Oman Electricity Market Rules

Market Rules Procedure

MRP-H: Data, Systems and Communications Processes

MARKET RULES REFERENCE: Section H

Version 1.0

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1. INTRODUCTION

1.1 Scope, Purpose and effectiveness

This Market Rules Procedure (**MRP-H**) sets out:

(a) a description of the Market IT System;

(b) requirements in respect of Party IT Systems, including a specification for Party IT Systems, and procedures and testing requirements for integrating Party IT Systems with the Market IT System;

(c) security requirements applying in respect of Data Communications (including any cyber-security requirements of the Authority);

(d) arrangements for the unique identification of each Party sending or receiving a Data Communication;

(e) arrangements for the authorisation by a Party of representatives to send and receive Data Communications;

(f) data protocols for Data Communications;

(g) the form and format of Data Communication required in respect of each Data Record, including whether it is made by upload to or retrieval from the Market IT System or otherwise;

(h) data validation and rejection protocols for Data Communications sent to the Market Operator;

(i) data storage and retrieval requirements;

(j) the basis on which the Market IT System will record and log the making of each Data Communication, whether it is validated or rejected, and the time at which it is effective;

(k) Alternative Communication means; and

(l) arrangements for planned downtime of the Market IT System and the impact of such downtime on Data Communications.

The Parties to the Oman Electricity Market Rules (**the Market Rules**) must comply with the requirements set out in this MRP.

1.2 Market Rules Provision

This MRP-H should always be read in conjunction with the Market Rules.

This MRP-H has been produced in accordance with the provisions of the Market Rules, in particular Sections H of the Market Rules. In the event of an inconsistency between the provisions of this Statement and the Market Rules, the provisions of the Market Rules shall prevail.

1.3 Review Procedure

The Market Operator may review this MRP-H from time to time and make changes, subject to the Authority's approval in accordance with Market Rules Section C.6.2.

1.4   Definitions and interpretation

Save as expressly defined, words and expressions defined in the Market Rules shall have the same meanings when used in this MRP-H. The rules of interpretation set out in Section B.3 of the Market Rules shall apply in the interpretation of this MRP-H.

References to particular sections relate internally to this MRP-H unless specifically noted. References to Market Rules sections are to the relevant sections of the Market Rules.

1.5   Compliance with MRP

Parties to the Market Rules are required to comply with this MRP-H under the terms as set out in the Market Rules. This MRP-H does not create any additional rights or obligations.

2. DESCRIPTIVE OVERVIEW

2.1 Market IT System

The Market IT System is referred as the Market Management System (MMS). GE Power Solutions LLC developed and implemented the MMS including software development and hardware purchase and installation. The MMS is based on GE's e-terraTDF (Time Series Derivation Framework) product and e-terramarket clearing module (market scheduling engine).

The Market Operator is responsible for operating and maintaining the Market IT System and ensuring its functions are compliant with the Market Rules. The main functions of the Market IT System are to enable:

- Market Participant and Facility Registration.
- Acceptance of Market Party Energy Offers and other data.
- Market Clearing
- Data Exchange
- Recording and Data Aggregation
- Settlements calculations
- Scarcity calculations
- Reports publication

The system solution consists of three (3) interacting systems, namely the market trading System, Market Scheduling System and market Settlement System. These three packages of systems are on three separate instances of e-terraTDF and integrated through Application Programming Interfaces (API).

The market trading System allows access, operation, reporting and administration of the market through several interfaces:

- A Role Based Web User Interface accessible to the Market Operator, the Pool Participants, Power Procurer, the Authority and the Transmission Company, allowing each Party to perform their role in the market.

- A Web-Services API exposed to the Market Scheduling System, the Market Settlement System and to third Party systems such as the market website, and the Pool Participants IT systems.

The Market Scheduling System provides for the administration, control and the execution of the market calculations which determine the Market Schedule Quantities, System Marginal Price and Scarcity Results. This includes the collection of the calculation inputs, processing input and output data, the mathematical optimization and export of results to the Market Trading System and Market Settlement System.

(a) The Market Settlements System provides for the administration, control and the execution of the meter data aggregation calculations, settlement calculations and the production of the settlement statements for each participant. This includes the collection and validation of the inputs from the Market Trading System, the detection of missing data, the control and the validation of the calculations and the calculation results export to the Market Trading System.

2.2 Party IT Systems

Each Party other than the Market Operator shall provide, operate and maintain its own Party IT Systems.

The functions of a Party IT Systems are:

a) To create data that is required to be submitted by the Party under the Market Rules
b) To enable the Party to send and receive Data in accordance with the data and communication protocols in this document and the market rules; and
c) To interface with the Market IT System for that purpose.

Hardware and Software requirements

The minimum recommended workstation requirements for interacting with the MMS are
- 2 GHz processor
- 4 GB of memory
- 2 Mbps Internet connection
- A valid certificate provided by the Market Operator

By meeting these standards users will ensure timely exchange and processing of data with the MMS.

The MMS interface has been tested on Chrome Browser but is compatible with most common browser software such as Explorer, Firefox etc.

2.3 IT Security of the Market IT System

The MMS is built on the GE framework e-terraTDF (Time Series Derivation Framework), which is configured and customized to match the Oman Electricity Market business requirements.
In e-terraTDF, security is built into the system: a fine-grained and all-encompassing authentication and authorization sub-system controls access for features and data. By proper use of encryptions, end-to-end data integrity and confidentiality is maintained throughout business operations.

a. Secured exchanges

When supported by the underlying channel, the solution uses secured protocols such as HTTPS, SFTP, LDAPS. Secured protocols are supported both for inbound and outbound interfaces. The set of accepted combinations of protocols (TLS 1.x), and cypher suites is restricted to the most secured ones, as recommended by reference configurations.

b. 2-factor authentication for the user interface

Users are identified through 2-factor authentication: X.509 client certificate and user/password. As a first level of authentication, the web front server checks the validity of the client certificate against the registered Certificate Authority. If the client certificate is valid, the client request is forwarded to the Application Server where a

login screen is displayed. The user must enter a valid user/password for getting access to the application.
User credentials are always exchanged securely over an HTTPS connection.

c. 2-factor authentication for web services

Access to web services from external systems requires also 2-factor authentication: each web service client is associated with a technical account protected by user/passwords and a client certificate. The SOAP request must hold a valid client certificate that is checked by the frontal web server. Then at the Application Server level, the SOAP request is inspected for a valid web service security token holding the account's login/password. Web service credentials are always exchanged securely over an HTTPS connection.

d. Role-based authorization

Users are granted roles that contain several permissions. Permissions determine whether a user can access:
    • a function,
    •a function for a given payload (business type, interconnector name, determinant name, etc.).

Permissions management is built into the core e-terraTDF's architecture: permissions are applied securely and consistently throughout the code, at the service level, thanks to a global security interceptor. This interceptor clearly isolates business code (services) from the customer-specific decision to allow or deny access to the corresponding function.

e. Users, Roles and Permissions Management

Dedicated widgets allow the authorized user to visualize and edit Users, Roles and Permissions.

f. User Authentications and Password Policies

Redundant LDAP servers are used to store system's users and for authentication when accessing the system, LDAP servers support policies regarding passwords management, a set of rules are available to control how password are administered in LDAP based directories. The system security is improved by securing the passwords across all the platform, a set of rules are enforced to password usage. These rules are made to ensure that users change their passwords periodically, passwords meet construction requirements, the re-use of old password is restricted, and to deter password guessing attacks.

2.4   Party identification

Each individual user will be given a unique logon to the MMS which will be associated with the Market Party they are representing. This Logon will be accompanied by a user generated password and a certificate that will be generated by the Market Operator on request for access.

When Accessing the Interface or Exchanging data with the MMS, user will be required to identify themselves using their unique logon and password. This will allow the user access to information relating only to their associated Party and general information that is available to all Parties.

Users cannot access multiple Parties Data using the same certificate. If a user is representing multiple Parties, they will need a separate logon and certificate for each Party.

The Power Procurer, Transmission Company and Regulator will all be provided a read only access to all Parties data that is relevant to the operation as outlined in the Market Rules.

2.5   Authorisation of representatives

Within each Party, appropriate levels of access need to be given to individual staff members depending on the functions they need to fulfil with regards to the Market Rules. Each Party shall ensure that at all times it has appointed one or more authorised representatives.
This section establishes the procedures which Parties need to follow when authorising representatives to send and receive Data Communications and (in the case of an Other Party) to access the Market IT System on behalf of such Party, covering:

a. Establishing levels of authorisation

Each Party has levels of authorization established in the MMS according to roles stated in the Market Rules for the Pool Participants, Transmission Company, Power Procurer and Market Operator and this is depending on the applicable functions needed to be carried out by the Party in the MMS such as Registrations, Testing Schedule Notices, Performance Test Requests, Availability Certification Details, PPA Information, Market Messages, and Disputes.

b. How to authorise a representative

An official request from the Party for authorising a nominated representative shall be sent to the Market Operator and certain essential details of the nominated representative are also required to be submitted along with the request. These details are name, position, company email address, and mobile number of the nominated representative.
The Market Operator will create and provide a digital certificate as Secure Sockets Layer (SSL) to the representative in order to be installed in his workstation. In addition to that, a user account in the MMS will be created and furnished to the representative for his Party.

c. Duration, expiry, and renewal of an authorization

An authorization for a given representative will be valid until the receipt of official notice from the concerned Party stating the effective date of representative's employment status in terms of resignation or internal company relocation. There is no requirement for a periodical renewal of authorization.

d. Withdrawal of an authorisation

Withdrawal of an authorization will be appliable for cases associated with the Termination of Withdrawal of Market Party for a particular Party (Generator) as per the Market Rules. The Market Operator will revoke a digital certificate granted to the representative as well as cease his user account in the MMS.

2.6   Data protocols for Data Communication

Parties to the Market Rules are required to follow specific Data Protocols in order to submit and receive Data through Market Management System.

a. Procedures for submitting and receiving a Data Record

In order for a Party to submit and receive a Data Record, they have to have a stable internet connection and a valid access certification issued by Market Operator Certified Authority (CA). All Parties will communicate with Trading System, either through Market Participant Interface (MPI) using HTTPS protocol, or via web services.
SOAP web services support XML only and the MPI support downloading and uploading in both CSV and XML formats.
The Trading System receives data from the Parties as follows:
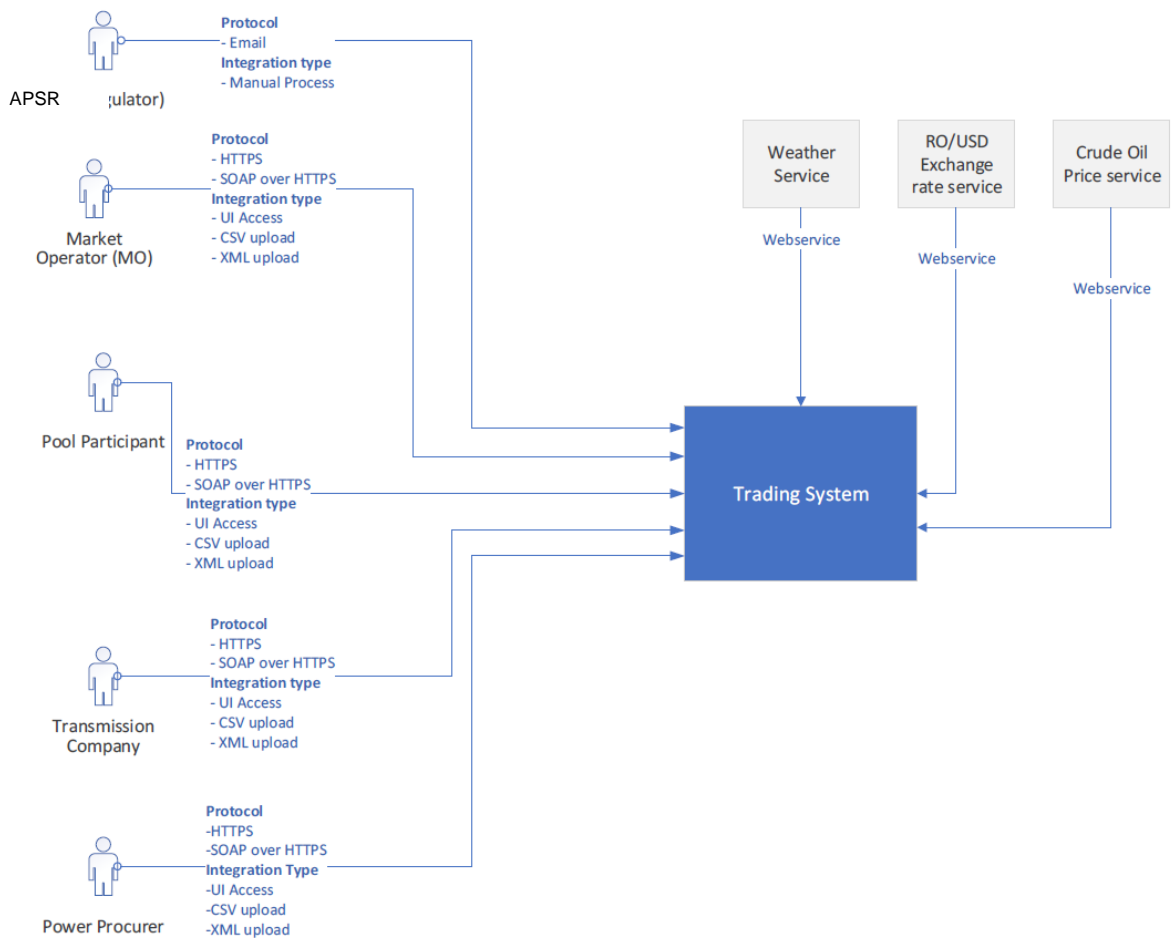

Figure 1: Trading System input data

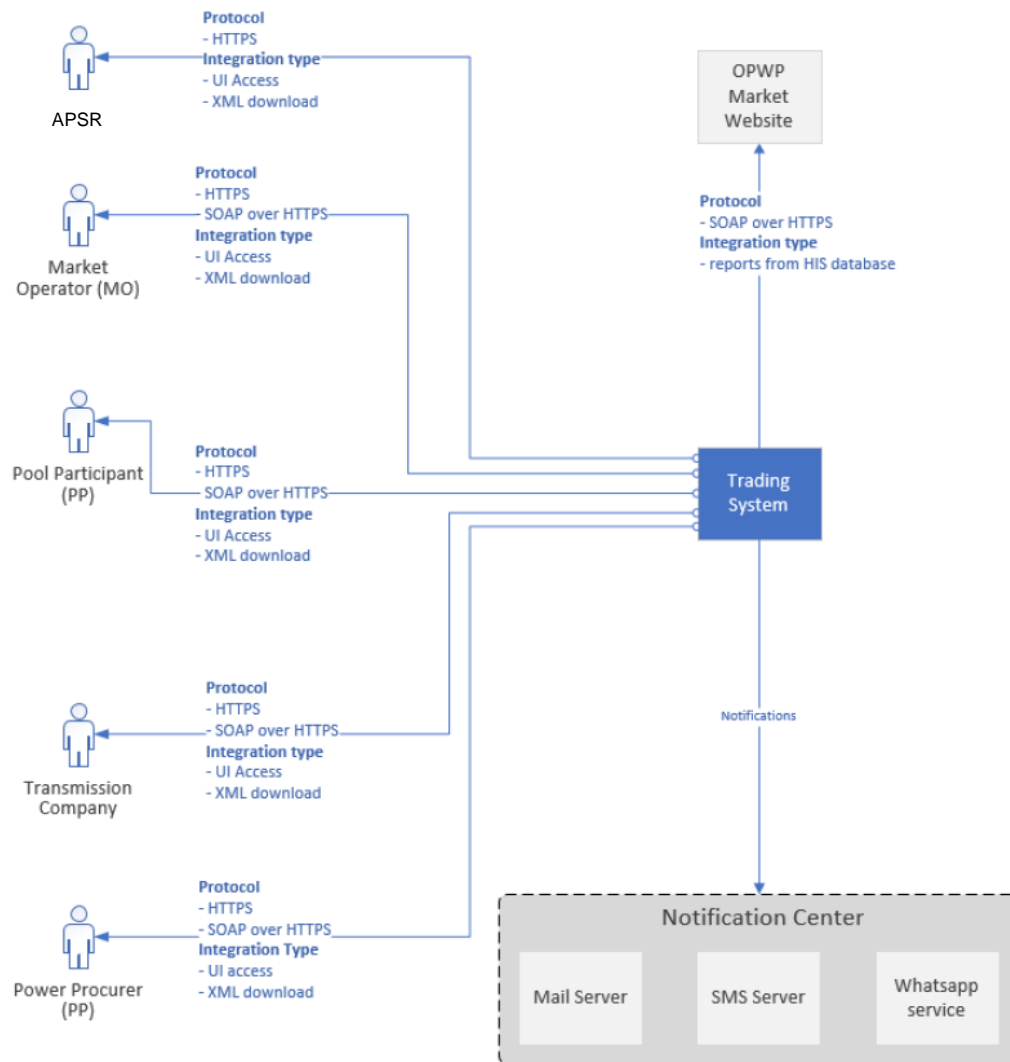The Trading System sends data to the Parties as follows:

Figure 2: Trading System output data

For each submitted message, an acknowledgement is generated including the result of the message validation.

Using MPI

Parties are able to submit Data Records either by uploading valid XML or CSV files to the MMS or by entering the data manually into the User Interface (UI). Besides, Parties are able to download all output files published by the Market Operator.

To submit or receive Data from MMS using MPI, the below procedures shall be followed:

i) Navigate to MMS Trading Interface
ii) Login with a valid username and password
iii) **If the user wishes to upload the Data Record file:**

User shall upload a valid xml or csv file through *File Management Widget*
If the uploaded file is acknowledged as *accepted*, user shall be able to view it from *Schedules > Daily Schedules* Menu or *Energy Offer* menu for Offer Data.
If the uploaded file is acknowledged as *rejected*, user shall correct the error and reupload the file.

iv) **If the user wishes to download the Data Record file:**
User shall navigate to *Schedules* Menu or *Energy Offer* menu for Offer Data and choose the name of the file they wish to download and the applicable Trading Day then click on *Extract* button and choose the desired format (XML, CSV, or Excel).

v) **If the user wishes to enter the Data Record manually into the UI:**
User shall navigate to *Schedules > Daily Schedules* Menu or *Energy Offer* menu for Offer Data and choose the name of the file they wish to upload and the applicable Trading Day and create new draft.
Then user shall enter the data manually for all Trading Periods as applicable and save the record.

XML formats

e-terra*TDF* includes internal ENTSO-E like formats to import or export any time series or standing data entities using XML files or SOAP Web Services. These formats will be used for all XML data exchange types in the MMS system.
An "xsd" file or "XML Schema Definition" specifies how to formally describe the elements in an Extensible Markup Language (XML) document.

CSV formats

Although XML is the preferred business-to-business communications standard for its many benefits (automatic validation, hierarchical data organization, etc.), CSV format (Comma Separated Values) will be also supported. XML and CSV files will pass through the same business validation rules.
The supported CSV format will be a hybrid of standard CSV formats and self-defining formats such as XML. This format extends the standard CSV format to include record-type information to permit the inclusion of multiple record types in a single file.
There are three fields used to provide record-type information:
1. An initial character that identifies the general type of record;
2. a name that identifies the record type; and
3. a name that identifies a record attribute

The initial character identifies the record as either an information ("I") record (header information), a data ("D") record or a comment ("C") record. There should be one "I" record for each record type, and there can be as many "D" and "C" records as required. All records have a common structure as illustrated in the following:
I,<record type >,<name of record attribute #1>,< name of record attribute #2>,…
D, <record type>,<name of record attribute #1>,< name of record attribute #2>,…
C,<free-text comments>

When data is defined using this CSV format, several record types may exist in the same file.

Using webservices

Parties are able to submit and receive Data Records by using SOAP webservice in XML payload only.

For any submission, validation rules will check the data content and the business process state to determine if the received data is acceptable or not.

For each received message, an acknowledgement is generated including the result of the message validation. In case of failed validations, an explicit rejection reason will be logged within the database and included in the acknowledgement message. It will include the Input type, the message identification and version and all other relevant detail to easily diagnose which data caused the validation failure.

The default behavior for files that include partial validation errors is to process the contents of the file that are correct and provide warnings on failed validations.

b. Timing of Data Record submissions

All Data Records must be submitted as per the timeline specified in the Market Rules Annex I-1 and Annex H-1. Parties are able to revise their Data Record before Gate Closure.

The below table identifies the opening and closing time for the submission of each Data Record. The file will not be accepted if it is submitted outside below timing boundaries.

a) System Data Records

Data Record	Sending Party	Receiving Party	Open Time	Close Time
Reserve Holding Thresholds	Power Procurer	Market Operator	d-1 00:00	d-1 10:00
Ex-Ante Spinning Reserve Requirement	Transmission Company	Market Operator	d-1 00:00	d-1 11:00
Inputs for Forecast Pool Demand	Transmission Company	Market Operator	d-1 00:00	d-1 11:00
Forecast System Exports	Power Procurer	Market Operator	d-1 00:00	d-1 11:00
Ex-Post Spinning Reserve Requirement	Transmission Company	Market Operator	d+1 00:00	d-1 12:00
Demand Shedding	Transmission Company	Market Operator	d+1 00:00	d-1 12:00
System Exports	Transmission Company	Market Operator	d+1 00:00	d-1 12:00

b) Offer Data Records

Data Record	Sending Party	Receiving Party	Open Time	Close Time
Structural Offer Data	Pool Participants	Market Operator	At Registration and thereafter as updated	At least 20 Business Days before effective date
Commercial Offer Data	Pool Participants	Market Operator	d-5 00:00	d-1 10:00
Technical Offer Data	Pool Participants	Market Operator	d-5 00:00	d-1 10:00
Revised Commercial Offer Data	Pool Participants	Market Operator	d-1 10:00	d+1 12:00
Revised Technical Offer Data	Pool Participants	Market Operator	d+1 10:00	d+1 12:00

c) Supplements to Offer Data Records

Data Record	Sending Party	Receiving Party	Open Time	Close Time
Curtailed Quantities	Transmission Company	Market Operator	d+1 00:00	d+1 12:00
Actual Availability	Pool Participants	Market Operator	d+1 00:00	d+1 12:00
Genset Actual Availability	Transmission Company	Market Operator	d+1 00:00	d+1 12:00
Fuel Consumption Data	Pool Participants	Market Operator	d+1 00:00	d+1 12:00

d) Dispatch Data Records

Data Record	Sending Party	Receiving Party	Open Time	Close Time
Genset Dispatch Quantity	Transmission Company	Market Operator	d+1 00:00	d+1 12:00

e) Meter Data Records

Data Record	Sending Party	Receiving Party	Open Time	Close Time
Required Meter Data	Pool Participants	Market Operator	d+1 00:00	d+1 10:00

c. Default rules for submitting and receiving Data

- Parties can submit and receive Data Record if they have access to the MMS.
- Each Party is permitted to submit and receive files which are belongs to them.
- Data Records submitted after Gate Closure will be rejected by the MMS.
- MMS is accepting files in XML or CSV format only.
- Parties can receive the Data Record in different formats which are XML, CSV, Excel and PDF.

2.7   Form and Format of Data Communications

For the Market IT System to readily process the submitted Data, standard formats have been developed for the Data Communications required by the Market Rules.

All external Parties and systems will communicate with the MMS through Trading System. The Market Trading System allows access, participation, operation, reporting and administration of the market through several interfaces Web User Interface or Web-Services APIs.

The Trading System receives input data from the following Parties:

- Market Operators and Power Procurer through CSV or XML file upload, User Interface (UI) entries or through SOAP Web Services.
- Pool Participants through XML or CSV file upload, UI entries or through SOAP Web Services.
- Transmission Company through CSV or XML file upload, UI entries or through SOAP Web Services.
- External data feeds through Web Services that have been subscribed by OPWP, including:
  - Weather Forecasts
  - Crude Oil Prices
  - Currency Exchange price

To download all output files published by the Market Operator, Parties can login into the Trading System using the Market Participant Interface (MPI) and download the required files in either csv, xml or excel format.

In addition to the MPI, a SOAP web service is provided to query output data.

2.8   Data validation and rejection

To ensure Data Communications are fit for the purposes of the Market Rules, a procedure to check if submitted files are valid or not need to be developed.
The MMS performs validation on all Data Records prior to its acceptance. This validation consists of both technical validations such as formatting and compliance with xml schemas, and Market Rule validation against registered standing data .The files are considered valid if they are:

a)   complaint with xml or csv format;
b)   compliant with the registered standing data;
c)   compliant with the requirements of Market Rules;
d)   compliant with MMS declaration gates;
e)   complete; and
f)   is the Party, according to the Market Rules, has the permission to submit such file.

2.9 Data storage and retrieval

Data Communications made for the purposes of the Market Rules are stored and if required retrieved from storage, including:

(a) Data Records are stored in the MMS storage for both operational and historical use.

(b) Two sites have been implemented to store the Data Records which are the Primary Data Center (PDC) and Disaster Recovery Data Center (DRDC). The Data Records are replicated between the two sites by a fiber connectivity.

(c) A backup solution is implemented as part of the MMS infrastructure and multiple backup policies have been scheduled so another mean for the Data Records is ready for retrieval in case of a loss in the main storage.

(d) Different Access levels for retrieval of Data Records are implemented which are:

   i. Public: accessible by all Parties to the Market Rules and the general public;

   ii. Private: accessible by all Parties to the Market Rules;

   iii. Confidential: accessible by the Market Operator and the individual Party the Data relates to; and

   iv. MO only: accessible only by the Market Operator.

2.10 Recording and logging of Data Communications

The following details will be recorded and logged for any Data Communication made through MMS:

(a) Each data uploaded to the system either through web user interface or web service will have a unique identifier, named as document identification.
(b) A unique identification of the Party sending the data, named as sender identification
(c) The timestamp for Data Communication (DD/MM/YYYY HH:MM:SS)
(d) The size of the file
(e) The content of the file
(f) The result of file validation either accepted or rejected.

2.11 Alternative Communication Means

Pool Participants are allowed to use the following Alternative Communication Means as valid forms of communication for the duration of Communication Failures and System Failures. The Alternative Communication Means are:
   a) Email: all data communication shall be sent to Market Operation common email address only. Data sent to another email addresses will not be considered.
   a) Electronic data storage devices;
   b) Paper based; and
   c) Telephone.
As set out in Section H.5.1.3. of the Market Rules, these Alternative Communication Means are only valid forms of communication for the duration of Communication Failures and System Failures.

2.12 Market IT System downtime

a. Planned outages

Planned outages of the MMS will be notified to users via email and through the Market Notifications within the MMS. Updates to the MMS will be periodically scheduled and timed to cause minimal impact on the day-to-day operations of the Market Systems. The Market Operator will notify the parties at least 5 days in advance before the planned outage. Planned outages may occur due to

- System Upgrades related to Market Rule changes
- Defect correction
- General System Maintenance
- Redundancy Testing

During Planned outages, the MMS will be unavailable for the submission of any Data or the exporting of Data. Before a Planned outage is commenced, the MMS will be backed up and all data submitted and received prior to the outage commencement will available when the system is restarted.

b. Defect and Issue reporting procedure

Participants should contact the Market Operator operations team initially to discuss any issues or identified defects with the MMS. The identified defects shall be also reported in written for the purpose of record.