ANNEX 8: GUARANTEED TECHNICAL PARTICULARS FOR MDS

Clause-KPLC REQUIREMENT	MANUFACTURER'S COMPLIANCE/ REMARKS	REFERENCE PAGE IN THE SUBMITTED DOCUMENTS
9.4 Operating Conditions		
9.4.1 The MDMS hardware suitable for operation in tropical climate where temperatures vary from -1 to 50 degrees Celsius; relative humidity reaching 90% and operating altitude ranging from sea level to 2200 m above sea level.		
9.5 Design and Construction		
9.5.1 The MDM System shall provide a joint infrastructure for data receipt on metered consumption from the implemented AMI system within KPLC.		
9.5.2 The MDMS shall potentially calculate consumed electricity, preserve and manage data, and provide access to subject data to all interested parties.		
9.5.3 The use of appropriate middleware will enable the connection of the MDM System with other business systems.		
9.5.4 MDM system is anticipated to use the available networks for connection with all entities within KPLC.		
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parties.		
9.5.3 The use of appropriate middleware will enable the connection of the MDM System with other business systems.		
9.6 Functional Requirements: The MDMS shall support the following functions:		
9.6.1 Data acceptance and upload on metered consumption and any other relevant data sent by Head End System (HES).		
9.6.2 Interaction and data exchange with other utilities systems such as SCADA, IMS, GIS, CRM.		
9.6.3 Data acceptance and upload on any data information sent by the Customer Management Information System (CMIS)		
9.6.4 Support web based interface for users		
9.6.5 Generation of prepayment tokens and onward transmission to the smart meter		
9.6.6 Validation, editing and estimation of received meter data. All functionalities related to validation, editing and estimation (VEE) should be centralized. MDM system shall initially be filled with all necessary data (identifiers of points of services of all customers), to enable the performance of VEE analysis of connected AMR system.		
9.7 Data storage, management and maintenance		
9.7.1 Scalability in terms of full integration with other Information Systems		
9.7.2 Revision of changed data		
9.7.2.1 Security in access management of all functions and data		
9.7.2.2 Calculation of consumed electricity for each point of delivery based on different price structures, including hourly and other specified tariff rate periods.		
9.7.2.3 Data based on the sequence defined in advance or on request		
9.7.2.4 Receive and manage information to support exchange between points of services, advanced meters, electric utility and interested third parties.		
9.7.2.5 Data transfer from the MDM system to the Billing System, as well as to other information subsystems within electric utility, shall be implemented through the (push) procedure (per sequence) or the (pull) procedure (on request)		
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9.7.2.6 KPLC shall retain the existing interface towards electricity customers.		
9.7.2.7 15 minute / 30 minute / daily / monthly load profiles (LP) specified by other information sub-stems should be used for VEE analysis needs, in cases when there is no sufficient data.		
9.7.2.8 MDM system database shall initially be filled with all necessary historical data (identifiers of points of services of all customers), to enable the performance of VEE analysis of connected AMI system.		
9.7.2.9 During initial system filling with the necessary data, the electric utility shall submit all its historical data, necessary to fill the MDM system database.		
9.7.2.10 In initial implementation phase, MDM shall receive, process and manage data on metered electricity consumption for all customers having advanced meters installed, read by AMI system, while data obtained from electricity customers with classical meters, read via handheld devices or manually will be received from the Electricity Billing System, for using the existing interface to migrate data.		
9.8.1 The MDMS Software Requirement and Technical Characteristics		
9.8.1.1 The MDMS shall be supplied complete with all the required applications, databases and other items necessary for its perfect operation;		
9.8.1.2 The contractor shall be solely responsible for the execution of all the installation services and supply of all the equipment needed to make operable the Meter Data Management System "MDMS" specified in this document.		
9.8.1.3 The Contractor shall include all the applications and licenses to implement the MDMS, with all the characteristics and features defined in this specification. The licenses Shall be for the perpetual use of KPLC		
9.8.1.4 The MDMS shall be scalable and will allow the use of multiple instances provided they		

be integrated into a single database.		
9.8.1.5 With the implementation of the MDMS, KPLC shall be able to remotely collect data from the meters through the AMI Head End application (MRS) for the following functions:		
9.8.1.4 The MDMS shall be scalable and will allow the use of multiple instances provided they be integrated into a single database.		
9.8.1.5 With the implementation of the MDMS, KPLC shall be able to remotely collect data from the meters through the AMI Head End application (MRS) for the following functions:		
(a) Billing		
(b) Fraud detection		
(c) Establish new tariff structures		
(d) Improve the service quality index		
(e) Eliminate operational costs of commercial procedures		
(f) Control and management of customer loads		
(g) Resources in the field (transformers, cables, among others)		
(h) Improve network expansion planning.		
(a) Billing		
(b) Fraud detection		
(c) Establish new tariff structures		
(d) Improve the service quality index		
9.8.1.6 KPLC shall remotely collect near real time and on demand meter readings.		
9.8.1.7 KPLC to remotely “ping” any individual meter		
9.8.1.8 The bidder shall include the supplies and activities necessary and mandatory for MDMS to be fully operational, including the following:		
(a) Supply of the system application software and of the hardware;		
(b) Configuration of the database;		
(c) Implementation of the system including assistance in the installation of hardware, software and commissioning;		
(d) Implementation of the System Acceptance Test;		
(e) Provision of instruction manuals for the System, for Production and for Technical Support;		
(f) Provide training to KPLC team that will be responsible for the MDMS o		
9.8.1.9 The Contractor shall provide a		

Maintenance and Support Agreement. It will include the following activities:		
(a) Implementation of the patches and corrections provided by the manufacturers of the software that compose the environment of the HES		
(b) Installation of new versions and releases, including their analysis, their suitability for the use in the processes adopted by KPLC, their installation and follow up of the support activities, object of the contracts of maintenance of the mentioned software;		
(c) Troubleshooting of hardware, software, network, and other operating systems for servers and workstations that may be related with the MDMS;		
(d) Implementation of the System Acceptance Test;		
(e) Provision of instruction manuals for the System, for Production and for Technical Support;		
(f) Provide training to KPLC team that will be responsible for the MDMS operation.		
(g) All interfaces can be configured via a standard User Interface that includes standard adaptors allowing rapid integration and intrinsic data validation to ensure clean data loads.		
(h) Can be configured to pull in, normalize, and store data from any number of utility systems such as SCADA, GIS, IMS, CRM, Demand Analysis and Forecast and various AMR head-end systems (HES), weather data systems and other legacy and middleware systems.		
(i) Effectively ingest, store and process meter reads, as it adds meters to its system, creating valuable load profile data for each meter on the distribution system		
(j) Obtain meter data from existing external systems like the Customer Information System for a more effective grouping and reporting.		
(k) Capacity to Perform Validation, Estimation, and Editing (VEE) on all meter reads, to ensure “clean” data with no missing gaps. Standard tests to		

include: Missing Values, Zero Values, Static Values, Negative Values, Spike Check, Sum Check, Event/Status Check		
9.8.1.10 Users also shall can create their own custom VEE rules.		
9.8.1.11 Standard validation – Shall provide a set of standard validation which includes referential integrity, data version control, missing interval, negative value, zero value, static value, spike and sum checks, which can all be configured individually.		
9.8.1.12 Historical load validation – Load validation for both interval data and consumption data:		
9.8.1.13 The system shall can make comparisons against load profile models that are based on historical loads using the Interval Data.		
9.8.1.14 The system shall be capable to compare against historical consumption, and adjustments are made for weather and cycle length using the Consumption Data.		
9.8.1.15 The system shall provide a tool, preferable graphic that allows the business analyst to build and maintain custom logic sets for validation purposes. It shall allow the analyst to build unlimited logic.		
9.8.1.16 Estimation shall be provided for both interval data and consumption data.		
9.8.1.17 For interval data, estimation shall be performed using a sophisticated algorithm, which allows for weather-sensitive regression, day-type, and similar-day estimations.		
9.8.1.18 For consumption data, the estimate is derived from historical usage factors, and default values are used for the new meters.		
9.8.1.19 The editing function shall have a tool for analysts can view meter data in graphs or reports. Questionable data are highlighted with a suggested estimate, and the analyst can choose to accept the estimate, accept raw data, or input an alternative estimate.		
9.8.1.20 Enable user-friendly querying and reporting using standard reporting tools.		
9.8.1.21 The MDM shall support a role-based security model.		
9.8.1.22 The MDM shall have a powerful scheduling, archiving, and maintenance administration tools, robust task monitoring and error messaging.		
9.8.1.23 The MDM shall Supports a role-based		

security model.		
9.8.1.24 The System shall provide a powerful analytic tool to generate a list of suspicious accounts or meters that require further field investigation by the revenue protection team.		
9.8.1.25 The MDMS software shall allow standard validation tests; examining the results of various combinations of validation tests provides the first level in identifying potential energy theft.		
9.8.1.26 The software shall compare and analyze customer, meter and account data to identify individual consumption patterns and detect suspect consumption behavior. A set of logic tests shall be loaded during the implementation.		
9.8.1.27 It shall also allow an easy way to query and chart the data to extract business intelligence. Business Users can aggregate meters into meaningful collections, and then build logic tests against the meter data to look for outliers and meter anomalies.		
9.8.1.28 Application that uses logic tests to identify theft of service and malfunctioning meters. To combine individual validation tests to better pinpoint suspicious accounts.		
9.8.1.29 Automatically schedule and run a series of standard theft detection and logic tests to identify theft. These include:		
(a) Outage & Restoration Event management – Provides features such as the ability to manage events from AMI meters via the AMI Head End to the OMS. Some filtering mechanism is needed between 'raw' AMI outage events and the OMS. Some OMS provide this filtering.		
(b) Transformer and circuit loading through aggregation of meters		
(c) Meter Data Analysis – abnormalities such as zero usage, high/low readings, theft alerts.		
(d) Field Orders – filters events based on utility field orders. Can track orders, provide data to generate orders.		
(e) AMI Deployment management – Track inventory, deployment status, produces a schedule for installation team for meters and network equipment.		
(f) Supports customer web services and demand response and efficiency programs.		
(g) Supports soft and hard disconnects. A soft disconnect is a notice to utility when KWH usage exceeds a set value for a certain period for a certain customer.		

(h) Inactive Status		
(i) Pending Disconnect		
(j) Tamper Flag on		
(k) Reverse Rotation flag on		
(l) Meter changes		
(m) Repeat customer		
(n) Drop in Monthly Usage		
(o) Zero Usage (systematic intervals)		
(p) Reverse Spike in Usage		
(q) Spike in Usage		
(r) Load Factor > 100%		
(s) High quantity On/Off condition		
(t) Abnormal Voltage Variation		
(u) Abnormal voltage condition		
(v) Abnormal current condition		
9.8.1.30 The MDMS shall allow combinations of logic tests to refine results as well as allow the combination of meter read checks with CIS data elements to create further tests. These include:		
(a) Zero Monthly Consumption on Active Customers		
(b) Consumption on Inactive Customers or Disconnects		
(c) Seasonal Customer Use		
(d) Decrease in monthly usage		
(e) High load factors		
(f) Allow business users to create their own logic tests and iterative workflows to identify theft.		
9.8.1.31 The MDM System shall identify in a unique way all points in which electricity delivery to customers is executed.		
9.8.1.32 Unique POSN shall be awarded by the Commercial System and it shall represent a unique identifier serving for identification of the point on which calculation of consumed electricity is performed, whereas, consumption information may be collected from several advanced meters; i.e. Points of Service in which metering is executed via meters or calculation aimed at the substitution of the missing measurements.		
9.8.2 Data Exchange between MDM System and Other Systems		
9.8.2.1 Data transfer request should be executed consistently to and from the MDM System. Data exchange between the MDM System and other systems include:		
(a) Meter Data from Head End Systems (HES)		
(b) Data (customer information, billing) from		

Customer Management Information System (CMIS)		
(c) Data exchange with other utility applications such as GIS, IMS, CRM, SCADA		
(d) Information related to tariffs and price structures		
(e) Data on network resources on which Points Of Service (POS) have been implemented		
9.8.3 between MDMS and HES Data Exchange		
9.8.3.1 The MDMS shall be integrated with the HES(s) so that the MDMS knows via which HES device can be accessed.		
9.8.3.2 The MDMS shall support logical and physical device names, and logical device names to customers or contracts including all their histories.		
9.8.3.3 MDM system should receive and process data on metered consumption. Received meter data to be transferred to the MDM system from each advanced metering system include the following:		
a) Data on metered consumption for households, at daily level; data on consumption should be transferred at the end of every day.		
b) Data on metered consumption for households, at hourly level; data on consumption should be transferred at the end of every day.		
c) Data on metered consumption for Industrial and commercial Customers, at daily level; data on consumption should be transferred at the end of every day.		
d) Data on metered consumption for industrial customers; data on consumption should be transferred either as 15 or 60-minute data at the end of the every day.		
e) Interval Data		
f) Operation parameters, immediately data such as all events and alarms of meters, etc.		
g) Data on the network resource where the meter is connected		
9.8.3.4 Data transferred by metering control computer (MCC) is restricted to the maximum number of entries. Transfer in terms of data size shall be restricted in terms of prevention of too long or re-emission of data during the transfer of large data amounts containing errors.		
9.8.3.5 All data transferred via this data transfer method to be related to the same calendar day.		
9.8.3.6 Transferred parameters, at least contain identification information in the heading defining		

data upload priority for MDM System for several subordinated devices, when simultaneous data transfer is requested.		
9.8.4 Data transfer priorities		
9.8.4.1 Priority should be based on time and date of meter data creation.		
9.8.4.2 MDM system be capable to enable receipt and storage of all data on metered consumption every day for the previous daily reading period. To have successful data transmission, it is necessary for all process clocks on all computers within subject subsystems to be synchronized in terms of time.		
9.8.5 Manual entry		
9.8.5.1 MDM system should provide the possibility of manual entry of meter data and other data.		
9.8.5.2 Manually entered meter data shall be in the same format as the ones automatically enter the MDM system by AMI system, whereby, the same validation of message content is performed, as in the case of automatically transferred messages.		
9.8.6 Data validation prior to (VEE) analysis		
9.8.6.1 MDM system should perform, without restrictions, the data validations uploaded into MDM system.		
9.8.6.2 During every data transfer, verify if the combination 'POSN/Meter ID' is valid and is concurrent with data in the Commercial or Billing System.		
9.8.7 Data Exchange between the Billing or CMIS System and MDMS		
9.8.7.1 The system should be capable to receive and process the following transfers:		
(a) New unique POSN		
(b) Data on the network resource where the meter is connected		
(c) Request for meter data reading		
(d) Request related to data for electricity calculation.		
9.8.8 Data Transmitted to the Billing System (CMIS)		
9.8.8.1 The data on electricity accounting shall be transferred to the billing system under the		

scheduler defined in advance.		
9.8.8.2 In the definition of the requirements in terms of automated data transfer between systems, it is necessary to anticipate the submission of grouped accounting data in addition to standardized daily sequence and submission per an accounting period, in accordance with the operational technology of electric utility.		
9.8.8.3 All data on electricity accounting to be submitted to the Billing System will be archived by the System.		
9.8.8.4 During MDM system implementation phase, it should provide accounting data to the Billing System for each metering point containing an advanced meter and per the criteria defined by the utility.		
9.8.8.5 In case when there is no consumption at some metering point, the MDM system will submit a zero value for metered consumption to Billing System. It should also be noted that zero value represents a valid consumption reading which has undergone the validation process and that it does not represent missing data.		
9.8.9 Time Flow of Data Exchange		
9.8.9.1 Meter data uploaded daily into the MDM system are mainly data from the previous daily reading period.		
9.8.9.2 When for any reason meter data from the previous day shall be uploaded from AMI system, for efficient data transfer, missing data are usually transferred with high priority.		
9.8.9.3 In cases, when instead of missing accounting data, estimated values are sent to Billing System, it is possible to perform missing data transfer under lower priority.		
9.8.10 Data Exchange between MDMS and Other Utility Applications		

9.8.10.1 The Suppliers shall provide a solution to data exchange between the MDMS and other utility applications such as SCADA, IMS, CRM, and GIS.		
9.8.11 Data Exchange Methods		
9.8.11.1 The MDMS shall can exchange data with systems being used or will be developed in the future. The interface can be directly (access to the database directly) or indirectly.		
9.8.11.2 The communication with other applications shall be by the following methods:		
(a) Exchange by file formats: Excel, Text.		
(b) Send and receive data in XML format.		
(c) API function, web service compliance with standard IEC61968. The MDMS shall have passed EPRI IEC 61968-9 interoperability tests.		
(d) The system shall be able to exchange data without restriction.		
(e) Direct Database link		
9.8.12 Report Generation Capabilities		
9.8.12.1 MDM system should automatically generate reports, whereas, it is not only limited to:		
a) Confirmation of successful load data transfer by AMI System		
b) Confirmation of all data changes in the database occurring due to the addition, migration or change in any of the metering points.		
c) Reports related to meter data, unsuccessful meter data upload and unsuccessful meter data receipt.		
d) Difference between the meter identifier and the identifier of POSN		
e) Lack of storage capacity in the database or on disk		
f) Computer network problems		
9.8.13 User Interface		
9.8.13.1 The MDM system operator interface		

shall be web-based		
9.8.13.2 MDM system shall have an internal graphical profile management enabling supervision, change and management of processes and data within the system.		
9.8.13.3 If data transfer is completed unsuccessfully, MDM system will send an internal message, if necessary, it may notify AMI system operator about the failure.		
9.8.14 Customer Self Care Portal		
9.8.14.1 In addition to the web-based portal, the same features shall also be available on a mobile app having the following capabilities:		
a) Read smart meter		
b) Charge smart meter		

c) View remaining credit		
d) Check and view consumption history		
e) View company announcements and notifications		
9.8.15 Data Management		
9.8.15.1 **Data Grouping**		
a) The MDM system shall group gathered meter data for the purposes of billing, reporting and analysis.		
b) Compared to accounting data, MDM system will group confirmed meter data per tariff periods, established daily.		
9.8.15.2 **Data Versions**		
a) MDM system should provide access to meter data by using the corresponding data version. Every time meter data is altered; MDM system should update only data related to that metering point and certain date of the year.		
9.8.15.3 **Data Monitoring**		
a) MDM system shall make such information available in the form supporting the revision process, starting from the meter data receipt to the final generation of accounting data. It is necessary to record meter data versions used for creation of accounting data sent to Billing System, for keeping the records on change for revision needs.		
b) MDM system should enable the usage of real meter data during revision, when they are available in the system, instead of data replaced or estimated, used for generation of accounting reports. All newly arriving data will be processed through VEE analysis.		
9.8.15.4 **Validation, Editing and Estimation (VEE)**		
a) All meter data received by MDM system will be subject to VEE analysis. Automatic process of VEE analysis should be realized within MDM system. The VEE analysis process performs analysis of current meter data for finding possible anomalies, and in the case that anomalies are discovered, an error report is generated, as well as the request for data correction within the MDM System with the		

estimated value.		
b) VEE analysis within MDM System, necessary to possess the entire documents related to algorithm implementation used for the validation and estimation of meter data, whereas, applied algorithms must be explained on real examples, with clearly defined data flows and definitions. The MDM System shall use subject algorithms for future revisions and improvement of the analysis procedure.		
c) MDM System should continuously validate meter data in search for possible anomalies. Various rules should be enabled within the MDM system for meter data		

validation coming from certain metering points or groups of metering points. Applied validation algorithms should not disturb the existing business processes within electric utility.		
d) MDM system should have automated estimations techniques to complete missing or invalid data.		
e) MDM system should enable meter data change by the MDM system operator. Review and change of meter data shall be restricted to certain metering points, for which an identity has been identified as the primary authority for such data.		
f) VEE methods shall include:		
Control the continuity of the data file (if the meter data stored in format file)		
Too many cycles zero		
Too many cycles outage		
Comparison consumption with previous month		
Comparing consumption with the same month of the previous year		
The data values in the range defined by the user.		
Peak power compared to the previous month.		
Peak power compared to the same month of the previous year.		
Gap detection		
Maximum and Minimum		
Status flag		
Support define the basic functions for authentication data (+, -, *, / mathematical functions such as square root, log, sin …etc.)		
Allows creation of formulas calculated based on the basic functions.		
9.8.15.5 The authentication data should be the administrator configured based on existing law.		

Data should be authenticated automatically after storage.		
9.8.15.6 Non-plausible value does not need to be replaced automatically. The replacement value can be estimated linearly between the non-plausible value immediately before and after the value of the time series. It is also possible to use historical values or values from the other meter.		
9.8.15.7 Editing data shall include the display of data in tabular and graphs. Any type of editing data shall be tracked.		
9.8.16 Functional Requirements in Terms of Data Storage		
9.8.16.1 **Reference Data**		

a) MDM system shall receive and process incremental changes of metering point data.		
b) KPLC will be responsible for providing data on metering points, meters, network topology, customer data, as well as other reference data, for the purpose of their full synchronization.		
9.8.16.2 **Meter Data**		
MDM system shall be capable to receive notifications on the addition of the new metering point, new meter (either classic or advanced), meter dismantling, as well as change of information related to the metering point by any utility system.		
9.8.16.3 **Archive Data and Data Restoration**		
a) An archiving procedure should be implemented enabling efficient data storage for the time of at least 6 years, and subsequent transfer to storage media providing permanent storage.		
b) An archiving procedure should be implemented enabling efficient data storage for the time of at least 5 years, and subsequent transfer to storage media providing permanent storage		
9.8.16.4 **Historical Data**		
a) MDM system should be able to store data for on-line availability. In addition to this, MDM system has to be able to store data for off-line availability, for providing historical reserve. MDM system should be able to provide all these data for the purpose of submission to all interested parties.		
b) On-line availability of meter data and ancillary accounting data should be provided for at least 24 months.		
c) Off-line availability will primarily be used for the purpose of revision, but also for historical analysis of consumption trends.		
9.8.16.5 **Database for MDMS**		
a) Preferably, it should be an Oracle database or alternatively MS/SQL.		
b) Database should be able to store all meter data for a minimum time of five (5) years. The		

database should support data warehouse functionality including the concept of very large database (VLDB) like partitioning of tables, indexes, etc.		
c) Database should have a multi-server concept that means that one database can run on several independent servers.		
d) Database shall support online backup and recovery.		
e) Easy backup of the original data and meter data after processing.		
f) The database should support a standby database on a different location to ensure disaster tolerant systems. All changes made in the primary database should be		

applied to a standby database on a different location. In case of a disaster the standby database can be activated and will operate without data losses.		
g) Capability to have near zero downtime for databases.		
9.8.16.6 **Meter Data Storage**		
a) Meter data from different sources should be stored in the database to guarantee correct, repeatable and auditable results. Data from this storage should be used for all other systems connected to the MDMS.		
b) The MDMS shall store all kind of meter data like interval/register data, billing values, events, electricity parameters including all their histories in a unified format.		
c) The meter data should be stored for at least five (5) years online.		
d) The MDMS shall store also the historical values in case that the meter data changes due to validation or recalculation.		
e) The MDMS shall store for every meter and for every register the following attributes: -		
i) Timestamp valid from,		
ii) Timestamp valid until,		
iii) Raw value,		
iv) Report value (after VEE),		
v) Creation timestamp,		
vi) User or process who has created this value (acquisition, validation, user name, etc.).		
f) The MDMS shall store cross sums where meter data calculation or aggregation can be stored.		
g) The data should be divided into several data segments to provide access to certain data segments only.		
9.8.16.7 **Event and Alarm Processing**		
a) MDMS shall be responsible to store all kind of events and alarms and initiate actions based		

on events and alarms.		
b) Once the alarm is registered and passed to the MDMS appropriate and predefined actions will be processed by the workforce management system of the MDMS. This could be issue an inspection order for the meter maintenance, notification in the CMIS system or others.		
c) Every meter type and every HES will register different events with different codes. This may result into a big set of possible events and alarms. The Supplier shall define the events and the alarms that should be handled within the MDMS.		
d) The MDMS shall have the capability to define translation tables for every meter type or HES. This should unify the events in the MDMS and ensure that same events will have the same codes. The MDMS shall be configurable in such a way that for every event and alarm a pre-defined action will follow.		
9.8.16.8 **Security**		
a) Encryption		
i) All data transfer between MDMS and other systems shall be encrypted.		
ii) Secure Sockets Layer (SSL) Protocol should be used for IP based connection. Secured sockets should be used for Web services.		
iii) Data encryption for storage, backup.		
b) Authentication		
i) User management, Group users, roles of users and group users respectively.		
ii) MDM system should implement a security procedure on all access levels through the usage of users, groups of users, as well as their roles.		
iii) User authentication by unique identification of the user with a username and password. Without the valid combination, access to the application should be denied.		
iv) Create multiple user access priority level software / function / module / different data areas.		
v) Records should be kept about the users		

having system access, with specification of privileges for each user, as well as system access records (identification of successful and unsuccessful attempts).		
vi) The user account is locked after a number of failed login attempts. The number of login attempts is set by the administrator on system setup.		
vii) When user privileges are changed, MDM system should register the security level change, time of the change and who executed the change.		
viii) Logging of all system events. All the system events shall be stored in the system per the period required by the user (e.g. 7 days, 30 days, 365 days, etc.) to serve as an audit trail. This data can be removed manually or automatically by the administrator.		
ix) Mobile administration software shall use certificates for to authenticate field tools		
9.9 MDMS HARDWARE		
9.9.1 General requirements		

9.9.1.1 The proposed system shall be designed for an open and scalable configuration, to ensure inter- compatibility with other systems of KPLC, the future smooth expansion as well as easy maintainability.		
9.9.1.2 The proposed hardware configuration should be extended by adding either CPU processors /memory boards / disks etc.… in delivered units or additional units for capacity extension.		
9.9.1.3 All hardware shall be manufactured, fabricated, assembled, finished, and documented with workmanship of the highest production quality and shall conform to all applicable quality control standards.		
9.9.1.4 The hardware architecture shall be based on open system with a very high level of operational security and safety.		
9.9.1.5 All computer equipment shall be current models from main worldwide computer manufacturers selected for efficient operation of a real-time system.		
9.9.1.6 No proprietary hardware shall be accepted for servers and workstations.		
9.9.1.7 The processors shall include facilities for orderly shutdown and resumption of processor operation upon detection of power loss and subsequent resumption of power.		
9.9.1.8 Redundancy of equipment supporting critical functions is mandatory.		
9.9.1.9 The hardware shall be connected to a LAN network. The system architecture shall ensure fast communication between servers and workstations.		
9.9.1.10 The KPLC prefers the utilization of commercially-available hardware (Commercial Off-The-Shelf; COTS) for as many of the system components as possible.		
9.9.1.11 In the field performance test and prior to the end of warranty period, the Supplier shall		

have all hardware inspected and certified as acceptable for service under a maintenance contract by the local service offices representing the equipment manufacturers.		
9.9.2 Form of Hardware		
9.9.2.1 To the greatest extent possible, equipment shall be supplied as rack mounted units, unless otherwise specified.		
9.9.2.2 Cabinets housing the racks shall be so fitted to ensure that at least one third (1/2) of the cabinet is left free and available to use for future growth.		
9.9.2.3 The final distribution of hardware within the enclosures shall be subject to the review and approval of the KPLC.		
9.9.2.4 The supplied model of equipment shall have redundant power supplies.		
9.9.2.5 The power supplies shall incorporate automatic voltage selection and hot swap capability. In case of failure of one of the redundant power supplies, the other one shall support the power needs for the whole equipment.		

9.9.2.6 The hardware shall have a minimum of two (2) 1 GB speed Network Interface Cards (NICs) with sufficient capacity for the supplied networks. The NICs shall be configured in a team or redundant fashion to support no single point of failure (NSPOF).		
9.9.3 Servers		
9.9.3.1 The Supplier shall provide the servers that capable of handling ten (10) million metering points.		
9.9.3.2 All the servers' items (CPU, RAM, Hard disks…) shall be dimensioned to answer the operational system performance required for data processing to ensure that the metering data point will be updated in period of 3 hour for one time.		
9.9.3.3 The data of the system will be updated online or the system shall support the multi-tenant architecture.		
9.9.3.4 The servers shall be able to process the data in memory.		
9.9.3.5 The Servers shall be implemented per the full redundancy concept for Main system and Backup System and shall be equipped with sufficient hard disk capacity and main memory to hold the complete data base and to perform basic data analysis, verification, filter and calculation functions, etc… which are required for efficient application server sharing.		
9.9.3.6 The servers shall run in redundancy replication online mechanism. The servers shall meet the growth rate of 10 percent (10%) one year.		
9.9.3.7 Each server shall be mounted in rack space, power and heat dissipation.		
9.9.3.8 Each Server, running preferably under Linux or Windows™ operating system, of a redundant set of servers shall be connected to both LANs to cope with the high availability requirements.		
9.9.4 Work stations		
9.9.4.1 The workstation shall include all hardware necessary to facilitate optimum user interaction with the MDMS and for efficient operational control and monitoring of the KPLC AMI.		

9.9.4.2 A workstation shall consist of the following equipment:		
(a) One or more color LCD (Liquid Crystal Display) monitors.		
(b) One alphanumeric keyboard.		
(c) One audible alarm.		
(d) One cursor control device.		
(e) Processor(s).		
(f) Card Reader Equipment to support (Two Factor Authentication).		
9.9.4.3 If the workstation is dedicated entirely to the GUI, it shall include sufficient capacity to satisfy the user interface performance and capacity.		
9.9.4.4 If the workstation also hosts non-GUI functionality, it shall also satisfy the capacity		

and performance requirements for servers, including main and auxiliary memory requirements.		
9.9.4.5 All workstations shall include facilities to detect the loss of input power, execute an orderly shutdown upon loss of input power, and automatically resume operation when power is restored.		
9.9.4.6 The workstations shall support the resolution of the monitors driven by it.		
9.9.5 Monitors		
9.9.5.1 Each monitor will be of the flat panel (TFT) type with the following characteristics:		
(a) Best video image resolution of 2560 x 1600 pixels (minimum) or higher resolution.		
(b) Minimum screen diagonal measurement of thirty-two (32) inches.		
(c) Anti-glare screen coating.		
(d) Pixel pitch in accordance with the Resolution.		
(e) Minimum viewing angle of 160 degrees (horizontal and vertical)		
(f) Minimum image brightness of 300 cd/m2.		
(g) Image contrast ratio of 1000:1 (typical); 500:1 (minimum) or better than Pixel response of 8 ms or less;		
(h) Colour depth 16.7 million;		
(i) Video inputs: VGA Analogue, using either standard 15-pin Sub-D or dual-purpose DVI 24 pin connector or Digital using DVI-D or HDMI.		
9.9.8.2 **KPLC Corporate WAN**		
(i) The MDMS shall interface to the KPLC's Corporate WAN and KPLC is responsible for the supply of the Corporate WAN.		
(ii) The Supplier shall be responsible for the connections from the MDMS to the KPLC' Corporate WAN.		
(iii) The MDMS shall connect to the Corporate		

WAN via a firewall to be supplied by the Supplier. This connection shall be done by means of an Ethernet interface using Category 6 STP cabling or better.		
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