer may be used.

3.3 Users and Characteristics

The module should act as a common database for all transmission assets, statistics, operational and maintenance data. The target audience for the revamped module are:

1. All transmission offices
2. Generation SBU management offices
3. SLDC and STU management

4. All middle level and top level managers
5. Corporate Planning and other stake holder offices
6. Board of Directors

The types of users of the software can be grouped under followed general heads:

User	Function	Inputs	Outputs
Station in Charge (Substation & Gen. station)	Custodian of substation asset and operation data, Maintenance of assets and updating reports	Asset data entry, Interruption data entry, asset maintenance log	Historical Asset data (specific to the station), Maintenance schedule and reports, Interruption, monthly availability, etc.
LMS AE	Custodian of lines and towers data, Maintenance of assets and updating reports	lines and towers Asset data (including geo- spatial) entry, Line maintenance log	Maintenance schedule and reports, Interruption and monthly availability, Location of fault, Historical data on the feeder and tower asset history, etc.
Sub – Division (Transmission, Generation & LMSD)	Verification of station asset data, Preparation of maintenance schedule, Verification of maintenance reports, Interruption and availability certification.	maintenance schedule updating, Verification of asset and operation data, Total energy import and export	Total assets based on type, Location, Year of commissioning, Status: In- service / faulty/spare, etc... Pending Schedules, History of maintenance of an asset
Division (Transmission, Generation)	Approval of maintenance report And transmission availability	Verification of maintenance schedule, transmission availability, Total energy import and export	Asset report, Interruption report, Asset status report, Maintenance reports, Energy audit, Load and peak demand statistics, Key Performance indices, etc.
Finance	Asset code generation	Financial code, asset capitalisation approval, cost data of asset and cost updates	Fixed asset register, Station Asset details, Asset register, Spare availability reports, aging report of assets

User	Function	Inputs	Outputs
Circle (Transmission, Generation)	View data and generate custom/predefined reports on assets, operation and maintenance.		Asset, operating and maintenance data dashboard with historical data report generation based on predefined and user defined constraints for required time period.
SOC (AE,AEE and Division logins to be considered)	View data and generate custom/predefined reports on assets, operation and maintenance.		Asset, operating and maintenance data dashboard with historical data report generation based on predefined and user defined constraints for required time period.
SLDC	View data and generate custom/predefined reports on assets, operation and maintenance.		Asset, operating and maintenance data dashboard with historical data report generation based on predefined and user defined constraints for required time period.
Management (Chief Engineers and Directors)	View data and generate custom/predefined reports on assets, operation and maintenance.		Asset, operating and maintenance data dashboard with historical data report generation based on predefined and user defined constraints for required time period.

3.4 Outputs expected

1. The module should provide general or custom made reports as required by the user. The reports should be available to view in the browser as well as for download in .xls or .pdf formats as required.
2. Provision for generating user defined reports with each item on the report customisable. Drop down option for selecting the items to be included in the report to be provided so that custom reports can be generated.
3. The Dashboard should contain a calendar to which daily major activities scheduled under his/her jurisdiction and notifications or alarms will be available corresponding to the user profile.
4. The graphical statistics as displayed on the user dashboard updated corresponding to real-time data, wherever possible.
5. The general predefined reports are to be generated for the user profile. Sample reports are attached along with as Annexure 1-3.

3.5 Design and Implementation Constraints

- The scheme of data logging used in the existing modules may be followed with modifications/additions of features as required.
- The data is to be captured by way of “implementing the work-flow” of the data generating office, to the maximum possible extent, by which automatic and timely data can be ensured, rather than just “enforced data entry”.
- Duplication of similar data entry must be avoided strictly. Validation of data entry (both front end and back end) is a must. The data type and range of data is to be strictly validated.
- The data entry as far as possible must be through drop down/selection, avoiding typing of data to avoid human errors as far as possible. For manual data entry, validation of data is to be ensured at every point - data type, possible limits, entry in the chronological order to be verified.
- The modules must be web based and accessible for data entry in all modules from anywhere.(not restricted for KSEBL network)
- The login credentials should be through HRIS SSO role and every operation must be tagged with time stamp and user details.
- Option for automatic data collection from meters and protective equipment needs to be considered while designing.
- The time available for revamping the existing modules with additional requirements and improved usability and functionality is limited and must be completed within the time period specified in the contract.

3.6 Assumptions and Dependencies

The factors that could affect the requirements stated in the requirement specifications document. These factors are not design constraints on the software, but are rather, any changes to them may affect the overall requirements. Following are the major assumptions and dependencies;

- The existing data in the Power System Engineering Modules need to be migrated to the revamped module, with all ownership and connectivity considerations after proper revalidation.
- The initial data for all the modules as available in existing modules and other related software needs to be imported / migrated to the module, thus avoiding duplication of data entry to the extent possible.
- Integration and data sharing with existing/planned software – ORUMANET, SAMAST, Permit Management Software, ERP of KSEBL, etc. need to be considered while designing.
- The modules will be owned and maintained by the IT wing of KSEBL. Required support on the module will be provided after rolling out for all users of the module.
- It is assumed that the system architecture with respect to hardware, software, connectivity and other infrastructure would be available as envisaged for the proper functioning of the application.
- Interfaces to KSEBL applications will be provided as web services based on the formats devised by KSEBL IT Team.
- The external interfaces would be dependent on services provided by other government agencies or service providers.
- All the legal/regulatory/administrative approvals/changes, if any, would be undertaken by the KSEBL to enable the functionality covered in this document.

3.7 Data Migration:

The data currently available in the Power System Engineering Modules should be migrated to the newly revamped module. This process will ensure that all existing data is transferred seamlessly and remains accessible within the updated system, facilitating smooth integration and continuity of operations.

4 Other Non-functional Requirements

The section identifies non-functional requirements to be supported by the application. It also includes the non-functional requirements for the support & management service, Design, development and testing of the service.

4.1 Performance Requirements

- The data entry must be smooth with required pop up help messages wherever required.
- The application must be (open easily and easy to navigate)

4.2 Software Quality Attributes

- Reliability: the data is used for transmission system operation management and planning and therefore the reliability, integrity and consistency of the data and the reports generated are critical.
- Portability: the Software must be compatible and developed using cut-in-edge technology for compatibility with future innovations.
- Adaptability: The possible changes in the data structure and requirements itself must be addressable with the software used for development of the module.

4.3 Application Requirement description

- The application should be platform independent of Operating System, browser etc
- The Application shall be developed in Open sources laguages like PHP/JAVA and DB in Opensource platform (Postgre SQL). The application shall be mobile responsive

4.4 Scalability Requirement description

The application must be scalable in design and implementation. The application can efficiently handle increased demand and adapt to changing requirements over time.

4.5 Change requirement Management

During the support period(Warranty /AMC Period), any enhancements or customizations that fall within the 03 person-days limit are to be provided without incurring any additional charges to KSEBL.

4.6 User Manual

The firm should prepare detailed video-based user manuals covering “step-by-step” and “how to use” concepts for the application. User manuals for different user levels shall be provided

4.7 Training

End-User Training:

Needs training to the Trainers of KSEBL for arranging training sessions for individuals or groups who will be using the software. This includes guidance on how to navigate the interface, perform specific tasks, and make the most of the software's features.

4.8 Application knowledge Transfer:

This training (Knowledge Transfer) shall be provided to the KSEBL’s Core IT Team members(minimum 10 employees) at Thiruvananthapuram, Kerala. It includes Software Architecture, Design Pattern, Documentation, Deployment Process, Configuration Management, Data Model and Database Schema, API & Integration's, Security Considerations, De-Bugging and error handling etc.

4.9 Training Materials

The firm shall be responsible for preparation of the training materials, handouts covering “step-by-step” and “how to use” concepts for the application.

4.10 Project Inception

The firm should prepare a detailed Project Plan detailing all tasks including the person in charge, allocated resources, timelines for each activity, milestones, and deliverables

4.11 Requirement study

The firm should review and finalize proposed SRS in discussion with KSEBL and submit a detailed SRS to KSEBL.

4.12 System Design & Integration

Based on the SRS the firm should perform detailed system design of the application. As part of this phase the firm should submit design documents and project methodology. The application shall be integrated with KSEBL internal applications, Single Sign On(SSO), SMS gateway, Payment Gateway, Whatsapp etc and capable to send communications through email & other modes.

4.13 User Acceptance Tests (UAT)

The firm should conduct User Acceptance Tests (UATs) to ascertain whether the application and its sub-system is capable of meeting the functional requirement as per the requirement. Conducting such tests will be responsibility of the vendor. KSEBL will provide full co-operation to the vendor in conduct of the tests.

4.14 Source code & Documentation

The source code of the application along with full documentation is to be handed over to IT wing of Kerala State Electricity Board Ltd (KSEBL). A detailed documentation explaining the structure of code should be submitted along with source code. The development firm shall Provide comprehensive technical documentation that covers the architecture, design decisions, and the internal workings of the application. The intellectual property rights of the application with KSEBL only

4.15 Product Support

The vendor shall provide comprehensive product support, including bug fixes, updates, and technical assistance, for a minimum period of **1 year**(Warranty Period) from the date of deployment, ensuring the smooth operation and maintenance of the application. If AMC is required, KSEBL will issue a separate order

4.16 Data Security

Ensure the design of the web-application shall follows the NCIIPC, CERT-In guidelines and security auditing of the application is also included in the scope of the work. The vendor shall provide the necessary steps/support to obtain certification from a CERT-In empaneled agency

4.17 Version Control System

The application development shall follow the version control system as insisted by KSEBL IT wing.

4.18 Time line

The selected firm shall complete the development of the application with in 6 months from the date of issue of Letter of Award.

4.19 Other requirements:

- Pre-qualification: The firm shall have successfully completed two government/Public Sector projects for consideration in the pre-qualification process. Copy of the Work order shall be submitted
- Cost: Technically qualified bidders shall quote the amount as a lump sum, excluding AMC (Annual Maintenance Contract) charges. This amount must include all activities from SRS (Software Requirements Specification) preparation to the Go-live phase of the security-audited application. It should also cover training sessions for the IT team and end users, as well as the implementation of security updates, bug fixes, and any related tasks.
- The application shall be hosted at the KSEBL Data Center in Thiruvananthapuram and the Disaster Recovery (DR) Center in Cherthala.
- The application shall incorporate the latest advanced technologies, including Artificial Intelligence (AI) and data analytics etc
- **The above requirements are based on the existing stages and shall be further elaborated or supplemented with additional requirements as necessary**