TECHNICAL SPECIFICATION

SCOPE OF WORK: Implementation of Market Management System for Moldelectrica

PERIOD OF PERFORMANCE: 12 months

PLACE OF PERFORMANCE: Chisinau, Moldova

The objective is to strengthen Moldova's energy security by: (1) advancing physical and market integration of the Moldovan energy sector with Europe; (2) increasing renewable energy integration; and (3) increasing investment in energy efficiency and domestic power generation, particularly through increased adoption of renewable energy technologies.

The expected outcomes of this activity are to:

- Delivery and installation of hardware equipment and 3rd party software

- Detail design and drawing. High level and detailed design (HLD & LLD) documents shall be produced with details commensurate to the viewpoint such as conceptual, logical, physical and deployment views of the target design for Moldelectrica to review and approve before commencement of implementation. As per industry accepted practices, these design document should contain all relevant information for Moldelectrica to make informed decisions with regards to the effectiveness and fitment of the target design, such as architecture decisions, risks, assumptions, issues, dependencies, network communication, information flow, process flows, etc.

- Development and Implementation of Market Management System including interfaces with other systems and databases filled up as required to start operation

- Training for Moldelectrica

-Testing and documentation

-Warranty, Maintenance and software support for one year including spare parts stock.

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ACRONYMS

Acronym	Meaning
AAC	Already Allocated Capacity
ACER	European Union Agency for the Cooperation of Energy Regulators
AD	Active Directory
aFRR	Automatic Frequency Restoration Reserve
API	Application Programming Interface
ATC	Available Transfer Capacity
BD	Bill Determinant
BRP	Balance Responsible Party
BSP	Balancing Service Provider
CIM	Common Information Model
CSV	Comma Separated Value
CZC	Cross Zonal Capacity
DAM	Day-ahead Market
ECAN	ENTSO-E Capacity Allocation and Nomination System
ENTSO-E	European Network of Transmission System Operators
FCR	Frequency Containment Reserve
FSKAR	Financial Settlement of KΔf, ACE and ramping period
GL	Grid Losses
HTTPS	Hypertext Transfer Protocol Secure
IDM	Intra-day Market
JAO	Joint Allocation Office
JDBC	Java Database Connectivity
LDAP	Lightweight Directory Access Protocol
LFC	Load Frequency Control
mFRR	manual Frequency Restoration Reserve
MMS	Market Management System
MP	Market Participant
NTC	Net Transfer Capacity
ODBC	Open Database Connectivity
PS	Power System

PTR	Physical Transmission Right
REMIT	Regulation on Wholesale Energy Market Integrity and Transparency
RES	Renewable Generation
RR	Replacement Reserve
SCADA/EMS	Supervisory Control and Data Acquisition/Energy Management System
SFTP	Secure File Transfer Protocol
TRM	Transfer Reserve Margin
TSO	Transmission System Operator
TTC	Total Transfer Capacity
UI	User Interface
WLAN/LAN	Wireless Local Area Network/Local Area Network
XML	Extensible Markup Language

0 Backgroud

0.1 The Purchaser

The beneficiary of the system will be Moldelectrica (MEL). MEL provides transmission services and centralized dispatch services to energy companies in Moldova, enables cross-border and internal energy markets, supports capacity allocation, and provides balancing market and imbalance settlement services.

0.2 Business Objectives of the Purchaser

The transmission system operator Moldelectrica was certified on 11 July 2023 as an independent system operator (ISO) - the only licensed Transmission System Operator (TSO) in Moldova authorized to operate and ensure the development planning of the transmission network of Moldova, who is entitled to ensure the centralized dispatch process of the electricity system.

The National Control (Dispatch) Centre, or NCC, of Moldova is located at MEL headquarters and it provides control over the operations of Moldova power system and ensures overall system reliability and proper operation of 400/330/110/35 kV transmission facilities under the normal operational mode, as well as in emergencies. MEL is in the process of replacing its real-time control system with a modern SCADA/EMS system to achieve various business objectives.

MEL needs to implement an overall Market Management System to meet the requirements for developing electricity market in Moldova and the commitment to be part of the single European market and full member of the ENTSO-E. Such system needs to support activities related to scheduling of internal and external energy trades, cross-border capacity calculation, allocation and nomination, balancing activities, settlement services, communication with external systems and reporting mechanisms.

Thus, new MMS together with the new EMS/SCADA shall improve the system operation, facilitate the open market development as well as the energy exchange within the country and with neighboring countries. MMS interaction with new EMS is an absolute must.

0.3 Contractor

The Contractor shall have experience in assembling MMS system and modules as required by market model and have a good base product line of state-of-the-art, EU and ENTSO-E conform IT characteristics.

The Contractor shall make a proposal for project management, task analysis, function implementation, hardware and software delivery and system integration services. The Contractor shall design, develop, supply, install and commission the complete system for MMS and related communication channels. Three environments - Production, Test and Disaster Recovery site are encompassed by this procurement.

It is the Contractor's responsibility to include in the Bid, and in Works, Supplies and services all items necessary to render turn-key complete and functional systems properly interfacing with external platforms.

The absence of mention of any specific items in this chapter, in the technical specifications, or in the price schedules shall not relieve the Contractor of this obligation.

1MMS functional overview

1.1 BUSINESS REQUIREMENTS

For Moldova to implement the European target model for electricity wholesale markets, changes in the laws, market rules, business processes need to be implemented. Moreover, numerous functions must be operated by Moldelectrica in order to become full member of ENTSO-E in line with SAFA Catalog of Measures. Finally, the transposition of Electricity Network Codes in local legislation and its implementation for forward, day ahead and intraday markets and timeframes followed by required balancing services is the final target model to which Moldelectrica is heading at.

Moldelectrica, the Transmission System Operator, is responsible for scheduling transactions between market participants, supporting allocation of cross-border transmission capacities in both long-term and short-term time frames, providing balancing services to the market and procuring ancillary services and the energy needed to cover transmission network losses. The TSO is responsible for all reporting and settlement tasks in relation to its market activities. All those functions are subject to Market Management System (MMS) and are under scope of this project.

Market operator (MO) is operating organized electricity market on the day-ahead and intra-day time frames in an implicit manner, while Allocation Platform (AP) is conducting explicit forward capacity allocation on yearly and monthly time frames. The latest two subjects and their functions are yet to be implemented in Moldovan energy market and are still under responsibility of the TSO.

1.2 BUSINESS PROCESSES AND MODULES

The solution delivered shall conceptually meet the design represented in Figure 1 and will support market activities according to ENTSO-E regulations.

MMS functions shall be built on a common platform, where functional modules can exchange the necessary data internally with each other and externally with other systems and user/participants.

References for data exchange between the modules, systems and/or Market Participants must follow implementation guides, policies and standards available at https://www.entsoe.eu/publications/electronic-data-interchange-edi-library/ but not limited to :

- ENTSO-E EIC DATA EXCHANGE IMPLEMENTATION GUIDE VERSION 1.2
- ENTSO-E CAPACITY MANAGEMENT MODULE IMPLEMENTATION GUIDE VERSION 1.1
- ENTSO-E RG CE Schedule Reporting Process IMPLEMENTATION GUIDE VERSION 2.1
- ENTSO-E ESS (ETSO Scheduling System)
- ENTSO-E ECAN (ENTSO-E Capacity Allocation and Nomination System)

- IEC 62325-451-6: Transparency Platform publications
- COORDINATED CAPACITY CALCULATION IMPLEMENTATION GUIDE
- Synchronous Area Framework Agreement for Regional Group Continental Europe Annex 3: Policy on Accounting and Settlement
- Synchronous Area Framework Agreement for Regional Group Continental Europe Annex 3: Policy on Scheduling
- ENTSO-E automatic frequency restoration reserve process implementation guide
- Common Platform for manually activated frequency restoration reserves IMPLEMENTATION GUIDE
- Accounting and Financial Settlement Of Kf, ACE And Ramping Period (FSKAR)

Functional specification, processes and all activities need to be aligned with published Moldovan legal framework, as well as any modifications made during the implementation phase and warranty period.

The Market Participant Registration and Standing Data module on the one hand serves as an interface to feed market participant data into MMS and on the other hand also as a central repository of these data in order to support the operation of all functional modules of MMS.

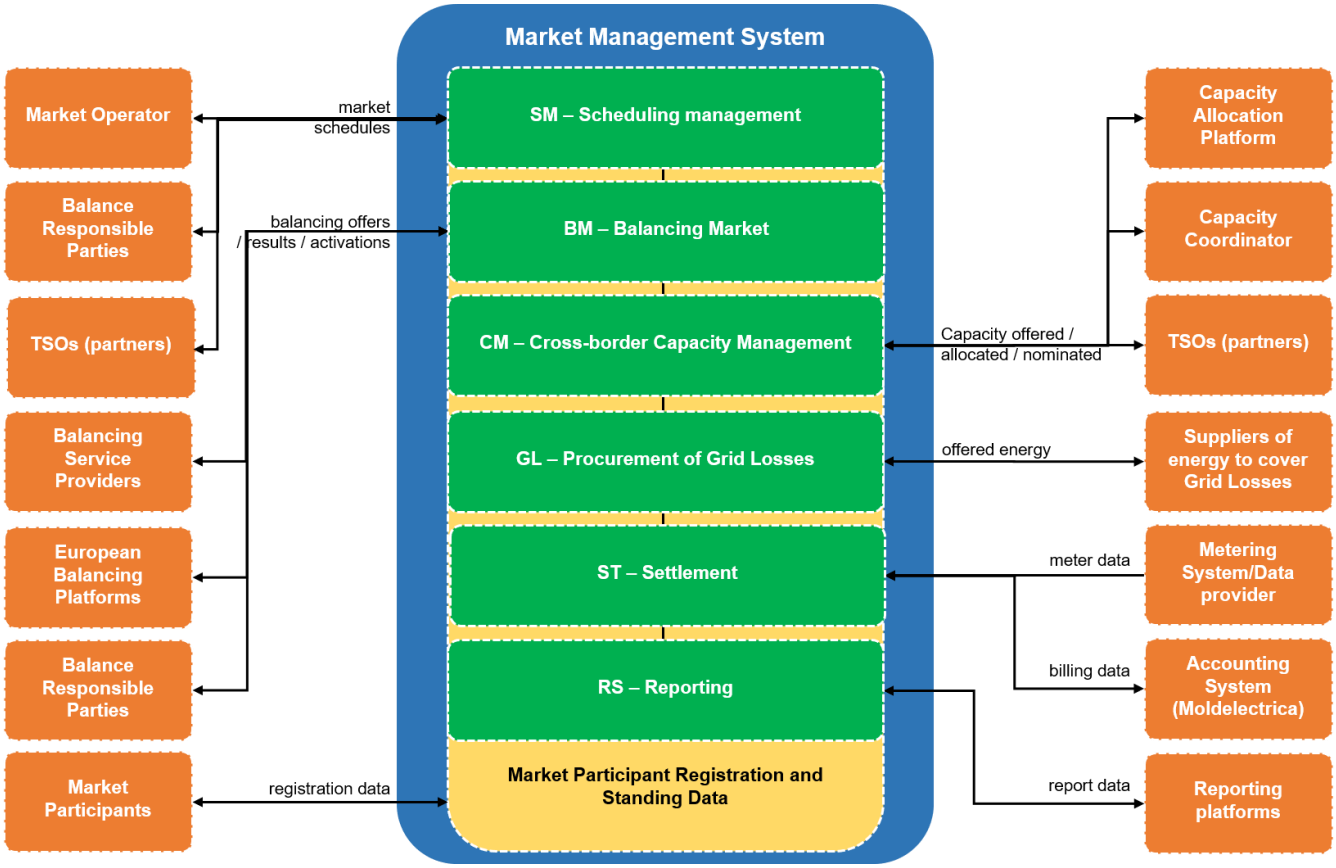

Figure 1. Overview of Market Management System functions

The Scheduling management module is responsible for supporting the planning processes, where BRPs, partner TSOs and the Market Operator exchange schedule data with MMS. This information will be used by other MMS modules.

The operation of the balancing market is supported by the Balancing module by receiving balancing offers from Balancing Service Providers, clearing of balancing markets and activating required balancing services. In addition to this, MMS shall support the cooperation with European Balancing platforms to integrate Moldova's balancing market with other European balancing markets.

Responsibilities of Moldelectrica in terms of Cross-border Capacity Allocation on several time frames shall also be supported by MMS. In cooperation with partner TSOs, this module shall execute the calculation of offered capacity to the market and also the cooperation with external allocation platforms, following the requirements of these platforms. MMS shall also be capable of supporting a coordinated capacity calculation process according to the ENTSO-E regulations.

Moldelectrica has the responsibility to procure the energy required to cover grid losses in a non-discriminatory and effective way. MMS therefore shall be capable of organising electronic auctions for the procurement of such energy on different time frames.

The Settlement module shall realise all financial settlement calculations, which result from Moldelectrica's market related activities. This module is heavily dependent on data from other MMS modules and from the external metering system. This shall cover e.g. the settlement of imbalances, the settlement with balancing service providers,TSO-TSO settlement, etc. Settlement results shall be communicated to market participants and Moldelectrica's internal accounting system. The currency used within the system is euro (EUR) and national currency (MDL)

The Reporting module is accountable for generating all reports, which are defined by local or international regulations (e.g. ENTSO-E, ACER). It shall also support Moldelectrica's everyday market management activities. Report information will be shared with market participants or regulator, and will also be published on Moldelectrica's official internet site.

2MMS general requirements

2.1 System-level requirements

The MMS platform should be scalable, expandable and adaptable, in order to allow for new market rules, new functions and users to be added to meet the market expansion as well as potential modifications in the regulatory framework. The delivered software should be flexible enough to be easily configurable and be able to support new rules and the evolution of the market architecture.

The mathematical formulation of the market applications should be implemented to meet the MMS functional specifications. Moldelectrica should receive adequate documentation regarding the market applications, including the mathematical formulations in order to have a proper understanding of the algorithms and mechanisms, as well as to be able to configure and modify them as far as possible.

Use of standard protocols is mandatory wherever they exist. User interface should be provided to configure main MMS parameters such as gate closure etc. The system dimensions shall be enough to meet the development in the next 10 years, this will be finalized in the Detailed Design Phase. The system shall contain adequate spare computing resources to allow such increases. Additionally, the system shall be scalable to increased network size, number of resources, constraints, and users, without replacing the system through incremental additions of processing or database capacity.

In addition to the Production System, a Development and Testing System that will be a replica of the Production System with its own infrastructure shall be provided. This will provide the environments for developing / modifying and testing new market functions or modify existing ones to meet evolving market requirements. It shall have the capability to import and test save cases from the production MMS and also the capability to automatically transfer approved changes to the Production System. A disaster recovery strategy and functionality should be provided along with the production system, development and testing systems.

All 3rd party and system software should fully support at least the English language. The MMS should provide the capability for the users to choose between the English, Romanian and Russian languages for Operator and Market Participants' UI and reports. The translation of the input text required for Romanian and Russian parts will be provided by Moldelectrica.

Potential modifications in the MMS should not affect other running MMS functionalities and should be completed with a minimum downtime of the MMS platform.

Web--enabled and user--friendly interface should be used for the administration, configuration and setup of applications.

For the sizing of MMS the following parameters shall be considered:

- Planned number of Moldelectrica MMS users: 50
- Number of control area: 1
- Number of bidding zone: 1
- Number of MPs: 1000
- Number of BSPs: 100
- Number of BRPs (theoretically each market participant can be a BRP): 1000
- Number of suppliers of energy to cover grid losses: 50

2.2 Minimum architecture requirements

a) High level Logical architecture (2 locations, data synchronisation, separation from external world)

b) Platforms (Production System, a Development and Test System, etc.)

Market Management System (MMS) shall be installed at 2 different physical locations: the Main Site and the Back-up Site. All hardware equipment installed at Main and Back-up Sites shall meet the minimum requirements listed in the hardware specifications. Figure 3 represents the high-level architecture of MMS.

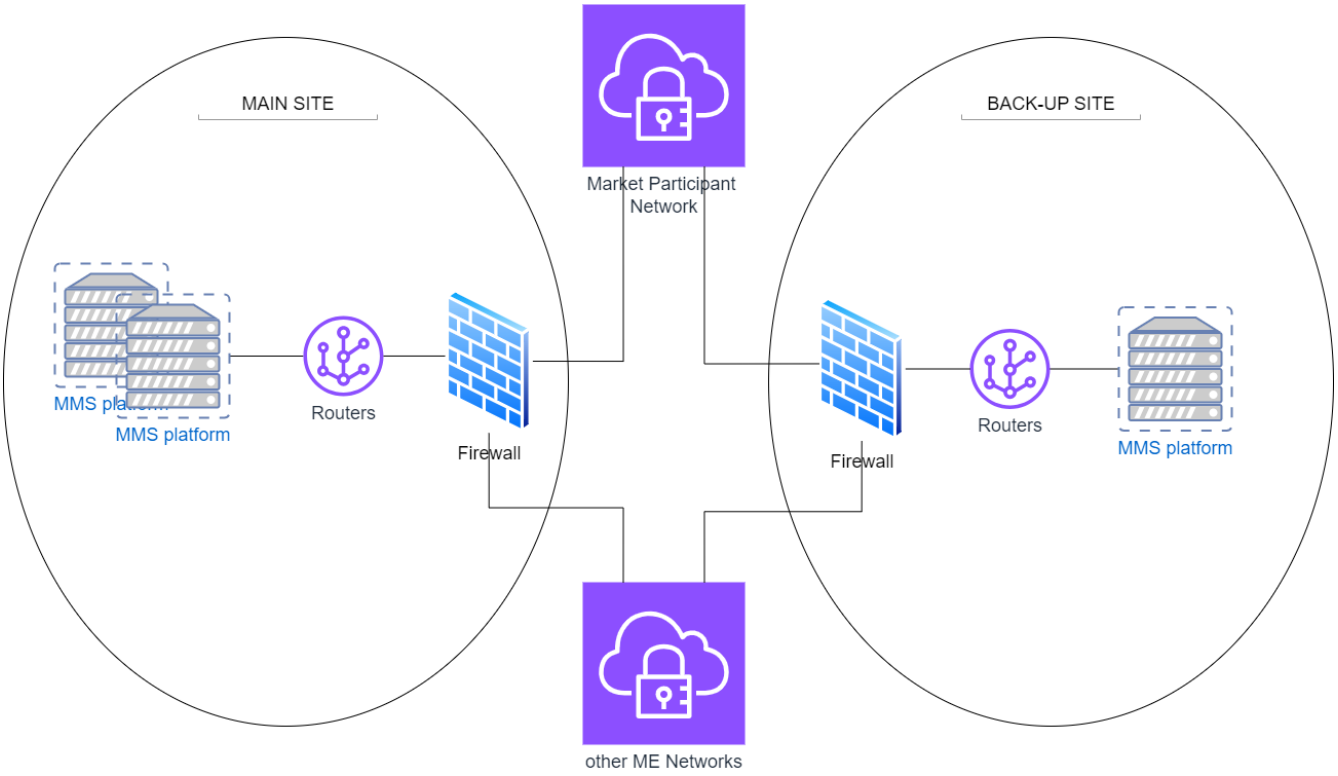

Figure 3. MMS high-level architecture

The MMS System shall be isolated from the Public Internet. All communication from and to the MMS Infrastructure should be monitored and inspected by firewalls. In case virtualization technique is used, the redundant connectivity of the servers to both the Local Area Network and the Storage Area Network as well as the bandwidth needed by the solution must be clearly identified.

All the traffic between the Market Participants and the MMS System should be encrypted. Routers on both sides should support security features.

The MMS system installed at the main site must be fully redundant, while the MMS system installed at the back-up site may be non-redundant. In addition, failover capability from the main site should exist, thus creating a fully redundant MMS Production System.

Data file and database replication between the sites should be provided and be synchronized using a standardized Disaster Recovery technology. The proposed synchronization/replication technique between the two sites should be clearly explained.

2.3 Security requirements

2.3.1 User Authentication

All users should be properly authenticated to use the System and access it's resources. The Contractor shall ensure that Identity Management services for all applications running on the MMS servers are integrated. Identity Management services will indicatively include:

- SSO authentication;
- LDAP / AD secure authentication;
- SSL support;
- User friendly interface for management and monitoring.

Active Directory (AD) central server using Lightweight Directory Access Protocol (LDAP) shall be hosted by the MMS for user authentication. Two-factor authentication (2FA) should be implemented for all users. In addition to 2FA, programmatic access via web services API should also be possible.Tokens should be provided for programmatic access. These tokens should be compliant to current international standards.

Each log-on and log-off shall be reported as an event. The event message shall indicate the date and time the procedure was executed, the name of the console and the identification of the user. User passwords shall be stored in encrypted form. A secure method shall be provided to establish and change passwords and user identifications. A password policy should be established which will define a set of rules, such as password length, formation, blacklists, expiry. Users shall have the ability to change their own passwords.

2.3.2 User Permissions & Roles

After a user has been authenticated, an authorization process shall determine who is allowed to do what and which information he/she is allowed to see and use. A user action shall be allowed only if the user has permissions for the subsystem, display, report or function. At the minimum such actions shall include at least:

- Calling a display;
- Viewing, editing, or printing a report;
- Operating on any value or its attributes;
- Managing any alarm.

MMS should use role-based authorization (a role is a set of permissions) to control access to system objects and data. It shall offer MMS administrators the capability to manage users, roles and permissions and according to that to be able to control who (users) has what access (roles--permissions) to which resources/information by setting the appropriate policies. MMS users shall be granted permission to perform an action based on their role.

2.4 Data management requirements

2.4.1 General Requirements

MMS data should be stored under the context of a 2-tier storage scheme (Primary and Secondary). Primary Storage should hold all Data required for the MMS day-to-day operation, and Secondary Storage should be used for backups.

The MMS platform must at least support the following data storage general requirements:

- Primary and Secondary Storage should be in common disk arrays
- The Secondary Storage should be used for backups
- Tape Data Storage should also be provided for on demand and scheduled backups for long term offline storage.
- Timestamps (when data was created, by whom, and when updated and by whom) should be used for all data records.
- Access to data shall be configurable via security roles.

2.4.2 Effective Date Management

All data must be tagged with an effective date and time. This tag must be used to select the appropriate reference data for each settlement period so that settlement and billing, shall use this data in effect for that settlement / billing period regardless of when settlement or billing is actually run. In addition, all rules set up in the calculator engine must also be similarly tagged.

Transaction inputs and outputs must also be tagged appropriately to ensure that the most current valid data is used. The system must record the run times and track when key inputs are updated to trigger reruns.

2.4.3 Time resolution of input data

MMS input data in general can be in any time resolution. MMS shall handle the following time intervals for the input data: 4 seconds, 1 minute, 5 minutes, 15 minutes, 30 minutes, 1 hour, 1 day, 1 week, 1 month, 1 quarter, 1 semester, 1 year.It is important to note, that in some special cases MMS shall be able to handle time series data with time resolution less than 1 minute. Such situations can be e.g. the data sent/received to/from EMS/SCADA system in relation the execution of aFRR balancing energy activation, or the data sent/received to/from European balancing platforms. MMS administrator could configure input data time resolution.

2.4.4 Data Integrity

The MMS must implement and support declarative and procedural referential integrity to ensure that an entity cannot be inserted, updated, or deactivated in such a way as to have invalid references or orphans of any of its dependents. This referential integrity shall ensure that the databases are not corrupted and that audit capabilities are not compromised.

Referential integrity checks must be performed to ensure that only clean data is used. Any transactions that fail the referential integrity check as well as any invalid records or records with discrepancies must be written to a separate log file for checking.

2.4.5 Archiving

The MMS platform shall at least support the following automated archiving requirements:

- The data retention period (on the live system) should be configurable. At a minimum 36 months of data are to be kept on the live system;
- All data should be kept for at least 10 years.

2.4.6 Back-ups

A back up of data is taken every day (Monday to Sunday). If for maintenance reasons, backups are not performed, they shall be done on the next possible day. System shall execute Monthly Backups with logging in a full or incremental way. The backup should be scheduled to run automatically.

Data to be backed up include the following information:

- Operating Systems
- Applications and all application data (including the software, all 3rd party dependencies, configurations, etc.)
- All Databases

A backup shall be validated every 3 months. As part of this process the capability will be provided to ensure that data can be fully restored.

2.4.7 Auditing Capabilities

The Contractor is responsible for any necessary implementation so that all Applications are fully auditable. In particular, all configuration options, all data input, including input data and changes from the UI, and all data output must be recorded efficiently for auditing purposes and for historical information archiving.

2.5 System Availability/reliability requirements

Every crucial and main function shall be supported by sufficient redundancy to ensure that any single failure will only briefly interrupt the availability of that function. Any function processing on a failed processor shall be automatically restarted on another processor.

Each automatic transfer to backup resources of one or more functions interrupted by a failure shall be completed with no loss of data. Functions that were scheduled to execute during the time that a transfer is occurring shall automatically execute following completion of the transfer.

The Applications/Systems should be available to the users continuously without any interruption to the specified services. Users shall never be disconnected, put on hold or placed in a wait queue. All Web, Application and Authentication/Authorization should be redundant, and database systems should be in database clusters.

The Applications/Systems shall be available for use 24 hours per day, every day. The Applications/Systems shall have no single point of failure. It shall be designed for 99.5% availability. Any failure to equipment, software or networking should be handled by the MMS redundancy.

Thus the back-up site will be used for fallback, as necessary, and then fall forward once the main site systems are restored. In that terminology:

Same site failover processes for the databases shall have a downtime of no more than 5 (five) minutes. Failovers for all other systems and processes should have a downtime of no more than on (1) minute.

Fallback and fall--forward processes of the system between sites shall be manually triggered by the Operator and be automated to the maximum extent. In this case, a fallback or fall--forward process should cause a system downtime of no more than 15 (fifteen) minutes.

Upon restoration of the failed site, the databases shall be resynchronized.

2.6 Hardware and deployment requirements

The MMS system shall be deployed for the solution as per specifications below. The system shall be provided with optimal hardware configuration for the proposed solution. The MMS system shall be designed, installed and configured for both main and backup sites.

2.6.1 Hardware

The hardware capacity and processing power shall be sized/configured based on the scope of MMS system. It shall be designed to allow easy upgrade and expandable scalability, to increase processing power and main memory capacity.

The hardware infrastructure includes servers, disk and tape storage, network hardware (WAN/LAN/routers and network switches, firewalls, cabling, etc.), and includes all software/licenses for managing the hardware infrastructure.

The hardware for the system will be based on standard x86/64-bit architecture, consisting of 19" rack-mounted units.

2.6.2 Deployment

The current physical compute hosting and network capabilities as well as the future planned ones shall be assessed and the best deployment strategy shall be recommended for both the immediate deployment configurations and how to achieve the long-term desired end-state with minimal needed rework.

The servers should be deployed in a virtualised configuration to ensure flexibility in resource allocation. These servers will be exclusively used for MMS purpose and not shared for any other uses.

High level and detailed design (HLD & LLD) documents shall be produced with details commensurate to the viewpoint such as conceptual, logical, physical and deployment views of the target design for Moldelectrica to review and approve before commencement of implementation. As per industry accepted practices, these design document should contain all relevant information for Moldelectrica to make informed decisions with regards to the effectiveness and fitment of the target design, such as architecture decisions, risks, assumptions, issues, dependencies, network communication, information flow, process flows, etc.

2.6.3 Workstations

The MMS system shall be provided with twelve (12) workstations. Two (2)workstations shall be equipped with at least 4 Video Display Unit (VDU) Monitors, of 27" diagonal size, including Keyboard-Video-Monitor (KVM) sets/switches, keyboard and mouse; ten (10) workstations shall be equipped with at least 2 VDU Monitors, of 27" diagonal size, including KVM sets/switches, keyboard and mouse.

2.7 User Interface requirements

2.7.1 General UI requirements

The Applications User Interface (UI) shall combine state of the art technologies in suitable Web pages / Web sites to provide specific users' look and feel functionality according to their privileges.

The UI shall use the MMS Authentication and Authorization process for user login and to grant relevant roles and permissions.

UI displays shall facilitate filtering based on page filters and advance filters. Standard edit, insert, cancel and sort functionality will be available in all Applications displays. UI displays shall allow users to view all versions of data. UI will have the capability to export time series data of a given time period (max. duration of the period is 1 month) and set time resolution.

The Applications UI shall provide user friendly displays and tools to do manual corrections and bulk loading of data. UI displays shall also appropriately support copy/paste functionality.

The UI shall facilitate exporting of data in MS Excel compatible formats. An option shall be available to export selected rows & columns or everything.

The Applications shall provide a full set of displays that shall assist the user to navigate and review the data stored in the related databases.

Indicatively, the Market Applications shall provide the following capability:

- The Applications shall provide all the necessary user-friendly displays to inform the user about data related market operations.
- Information should be provided on the status of the submitted data or files (e.g., XML files with offers, nominations, etc.).
- User shall be able to easily search for or filter for a particular unit or entity in all displays. This shall include, but not be limited to, use of wildcard characters.
- The Applications shall use a workflow controller to manage all executions and the data transactions.

The user shall be able to enter the desired value anywhere within the data entry field. User entries shall be verified and invalid entries detected and reported to the user as user guidance messages. The data entry function shall provide a means to view the acceptable limits of data entry, if an unacceptable entry is detected. All enterable data fields shall be highlighted during the data entry process only. In order to distinguish mandatory enterable values from optional enterable values a different highlight or font will be required. In the displays where enterable fields exist, an on line help is required to inform at least about authorization features, mandatory enterable values, optional enterable values, alternative default values, limits acceptance, and required format for dates, and for decimal numbers.

Data entry UI shall be designed to minimize repetition in case of large changes.

If an insert/edit action is not completed within a specified time limit, the Application/System shall cancel the action and generate an event message. The timer shall be adjustable by the administrator for each user action.

The user shall be able to select another console without cancellation of an active data entry process. However, the user shall be able to end data entry at any time by selecting a cancel command or by requesting a different display in that console. These actions shall cause the data entry process to be terminated and the data values shall remain unchanged.

The ability to select data from one console and paste to another console shall be available if the data format is similar.

MMS shall have the capability to capture currently viewed displays or whole screen images. The image captured shall be stored as a file in an industry standard format, such as .jpg, .tif and .png.

2.7.2 Report Control

The Applications engines shall provide the capability for users to easily view the execution results and create reports at different resource and system levels.

The user shall be able to schedule periodic reports (including multi year, yearly, monthly, weekly and daily reports), direct a report to a display, preview a report on a display, print a report, and archive a report using a report scheduling display. The report scheduling display shall enable entry of the following parameters, with default values provided where appropriate:

- Report name;
- Report format
- Report destination (eg. printer or archiving device);
- Time/schedule when the Application/System should produce the report.

The user shall be able to examine and modify the contents of reports for the current period and for previous report periods using displays. Any calculation associated with the revision of data in a report shall be performed automatically after data entry has been completed.

2.7.3 UI Architecture

The UI system of MMS shall consist of all necessary infrastructures (hardware software) that facilitate the information exchange between Market Participants and Moldelectrica. It should provide:

- Operator's User Interface
- Participant's User Interface

Registered and properly authorized users, including application operators, are connected to this system for submitting data, receiving validation and acceptance of the submitted data or for publishing and viewing data sent and results of the MMS Applications.

The format and content of all exchanged data shall be predefined.

The UI should be able to implement the data import as well data exports from/to other Moldelectrica systems and applications that are not hosted in the MMS.

The UI should be used from internal and external users for submitting/overwriting/viewing technical data and information, depending upon their responsibility and privileges. Solutions with separate UIs for Internal Users (Operators) and External Users (MPs) are acceptable. All requests, from internal or external users, should be propagated and processed through the UI.

The UI should integrate all application respective user interfaces and it should also provide capabilities for integration of future applications.

This UI architecture should either serve both internal and external system users with single infrastructure or be separated into two, one each dedicated to serving internal and external users.

External Users (MPs) should access the UI through dedicated lines, while internal users should access UI through Local Area Networks.

The Contractor may propose for the implementation of the UI any equivalent solution with the same or better functionality and higher availability and redundancy.

UI shall support user-based localisation settings, which makes it possible to select the required time zone for displaying time series data. Time zones of UCT, EET and CET shall be supported as a minimum.

Besides technical logs for each of MMS modules, MMS shall also provide the general message log for each user, where any system wide events (reminders, expected cross-border limitations, MPs data actualizations, pending payment issues, emergency market suspension, etc.) or broadcast message can be registered. This type of events or messages shall be triggered by MMS or by Moldelectrica MMS operator. The MMS should allow users to choose between English, Romanian and Russian for Operator and Market Participants' UI and reports. Moldelectrica will provide the translation of the input text required for the Romanian and Russian parts.

2.7.4 Market Gates

The UI system shall manage the process of opening, closing, shifting and suspending Market Gates that activate the operations of the MMS applications. Further, the UI system shall manage the publishing and distribution of emergency announcements and notifications.

The Market Gates should be set according to the timing requirements of different market business processes.

2.7.5 Schedule and Control of market processes through a calendar

The proposed MMS system shall provide the capability to have market processes scheduled based on a pre-defined calendar. A dedicated calendar view shall support the scheduling of tasks for MMS operator providing an overview on the past, on-going and future processes. By selecting a process, the details of the process shall be displayed. It shall also be possible for the user to reschedule tasks starting from the calendar.

2.8 Validation requirements

a) Based on predefined and configurable validation rules

b) Supports data requests/views

c) Adaptability for market rule changes

d) Audit trail for rule modifications

e) UI for validation rules

The validation of submitted data from the users shall be based on validations rules. At a high level, the validation includes the following:

- Validate data submitted by the MMS Operator and the MPs. The Contractor is expected to implement the validation rules using a standardized "rules engine" (or equivalent) framework.
- Viewing and auditing capability of all submitted data.
- Capability to control the flow of data during
    - a. submission of declarations by Participants
    - b. the publication of declarations to each application,
    - c. data flows from each application module
- Support for Operator requested views and reports on all submitted data.
- Capability for Participant requested views on all Participant specific submitted data.
- Capability that will easily allow for complete maintenance, development, and implementation of all business rules.
- Ensure performance: validate data must be provided for further processing by other applications within a pre-defined time period

MMS shall provide the capability to easily change or add functions/rules to any of the existing business functions or validation rules, to accommodate future market rule changes.

The key requirements against the validations are as follows:

- Correct implementation of Market Applications business rules
- System should allow flexible scaling of the new validations
- Implementation of validation logic in a standardized rules engine
- Business Rules and rulesets shall be stored in a repository with an appropriate interface to facilitate future enhancements, maintenance, versioning, viewing, and reporting.

- The Business Rules interface shall clearly expose each rule, its relationship to other rules and its formulas and calculations so that the Operators can understand, manage and maintain such rules.

- System shall provide an audit trail for any modification or updates of business or process rules

2.9 Training requirements

Contractor shall provide intensive training for Moldelectrica MMS users and MMS operators to prepare for onsite installation, system operation, testing, maintenance and configuration. Training topics shall cover all MMS business functions, data management and IT system administration activities, interfaces, etc. Trainings shall be organised for dedicated user groups, e.g. managers, key MMS users, subject matter experts, MMS administrators, etc.

Contractor shall prepare a detailed training plan during detailed design phase of the implementation project, which will be approved by Moldelectrica. The plan shall contain among others the schedule of all suggested trainings, the content of the trainings and the targeted audience. Schedules of trainings must be harmonized with the other activities of the implementation project schedule. Contractor shall make detailed training documentations as part of the training plan.

Trainings shall be organised at the premises of Moldelectrica. The language of the training and of related written materials can be in English, but upon Moldelectrica's request a competent interpreter in Romanian/Russian shall be provided by the contractor. The number of participants per training session shall not exceed 10.

3Scheduling Process (SP)

3.1 High level process overview

The scheduling process implemented in the Market Management System (MMS) and the related information exchanges shall in general follow the ENTSO Scheduling process defined in the latest version of ENTSO-E ESS document and comply with the latest version of Harmonised Electricity Market Role Model. For full compatibility with data expected/received from external systems, the configuration should allow MMS Administrator to edit most of XML header and time series header tag values.

The high-level process is presented in Figure 4. The scheduling process starts with the initial transmission of the schedule document to the system operator by Balance Responsible Parties (BRPs) and the Market Operator (MO). During this phase the documents are verified syntactically (business validations), and independently of other schedule documents that have been submitted by other parties. As a response, the MMS sends a positive or negative acknowledgement of the schedule time series received.

Then the matching validation can be carried out on the time series within a document, as soon as the time series from the counterparty BRP has been received. In case of a mismatch, an anomaly document is sent to both parties involved informing them about the problem. The time series with errors then must be resubmitted by the BRP with corrected values.

In the next step TSO executes a balance and constraint analysis to decide, whether the schedules submitted are feasible. In this phase the schedules cannot be modified.

A similar process is to be run with neighbouring TSOs to execute TSO-TSO matching. The whole scheduling process is then closed by a final confirmation report sent to BRPs. The confirmed schedules then shall be available for the settlement module of MMS for running settlement business processes.

MMS shall support schedule submission process for the day-ahead and intra-day time frames with configurable submission time periods, as well as to perform back-office activities related to schedule management.

There is a special derogation for Transnistrian region, under which an in-kind compensation mechanism is applied for imbalance settlement. This mechanism is described in WEM Rules and implies the submission of a compensation schedule to MMS scheduling module. The compensation schedule shall be defined between 2 special BRPs (a BRP in Transnistrian region and a BRP in Moldelectrica's region) and MMS shall be capable of calculating the compensation schedule based on the net position of the BRP in the Transnistrian region and the related meter data. The resulting compensation schedule will be provided to abovementioned special BRPs and Moldelectrica MMS operator.

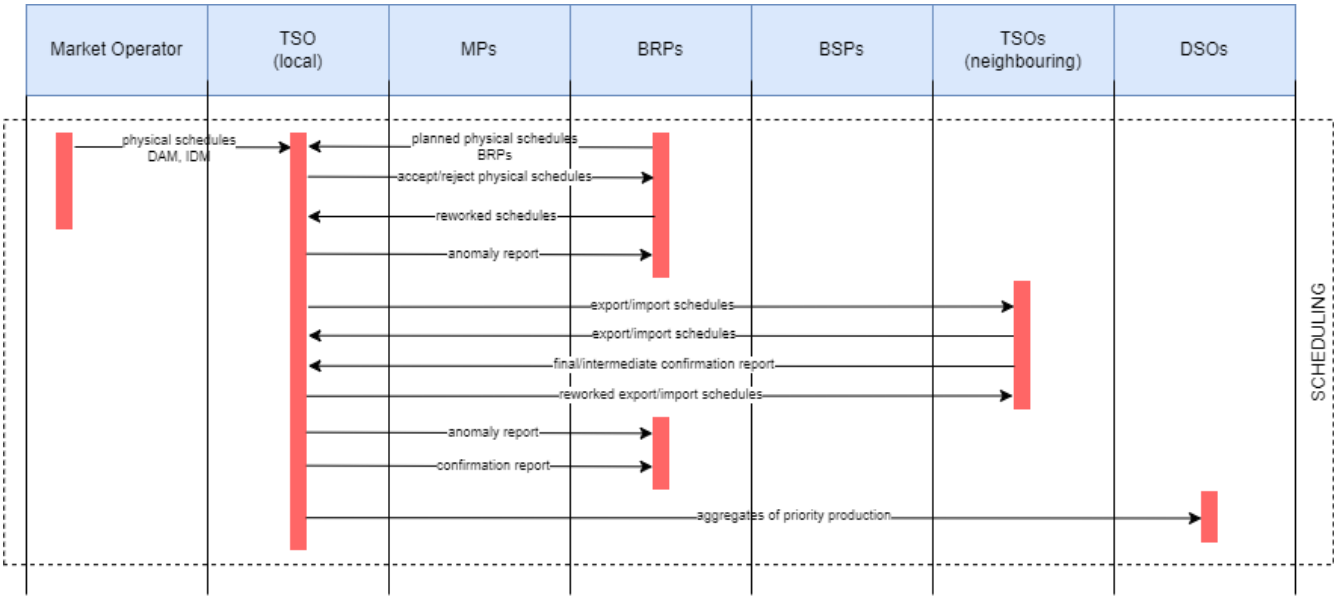

Figure 4. Scheduling process high level overview

3.2 Registry data for scheduling process

MMS shall maintain a central repository for storing and maintaining market participant and market related standing data. In contrast to time series data, values of standing data do not regularly change during everyday market operation. The scheduling module shall use and reference always the actual version of this standing data to maintain consistency with other MMS internal modules and MMS external market parties. Further requirements related to this topic can be found in chapter Market Participant Registration and standing data (MPR) Market Participant Registration and standing data (MPR).

3.3 Gating mechanism for process management

MMS shall provide a flexible process gating mechanism for controlling the schedule submission processes. The specific phases of schedule submission processes shall be controlled by specific statuses (e.g. open, closed) of dedicated gates (e.g. schedule submission gate, schedule correction gate, schedule acceptance gate, etc.). Gates also allow for the application of dedicated business rules for handling schedules. For all required schedule submission process MMS shall provide gates, which allow for the timely execution of scheduling processes defined by market rules in Moldova, taking into account the timing of all other market processes. Specific gates should be defined for different scheduling processes, like e.g. day-ahead and intra-day scheduling corresponding to the market rules in Moldova and the market processes of European markets.

MMS gates shall be fully configurable by MMS system administrator. MMS system administrator shall be able to create new gates or delete existing gates. Default parameters of gates shall also be configurable by MMS system administrator.

By default, day-ahead schedules must be submitted after the closure of organised day-ahead market, but before the opening of day-ahead balancing market. Intra-day schedules can be submitted until 1 hour before the time of physical delivery (configurable)

3.4 Schedule definitions

The BRP schedules can be of the following types:

- Generation schedule (per dispatchable generating unit/storage and aggregated for others as explained below)
- Consumption schedule (per dispatchable consumption units/storage and aggregated for others as explained below)
- Internal trade schedule (aggregated for BRP, per direction)
    - Trade with other BRPs
    - Trade with organised electricity market (PX)
- External trade (import/export) schedule (per BRP/Market Participant, per direction)

Generation schedules/Consumption schedule must be submitted per unit, if the unit prequalified for providing balancing services. Otherwise, generation schedules can be submitted for a group of units or for a power plant.

If BRP has small generation units less than 1 MW, the schedule must be sent in aggregated mode, with division by production technology (e.g. CHP, Hydro, PV, Wind, biomass, etc.).

Organised electricity market (power exchange - PX) also considered as a scheduling party (BRP) and must submit PX schedule to the MMS.

External trade schedules are used to cover cross-border trades of market participants and TSO cross-border schedules with neighbouring TSOs. For the scheduling process between TSOs, MMS shall implement the requirements of the latest version of ENTSO-E RG CE scheduling process, the market rules in Moldova and Moldelectrica's agreements for scheduling with neighbouring TSOs. MMS shall support data exchange between TSOs according to ENTSO-E RGCE Scheduling and Accounting Policy: Scheduling Area Schedule (SAS), Control Area Schedules (CAS), Scheduling Area Exchange Document (SAX), etc. MMS scheduling system shall also be able to handle the compensation programs for unintentional deviations according to ENTSO-E rules. MMS must provide the possibility of detailed configuration of the counterparty principle for individual TSOs.

External trades should be reported on CET/CEST time. All other schedules have to be reported according with configuration on EET/EEST or CET/CEST time.

Internal trades of PX could be on CET time starting from first day of day-ahead market coupling and Internal trades of all other BRP should be on EET

Schedule values shall be defined for all settlement time period intervals. The settlement time period interval shall be 15 minutes, with the possibility to aggregate to 1 hour.

3.5 Schedule submission

The MMS function for the submission of BRP schedules shall be fully compliant to the ENTSO-E SCHEDULING SYSTEM (ESS). It shall be possible for MMS users according to their user privileges to view, create and modify schedules within the time frame given by gates for schedule submission and modification. MMS shall also provide a feature for MMS user to check the correctness (formal syntactical check) of their schedule to be submitted to MMS. Submission of BRP schedules shall be possible in the following ways (according with user rights permissions):

- dedicated web service
- direct XML file upload to MMS
- dedicated MMS user interface for manual schedule submission

MMS shall support the versioning of submitted schedules according to ESS. All versions of schedules shall be stored in MMS for a period of 3 years and shall be directly accessible by MMS user. In addition, MMS shall also provide the capability to restore historical schedule data from maximum 10 years in the past.

The user interface for manual schedule submission shall provide means to user friendly data entry from external spread sheets and with autofill features. Also, the UI should provide all necessary features to enter any specific data related to a schedule type (e.g. cross border section, capacity contract type, capacity contract ID for external schedules, counterparty for internal trade schedules between BRPs, metering point ID for generation and consumption schedules). MMS shall provide a feature for user to check the correctness (formal syntactical check) of the schedule to be submitted

In case of XML file upload MMS shall also provide a feature for MMS user to check the correctness (formal syntactical check) of the schedule to be submitted.

3.6 Matching schedules

Within the schedule submission gate, and as soon as both schedules from counterparties of an electricity trade are available, MMS shall compare the schedules submitted by these counterparties. If the time series values do not match for a specific settlement time period, MMS sends an anomaly report to both parties, who can then correct the mismatches by submitting newer values for their schedules.

If time series values by the time of schedule submission gate closure still do not match for a specific settlement time period, then these values shall be corrected automatically by MMS by applying a predefined rule.

In case of BRP/Market participant schedules, this rule can be e.g. any of the following:

- the lower of the two non-matching values is automatically accepted by MMS for both schedules for that settlement time period
- buyer values are accepted
- zero volume is accepted for the time periods with mismatches
- For schedules created as a result of a day-ahead PX transaction, the schedule from the PX takes precedence

In case of TSO schedules, this rule can be e.g. any of the following:

- Accepting the lower value of the two non-matching schedules;
- Accepting the eigenvalue from the two non-matching schedules;
- Acceptance of the foreign value from the two non-matching schedules;
- Reduce mismatched schedules to zero

3.7 Final confirmation

By default, the final confirmation process shall run automatically by MMS driven by related market gates. In addition, MMS shall allow for manual execution of final confirmation process by TSO MMS operator with related privileges. The term "TSO MMS operator" within this document refers to an MMS user, who oversees/drives/controls Moldelectrica's market related business processes.

3.8 Validations

MMS shall execute syntactical and semantical validations on submitted schedules. Validations must be clearly documented in detail and as far as possible configurable by MMS system administrator. It should be possible for MMS system administrator to configure new validations, modify or delete existing ones in case market rules change.

Syntactical validations shall verify all important rules of the XML schema defined in ESS. MMS shall give reason information to the user on the identified errors for supporting the correction process.

MMS shall also provide features to run several semantical validations on submitted schedule data. These validations shall check the submitted schedule values and shall provide notifications to the MMS user about the results and the reason of errors. Validation shall be schedule dependent (i.e. only for specific schedules must be run) or applicable to all types of schedules.

The following validations shall be implemented in the MMS as a minimum:

- XML schema definitions
- File type
- Sender authorization
- Schedule classification
- Business type
- Missing element
- Authorization to upload schedule type
- checking against gate closure/open times
- checking against availability declarations of dispatchable generating units or consumptions
- checking for balance (at schedule level or at a BRP group level)
- matching of counterparty schedules
- checking schedule data of time series
- checking time data of time series
- checking potential min/max limitations of schedules
- checking potential gradient limitations of schedules
- checking against credit cover
- checking against availability
- checking against PTRs (as provided in Capacity Right Documents) and validation of schedules as per agreed TSO-TSO rules/agreements
- checking against counterparty for cross border trade

The actions of MMS as a response to the results of validations shall be defined in the detailed design phase of the MMS implementation project.

3.9 Cross-border schedule reduction by TSO

MSS shall provide a functionality to process the reduction of external (cross-border) schedules in case of force majeure. The functionality shall be in line with the procedures for allocating and granting Physical Transmission Rights (PTRs), including allocating and granting intra-day PTRs, in order to implement the entire process of PTR reduction and external schedule reduction.

External schedule reduction should be possible at different stages of the external schedule coordination process:

- Before the expiry of the period for long-term PTR nominations (external schedules based on annual and monthly PTRs);
- After the gate closure for long-term PTR nominations and before the gate-closure for short-term PTR nominations (external schedules based on daily PTRs);
- After the gate closure for short-term external schedule nomination;

In emergency situations, when delivery of additional electricity in form of emergency help from neighbouring TSO is not possible, MMS shall allow the reduction of already confirmed external trade schedules.

The system should have a functionality of setting the priority of reducing PTRs and external trade schedules by groups:

- **with pre-defined priority** – external schedules with a daily PTR are reduced first, schedules with a monthly PTR are reduced in the next stage, and schedules with an annual PTR are reduced in the last stage. The order of priority can be changed and set individually for each neighbouring TSO. The reduction of schedules in each of the separate groups (daily, monthly, yearly) should be carried out on a pro-rata basis (proportionally);
- **without any priority** – i.e. all external schedules are taken into account in one stage (regardless whether schedules are nominated with an annual, monthly or daily PTR). The reduction of schedules should be carried out pro-rata (proportionally);

The system should allow for the change of the reduction type (with or without priority) individually for each neighbouring TSO.

After processing the reduction, the system should further process (automatically and/or manually) the sending, receiving, validation (checking), reconciliation, as well as all processes of exchange of external trade schedules in accordance with the requirements of ENTSO-E RG CE. The system should process all necessary documents and information exchange messages in accordance with EDI standard.

The system should also allow all processes to be carried out in manual operation mode.

The system interface must allow configuration (setting) of all field attributes in the exchanged XML documents. Provision should be made for separate settings individually with any of the neighbouring TSOs.

3.10 Emergency External Schedules

The system functionality should allow the processing of emergency help (counter supply) external schedules from neighbouring TSOs.

In case of such emergency help form/to any of the neighbouring TSOs the system should process the sending, receiving, validation (checking), reconciliation of related schedules in accordance to the principles of "INTRADAY EXTERNAL (CROSS-BORDER) SCHEDULES".

In case Moldelectrica provides an emergency help (delivers electricity, i.e. export) from its control zone to the control zone of a neighbouring TSO, this should be considered as an electricity TSO shortage by the balancing mechanism and settlement procedures.

In case Moldelectrica receives an emergency help (receiving electricity, i.e. import) into its control zone from the control zone of any of the neighbouring TSO, this should be considered as an electricity surplus by the balancing mechanism and settlement procedures.

All processes should also be available in manual operation mode.

The system functionality should also allow the adjustment of external schedules by TSO MMS operator.

The system must allow configuration (setting) of all field attributes in exchanged documents. Provision should be made for separate settings for the different neighbouring TSOs.

3.11 Specific UI requirements for scheduling

MMS shall provide a user-friendly UI for viewing already submitted schedules and counterpart schedules with navigation features between the components of schedules. Views shall be adapted to the needs of different MMS users (e.g. TSO, BRP) to support their special roles in the schedule submission/validation/acceptance process.

Filters for viewing schedules according to their statuses, types, time frames as well as aggregates of schedules (e.g. import, export, internal purchase, internal sale, production, consumption, balance, individual time series or groups) with selectable time resolution shall also be available for the user.

MMS shall also support the correction of schedules and identifying errors in submitted schedule data by e.g. highlighting/colouring of related values, specifying differences between vales, etc.. TSO MMS Operator shall be able to make corrections to the schedules in case of emergency in a way, which allows for tracking back the actions.

MMS' user interface shall provide a feature to offer content and functions of the UI based on the user privileges of the connected MMS user. Specific functions of schedule management e.g. are only available for a TSO MMS operator, some others are only available for BRPs or for all MMS users.

Users of MMS, dependent on their user privileges, should be able to get an overview on actual gate statuses with a filtering possibility. TSO MMS operator shall be able to modify gate statuses temporarily through a dedicated user interface.

MMS users should be able to export already submitted schedule data into commonly used file formats (e.g. MS Excel, CSV, etc.) for further data processing outside of MMS. Bulk export of schedule data shall also be possible in a user-friendly way.

The following displays/views shall be available for the TSO user within the MMS scheduling module as a minimum:

- balance of a local Balance Responsible Party.
- balance of local balance areas.
- total plan of Balance Areas, Control Area
- management of mismatches and imbalances
- energy exchanges between balance areas
- production and consumption schedules
- cross border schedules
- Overview of events, messages, logs.
- availability information
- market gates management
- comparing allocated capacity with nominations
- SO-SO matching

3.12 Reports

MMS system should have a functionality to generate and process all relevant reports regarding the reduction of PTRs and external trade schedules for intersystem exchange and subsequent compensation (reimbursement of amounts) of market participants in accordance with the requirements of Moldelectrica and the relevant rules regulating these processes. The configuration of the reports should be flexible, so that Moldelectrica operators and users can prepare the reports according to the needs of the operational process.

3.13 Overview of messages, logs, events

MMS shall also provide capabilities to support auditing of the scheduling function by giving access to technical log data generated during the operation of MMS (e.g. data related to schedule submissions, validations, gates, message exchanges, user activity, changes in configuration data. A special logging functionality shall support the monitoring of schedule submissions through file upload and web services. This log shall register data related to the submitted files, the success/errors of submissions and their reasons. Filters shall support the user-friendly navigation between log entries.Cross-border Capacity Market (CM)

3.14 General functional requirements

MMS in general shall be able to support the processes of cross-border capacity allocation according to ENTSO-E Capacity Allocation and Nomination System (ECAN), following explicit allocation methodology. MMS shall support the business processes of a TSO within the ECAN process in a context, where Capacity Allocator role is played by external allocation platforms. MMS shall be able to support the capacity calculation process both in the way, when capacity is defined through an alignment between system operators and when capacity is defined through the interaction of a regional capacity coordinator, using the NTC-based methodology.

As a result of current and future capacity allocation arrangements, MMS shall be able to integrate and collaborate with Ukrenergo's Allocation Platform, Transelectrica's Allocation Platform and JAO's allocation system (e-CAT) according to the rules set by these allocation platforms. For full compatibility with data expected/received from external systems, the configuration should allow MMS Administrator to edit most of XML header and time series header tag values.

3.15 Cooperation with current and future capacity allocation arrangements

The allocation of the interconnection capacity between **TSO of Ukraine and TSO of Moldova** is currently carried out on the basis of joint annual, monthly and daily explicit auctions. The joint monthly and daily auctions are launched starting from March 2024 and take place on the Allocation Platform within NEK "Ukrenergo". The auctions cover 21 tie-lines with 110 – 330 kV voltage levels.

The Allocation Platform on the border between Bidding Zones of Ukrenergo and MOLDELECTRICA is provided by Ukrenergo, the Ukrainian TSO. Auction Tool means the information technology system used by the Allocation Platform (Auction office) to perform Auctions and to facilitate other procedures such as transfer or return of Long-Term Transmission Rights, nominations, etc. In the case of allocation of Cross Zonal Capacity between Bidding Zones of Ukrenergo and MOLDELECTRICA the functions of Auction Tool are performed by electronic auction system which can be accessed at website https://eap-office.ua.energy.

MMS shall establish the business processes defined by the Auction Tool of Ukrenergo for the specific situation of Moldelectrica as a neighbouring TSO with interconnections with Ukraine and follow the rules of allocation defined by the following documents:

- *Common Allocation Rules for Forward Capacity Allocation of Cross Zonal Capacities between Bidding Zones of National Power Company "Ukrenergo" ("Ukrenergo") and State Enterprise "MOLDELECTRICA" ("Long Term Allocation Rules").*

- *Common Allocation Rules for Daily Capacity Allocation of Cross Zonal Capacities between Bidding Zones of National Power Company "Ukrenergo" ("Ukrenergo") and State Enterprise "MOLDELECTRICA" ("Daily Allocation Rules").*

The allocation of interconnection capacity between the **TSO in Romania and the TSO of Moldova** is carried out on the basis of joint annual, monthly, daily and intra-day auctions that take place on the Allocation Platform within C.N.T.E.E. TRANSELECTRICA S.A.. The auctions cover 5 tie-lines with 110 – 400 kV voltage levels.

The Allocation Platform on the border between Bidding Zones of Transelectrica and MOLDELECTRICA is provided by Transelectrica, the Romanian TSO. Auction Tool means the information technology system used by the Allocation Platform (Auction office) to perform Auctions and to facilitate other procedures such as transfer or return of Long-Term Transmission Rights, nominations, etc. In the case of allocation of Cross Zonal Capacity between Bidding Zones of Transelectrica and MOLDELECTRICA the functions of Auction Tool are performed by electronic auction system which can be accessed at website https://newmarkets.transelectrica.ro/ .

MMS shall establish the business processes defined by the Auction Tool of Transelectrica for the specific situation of Moldelectrica as a neighbouring TSO with interconnections with Romania.

In the future Moldelectrica plans to entrust **Joint Allocation Office (JAO)** as Single Allocation Platform for all European TSOs to run capacity allocations for specific borders and for specific time frames as a capacity allocator for Moldelectrica as a TSO.

MMS shall establish the business processes defined by the Auction Tool of JAO for the specific situation of Moldelectrica as a TSO with interconnections with Romania and Undrain and follow the rules of allocation defined by JAO.

MMS shall be able to create and provide all input data in the required format to the Auction Tools above and MMS shall be able to receive and process all data in the required format from the Auction Tools above.

In cases where there are several Transmission Capacity Allocators (e.g. Transelectrica and JAO) involved in a border for different products, a Transmission Capacity Allocator could need information about transmission capacity rights of the Capacity Traders from another Transmission Capacity Allocator in order to correctly validate any resales. This information exchange between the Capacity Allocators shall be managed by the Allocators directly between them.

3.16 Establish offered capacity

This subprocess relates to the identification and publication of the offered capacity that can be allocated to the market.

Moldova is currently not part of a Coordinated Capacity Calculation system, NTCs are defined through individual calculations of neighbouring TSOs and an agreement process between them. The Integrated National Energy and Climate Plan (NECP) of Moldova for the period 2025-2030 sets the target of implementing a coordinated capacity calculation (CCC) methodology in accordance with applicable TCE regulations (FCA and CACM) in the 2022-2030 timeframe. MMS module managing cross-border capacity allocation shall therefore be able to support the actual as well as the future capacity calculation processes. Implicit allocations at day-ahead and intraday level and financial transmission rights are also expected. MMS module shall be able to support implicit allocations and financial transmission rights.

The Cross-Zonal Capacities (CZCs) are calculated individually using the NTC-based methodology. It is expected to switch to flow-based methodology by 2028. MMS should provide for flow-based approach the same functionality as for NTC.

In case Moldova takes part in a Coordinated Capacity Calculation process, then MMS shall be able to support this process by receiving CZC values either directly from external regional capacity coordinator or from Moldelectrica's other internal IT system.

3.16.1 Capacity values agreed between system operators

Within this process, Moldelectrica (and the neighbouring TSOs) calculate individually NTCs and ATCs on a given border and mutually agree on the NTC/ATC capacity that is available for the border and period in question.

Moldelectrica and neighbouring TSOs first shall agree on common NTC values. For doing this, MMS shall perform calculations to define the vales for all borders and settlement time periods of the auctions and in both directions, taking the results of SO-SO nomination matching and Already Allocated Capacity also into consideration. Calculation formulas shall be configurable by Moldelectrica MMS System Administrator. Input data for the calculation (e.g. Total Transfer Capacity - TTC, Transfer Reserve Margin - TRM, Already Allocated Capacity - AAC) shall also be stored by MMS for all borders and settlement time periods of the auctions and in both directions. AAC shall be received from Capacity Allocator, which can either be Allocation Platforms of Ukrenergo or Transelectrica or JAO.

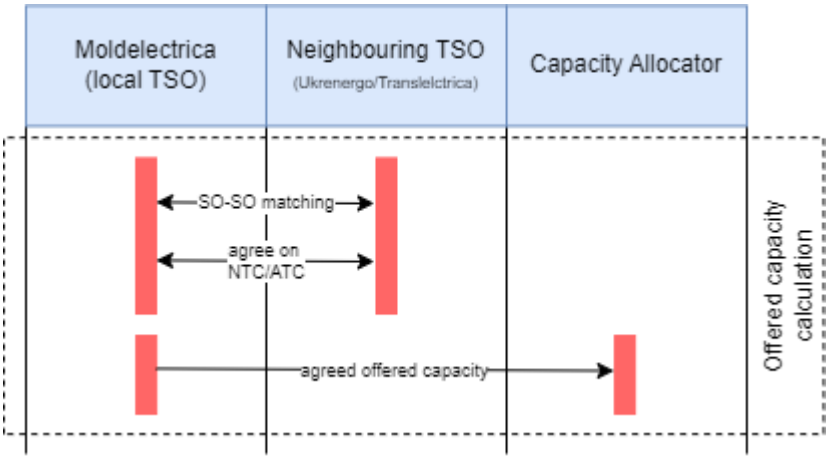

Figure 5. High level process of offered capacity calculation between TSOs for explicit allocation

MMS shall send calculated NTC values to neighbouring TSOs through a capacity document and receive NTC values from neighbouring TSOs through a capacity document. MMS shall then apply a certain rule for determining final common NTCs (e.g. choosing always the smaller value). This rule shall be configurable within MMs.

After concluding on common NTCs with neighbouring TSOs, MMS shall execute calculations to define ATC values. Calculation formulas in MMS shall be configurable by Moldelectrica MMS System Administrator.

Figure 5 represents the high-level processes of capacity calculations for the case of an explicit allocation process. In case of an explicit allocation process, MMS shall send the agreed offered capacity to the Capacity Allocator (allocation platform).

3.16.2 Capacity values through Coordinated Capacity Calculation

Within this process alternative, Moldelectrica and the neighbouring TSOs assign the task of capacity calculation to an external party called Capacity Coordinator (e.g. Coreso, TSCNet, etc.), who coordinates the capacity for a number of Market Areas. This is an alternative of determining capacity values through an alignment between system operators.

Moldelectrica and neighbouring TSOs first shall agree on common NTC values. For doing this, MMS shall perform calculations to define the vales for all borders and settlement time periods of the auctions and in both directions, taking the results of SO-SO nomination matching and Already Allocated Capacity also into consideration. Calculation formulas shall be configurable by Moldelectrica MMS System Administrator. Input data for the calculation (e.g. Total Transfer Capacity - TTC, Transfer Reserve Margin - TRM, Already Allocated Capacity - AAC) shall also be stored by MMS for all borders and settlement time periods of the auctions and in both directions. AAC shall be received from Capacity Allocator, which can either be Allocation Platforms of Ukrenergo or Transelectrica or JAO.

In this capacity calculation process, the calculation itself is run by an external system outside of MMS, but MMS shall be able to provide input data (relevant capacity information) to the capacity calculation, receive the results of capacity calculation and send confirmations of results after running specific validations.

Figure 6 represents the high-level processes of capacity calculations for the case of an explicit allocation process. In case of an explicit allocation process, MMS shall send the agreed offered capacity to the Capacity Allocator (allocation platform).

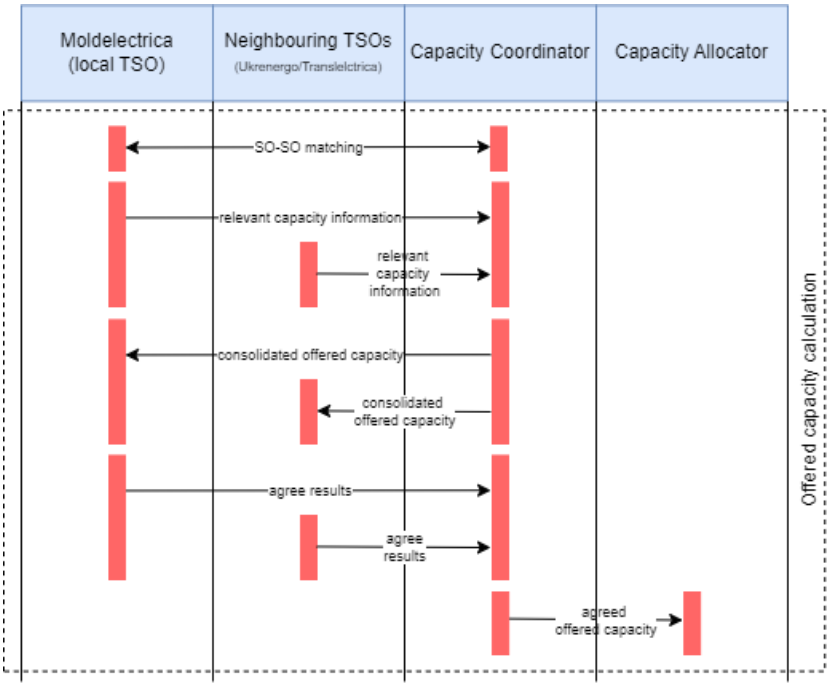

Figure 6. High level process of offered capacity calculation with capacity coordinator for explicit allocation

3.17 Interface with explicit allocation platforms

3.17.1 General process overview

a) Cross-border sections to be served

b) Auction time frames

c) Auction products and their attributes

d) Definition of gate opening/closing and publication dates/times,

e) Processes high level

MMS shall be able to exchange data defined in ENTSO-E ECAN document with external allocation platforms following the cross-border transmission capacity allocation processes of ENTSO-E Capacity Allocation and Nomination System. High level data exchanges are presented in Figure 7.

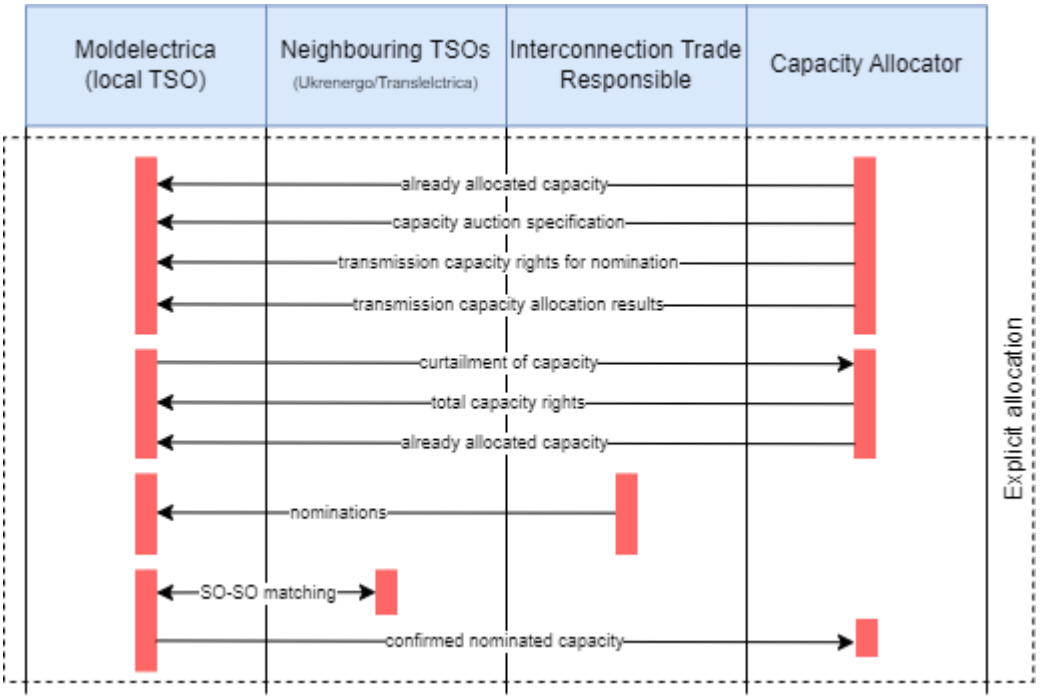

Figure 7. Explicit allocation process high level overview

The Transmission Capacity Allocator (external allocation platform) prepares the auction specification with the information provided by Moldelectrica on capacity to be offered to market and with the capacity rights that have been received for resale. The auction specification is then published by the Transmission Capacity Allocator and sent to System Operator in an Auction Specification Document.

After completing the auction process by Capacity Allocator, MMS receives the complete results of the allocation with successful and unsuccessful bids including the amount of released transmission capacity rights that has been successfully sold during the auction (explicit resales).

At any time in this process a Moldelectrica may inform the Capacity Allocator of a situation that requires curtailment of capacity at a given border.

Prior to nomination, the Capacity Allocator informs the Moldelectrica as System Operator of the capacity rights that may be nominated on a border.

When the nomination and its validation cycle is finalised at the allocation platform, the platform sends all the validated nominations to the System Operator.

The System Operator then enters the System Operator to System Operator exchange process with his counterpart to ensure the coherence of the nominations on both sides of the border. At the completion of this matching, the Transmission Capacity Allocator is informed of the confirmed nominated capacity.

3.17.2 Receiving Auction Specifications

MMS shall be able to receive auction specifications from Auction Tool in multiple versions (e.g. preliminary, final) and with the following minimum content:

a) Auction ID

b) Product information: (Cross Zonal border, direction, timeframe, bidding zone, Product e.g. base, peak, off-peak)

c) Capacities to be Allocated

d) Gate openings and closures

e) Timeframe for the publication of Auction Results

f) Reduction periods (if any)

g) Deadline Auction Results contestation

h) Deadline for return

MMS shall handle the message format of auction specifications as required by the Auction Tool (Auction Specification document or Capacity Document). MMS shall receive auction specifications for annual, monthly, daily, and intraday auctions, but also for other auction durations (e.g. number of days…).

3.17.3 Receiving allocation results

MMS shall be able to receive allocation results from Auction Tool in multiple versions (e.g. preliminary, final), which include the auction outcome of all bids and resales.

MMS shall handle the message format of auction results as required by the Auction Tool. MMS shall receive auction results for annual, monthly, daily, and intraday auctions, but also for other auction durations (e.g. number of days…).

3.17.4 Curtailment

MMS shall be able to send curtailment data to the Auction Tool, which include as a minimum the auction ID, the curtailed capacity values and settlement time periods. MMS shall send a curtailment message format as required by the Auction Tool.

4Balancing Market (BM)

The balancing process implemented in the Market Management System (MMS) and the related information exchanges shall in general follow the ENTSO-E Electricity Balancing Process defined in the latest version of ENTSO-E Reserve Resource Process (ERRP) as well as in the latest documents of European balancing platforms, and shall comply with the latest version of Harmonised Electricity Market Role Model and allow implementation of the latest Moldelectica's operational procedures related to balancing energy market and ancillary services market.

The balancing process in general includes the internal procurement of balancing capacity, the procurement of balancing energy closer to real time, and the interaction with European balancing platforms to provide/procure balancing services from other balancing areas.

The balancing electricity market in Moldova is an organized, centralized market where Moldelectrica, the TSO, buys and/or sells electricity from/to balancing service providers (BSP) that operate dispatchable electricity generating units and/or dispatchable electricity consumption installations in order to compensate for deviations from planned electricity generation and/or consumption, as well as to deal with internal network congestions.

4.1 Prequalification for balancing services

Participation to the balancing market is not mandatory for market participants (BSPs) that operate Electricity Generating Units and/or Dispatchable Consumption Points. Each balancing service provider intending to participate to the balancing market and to provide balancing service should successfully pass a pre-qualification process of its balancing resources, which can either be a production/group of production/storage or a demand-response facility.

The pre-qualification process itself shall be managed outside of MMS, but the data related to the results of the pre-qualification shall be registered in MMS, in a central repository for storing and maintaining market participant and market related standing data.

The central repository of MP data shall contain information on the pre-qualification of BSPs to participate to the balancing market. MMS shall ensure, that only pre-qualified BSPs are allowed to take part in balancing tenders. The MMS module for balancing shall use and reference always the actual version of this standing data to maintain consistency with other MMS internal modules and MMS external market parties.

The scope of data entered into MMS in relation to the pre-qualification results of a BSP shall cover all important technical and business information, which is required to operate the balancing mechanism in Moldova. As a minimum, the following pre-qualification data shall be stored in MMS:

- Full/short name
- EIC code
- Contact information (e.g. address, e-mail, phone number)
- Start/end date of qualification
- type of balancing services (e.g. FCR, aFRR, mFRR, RR,)
- direction of balancing service (e.g. UP and DOWN regulation or UP only, DOWN only)
- minimum/maximum generation/consumption capacity (MW)
- ramp rate (MW/min) for increasing/decreasing generation/consumption

- full activation time (min)
- metering point ID

- BRP ID (identifying the BRP to which the BSP belongs)
- comment

MMS data in relation to the pre-qualification shall also maintain a status indicator per BSP to track the actual status of the pre-qualification process (e.g. applied, verified, rejected, registered, active in BM).

It shall be possible for a Moldelectrica MMS user with related privileges to manually update the data entered into MMS in relation to the pre-qualification results of a BSP to keep it always up-to-date. Changes in pre-qualification data shall be tracked within MMS.

Further requirements related to this topic can be found in chapter Market Participant Registration and standing data (MPR) Market Participant Registration and standing data (MPR).

4.2 Availability declaration

Each balancing market participant that operates a dispatchable generation/ consumption/storage unit is obliged to submit a declaration of availability for the corresponding generation/consumption to Moldelectrica, using the MMS module for balancing, in accordance with the provisions of the Electricity Grids Code of Moldova. As a response to the availability declaration, MMS shall automatically send an acknowledgement to BSP to indicate the registration of new availability information in MMS. The declaration shall be resubmitted every time, when the availability of the generating/consumption unit changes compared to the previously submitted availability information.

MMS shall use the information submitted through availability declarations for the selection of balancing offers and for the activation of balancing services, and only available resources or resources up to their actual availability shall be selected/activated by MMS.

4.3 Procurement of balancing capacity

4.3.1 High level process overview

The high-level process is presented in Figure 8. In the initial phase of this process apre-qualification/accreditation process is to be fulfilled by Balance Service providers (BSPs) in order to identify specific balancing services that can be provided to the TSO. This prequalification process is run outside of MMS and provides for a list of prequalified suppliers. The initial list shall be provided by Moldelectrica. This registration data shall be entered into MMS, which shall provide a central data repository for storing and maintaining market participant data of BSPs. The balancing module shall use and reference always the actual version of this standing data to maintain consistency with other MMS internal modules and with MMS external market parties. Further requirements related to this topic can be found in chapter Market Participant Registration and standing data (MPR) Market Participant Registration and standing data (MPR).

As a next step TSO defines reserve requirements outside of MMS for all types of balancing capacity and the results of these calculations shall then be entered into MMS. This is followed by a tender processes, where reserve requirements are published to BSPs, who are then required to submit their balancing capacity offers to MMS, which meet the balancing capacity product specifications. Based on these offers, the MMS clearing algorithm which can be "pay as bid" or "marginal price" selects those ones, which fulfil the reserve requirements in every balancing time period and for all product types, and constitute the least overall cost for balancing capacity. TSO then informs BSPs of the preliminary tender results by sending them the planned BSP reserve schedules.

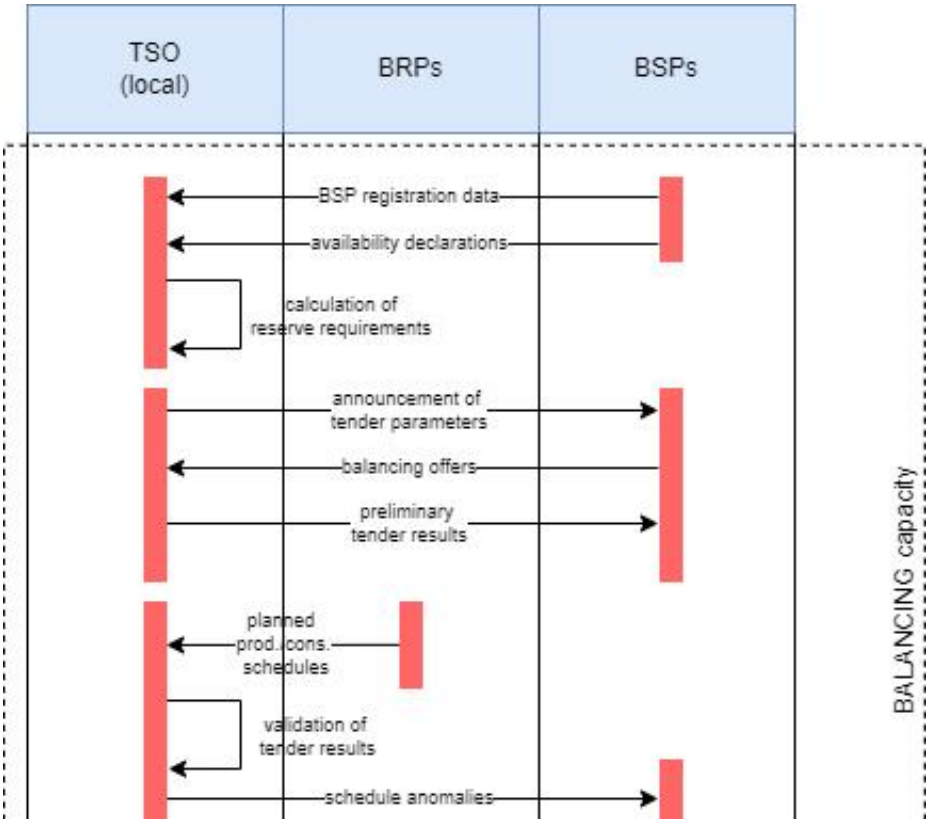

Figure 8. Balancing capacity procurement high level overview

The tender process is followed by a planning process, where TSO validates the reserve schedules against the generation/production schedules of BSPs, if these are available in MMS. If anomalies are identified, then this is communicated to the BSP which have to make the necessary steps to eliminate anomalies.

4.3.2 Calculation of reserve requirements

Moldelectrica at least once a year review and define the reserve capacity requirements for the scheduling areas for all balancing capacity products and for all tendered time period separately. This calculation is performed outside of MMS, but the results of the calculation shall be entered into MMS manually or by manual file upload. This constitutes the required amount of balancing capacity to be tendered.

4.3.3 Balancing capacity product definitions

MMS shall provide the capability to handle balancing products in compliance with ENSTO-E *standard* balancing capacity product definitions and *specific* balancing capacity products in Moldova with the requirements given in Table 1, Table 2 and Table 3 below.

MMS shall make it possible to run electronic tenders for the following balancing capacity products:

- Frequency Containment Reserve (FCR) – single symmetrical product for upward and downward directions
- Automatic Frequency Restoration Reserve (aFRR) – separate products for upward and downward directions
- Manual Frequency Restoration Reserve (mFRR) – separate products for upward and downward directions
- Replacement Reserve (RR) – separate products for upward and downward directions

Table 1. Minimum product requirements for FCR

Product characteristic	**Value**
Product's full activation time	in case of a frequency deviation equal to or larger than 200 mHz, at least 50 % of the full FCR capacity shall be delivered at the latest after **15 seconds**; in case of a frequency deviation equal to or larger than 200 mHz, 100 % of the full FCR capacity shall be delivered at the latest after **30 seconds**; in case of a frequency deviation equal to or larger than 200 mHz, the activation of the full FCR capacity shall rise at least **linearly** from 15 to 30 seconds;
Activation delay	2 seconds
Activation type	automatic
Minimum delivery period	15min
Maximum delivery period	15 minutes
Minimum size of the bid	1 MW
Maximum size of the bid	≤ from/to the BSP's qualified capacity
Minimum price of the bid	
Technical restriction of the bid price	

Table 2. Minimum product requirements for aFRR

Product characteristic	**Value**
Product's full activation time	7.5 minutes
Activation type	automatic
Activation delay	not exceeding 30 seconds
Deactivation time	Less than 7.5min
Minimum Delivery period	15 minutes, a bid can be activated and deactivated at any time during a delivery period.
Minimum size of the bid	1 MW
Maximum size of the bid	≤ from/to the BSP's qualified capacity
Minimum price of the bid	
Technical restriction of the bid price	

Table 3. Minimum product requirements for mFRR

Product characteristic	**Value**
Product's full activation time	12.5 minutes
Maximum delivery period	15 minutes for scheduled activation 30 min for direct activation
Minimum size of the bid	1 MW
Maximum size of the bid	≤ from/to the BSP's qualified capacity
Minimum price of the bid	
Technical restriction of the bid price	

Table 4. Minimum product requirements for RR

Product characteristic	**Value**
Product's full activation time	30 minutes
Activation type	manual
Preparation period	less than 30min

Minimum delivery period	15 minutes
Maximum delivery period	At least 30 minutes
Minimum size of the bid	1 MW
Maximum size of the bid	≤ from/to the BSP's qualified capacity (maximum that can be activated during full activation time)
Minimum price of the bid	
Technical restriction of the bid price	

MMS shall allow to change the characteristics of the above products and to define new balancing products by Moldelectrica.

In addition to the above product definitions, MMS shall be capable of handling the ENTSO-E standard balancing capacity product definitions with validity periods and with minimum duration between the end of deactivation period and the following activation as defined in Figure 9 below.

RR Product	#1	#2	#3	#4	#5
Validity period	15 minutes	1 hour	4 hours	1 day	1 week
The minimum duration between the end of deactivation period and the following activation	0 minutes				
Direction	Positive or negative				

mFRR Product	#1	#2	#3	#4	#5	#6	#7
Validity period	15 minutes		1 hour		4 hours	1 day	1 week
The minimum duration between the end of deactivation period and the following activation	0	0-8 hours	0	0-8 hours	0	0	0
Direction	Positive or negative						

aFRR Product	#1	#2	#3	#4	#5
Validity period	15 minutes	1 hour	4 hours	1 day	1 week
The minimum duration between the end of deactivation period and the following activation	0 minutes				
Direction	Positive or negative				

Figure 9. ENTSO-E standard balancing capacity products

4.3.4 Management of balancing capacity tenders

MMS shall be capable of managing the complete business process of ENTSO-E balancing processes according to IEC 62325-451-7:2021 for Moldova balancing market. The timing of processes shall be driven by a suitable gating mechanism, which makes it possible to flexibly configure the gate parameters to meet the requirements of local market rules in Moldova as well as the rules of European integrated electricity markets.

MMS shall provide the possibility for Moldelectrica MMS Operator to configure balancing capacity tenders by setting the following parameters:

- Gate openings/closures related to the tender
- Contracting time period
- Type of balancing capacity product
- Required total balancing capacity to be procured/Direction
- Limitations in offer price if any
- Price scheme ("pay as bid" or "marginal price")

- Free text filed

MMS shall provide a dedicated UI for Moldelectrica MMS Operator to overview the planned tenders with their timing and actual statuses. It shall also be possible to view and modify the parameters of specific tenders selected on this overview with sufficient user privileges.

4.3.4.1 Announcement on tenders

MMS shall automatically send announcements of tender openings to BSPs, when a specific tender is open. The announcement shall make it possible for BSPs to easily view/download the details of related tender by web services and manual download

4.3.4.2 Submission of balancing capacity offers

MMS shall make it possible for BSPs to submit their balancing capacity offers to the MMS platform in an electronic way. The MMS function for the submission of BSP balancing capacity offers shall be fully compliant to IEC 62325-451-7:2021.

Balancing capacity tenders shall be organised for several contracting time periods in MMS. The contracting periods of balancing capacity tenders shall be calendar years, quarters of a year, months, days as well as other periods of time. One tender contracting period may be limited to days and/or settlement periods within a given time interval, such as working days, non-working days and public holidays, day or night hours, peak or off-peak hours, or other types of intervals.

At least, daily auction have to run automatically according with configuration.

MMS shall implement dedicated gates for the submission of balancing capacity offers by BSPs. It shall be possible for MMS users, according to their user privileges, to submit, view, create, cancel and modify offers within the time frame given by gates for offer submission and modification. MMS shall make it sure, that only those BSPs can submit offers for a given balancing capacity product, who have assets registered as pre-qualified within MMS for the product.

Offer submission in MMS shall be possible for the balancing capacity products defined in chapter Balancing capacity product definitions Balancing capacity product definitions. MMS shall also provide a feature for MMS user to check the correctness (formal syntactical check) of their offer to be submitted to MMS. Submission of BSP offers shall be possible in the following ways:

- dedicated web service
- direct XML file upload to MMS
- dedicated MMS user interface for manual offer submission

MMS shall support the updating of submitted offers, always the latest version of the offers shall be available in MMS. All changes to the offers shall be tracked by MMS in a way, that allows to track the offers throughout its life cycle.

The user interface for manual offer submission shall provide means to user friendly data entry from external spread sheets and with autofill features. Also, the UI shall provide all necessary features to enter any specific data related to an offer type. MMS shall provide a feature for user to check the correctness (formal syntactical check) of the offer to be submitted.

In case of XML file upload MMS shall also provide a feature for MMS user to check the correctness (formal syntactical check) of the offer to be submitted.

The offer document shall be in xml format and shall comply with the IEC 62325-451-7:2021 "reservebiddocument" format.

Offers submitted by BSPs, shall contain at least the following information:

- BSP's ID
- Production/consumption unit ID
- Version of offer
- Tender ID
- Time interval for offer validity
- Time resolution
- Offered quantity (hMW)
- Offered price (MDL/hMW/h)
- Location of the offer
- Divisibility of offer
- Direction of offer (upward/downward)
- Step increment (if offer is divisible)

As a response to offer submission, MMS shall automatically send an acknowledgement in the form of an Acknowledgement Document respecting the ENTSO-E format IEC 62325-451-1.

Moldelectrica may enter into direct bilateral agreements with one or more qualified system service providers to procure balancing capacity for the management of internal congestions. MMS shall be able to provide the possibility store the important parameters of these balancing capacity agreements. Based on Moldelectrica MMS Operator decision, it shall be possible in MMS to select these agreements as winning balancing capacity offers in order to support potential activation of balancing energy delivery.

4.3.4.3 Validation of balancing capacity offers

MMS shall execute syntactical and semantical validations on submitted offers. Validations must be clearly documented in detail and as far as possible configurable by MMS system administrator. It should be possible for MMS system administrator to configure new validations, modify or delete existing ones in case market rules change.

Syntactical validations shall verify all important rules of the XML schema defined. MMS shall give reason information to the user on the identified errors for supporting the correction process.

MMS shall also provide features to run several semantical validations on submitted data. These validations shall check the submitted offer values and shall provide notifications to the MMS user about the results and the reason of errors.

The following validations shall be implemented in the MMS for balancing capacity offers as a minimum:

- authorization to submit offer (based on pre-qualification data)
- checking against gate closure/open times
- checking against total maximum qualified capacity of all units/direction belong to BSP
- checking against maximum/minimum price if any
- checking against minimum quantity of the bid
-

The actions of MMS as a response to the results of validations shall be defined in the detailed design phase of the MMS implementation project.

4.3.5 Validation of tender results

Following the offer submission gate closure time, MMS shall automatically evaluate the offers (clearing) by creating a merit order list of offers based on offered capacity price for each settlement time period and shall select those ones as winning offers, which together satisfy the tender volume requirement and constitute the least total procurement cost for Moldelectrica.

Based on winning offer data, MMS shall also create a reserve schedule per BSP.

If results of the clearing satisfy all requirements of the tender, then – depending on actual settings – MMS shall be able to approve the tender results automatically or MMS shall provide the possibility for Moldelectrica MMS Operator to approve the tender results manually.

If results of the clearing do not satisfy the capacity volume requirement of the tender (i.e. not all required capacity is covered by offered capacities), then Moldelectrica MMS Operator shall be able to decide on follow-up actions. It shall be possible e.g. to cancel the tender with setting a reason for it and/or organise a new tender for the same product to cover all required capacity volume.

4.3.6 Final tender results

After the validation of tender results, MMS shall send an announcement of all participating BSPs about the tender results.BSP could download by xml his results.

Following the successful closure of the tender process, MMS shall make tender results available to other MMS modules (e.g. Settlement, reporting, etc.) and Moldelectrica's other business applications for further processing.

4.3.7 Capacity transfer

The capacity won into the auction could be transferred between BSP with following rules:

1. The BSP A can transfer to BSP B part of one capacity product only if the BSP B has qualification for that type of capacity product and qualified quantity of BSP B is at least equal with transferred capacity from BSP A and his own contracted capacity or transferred from others BSPs

2. The BSP A can't transfer to BSP B more quantity than he has contracted or transferred from others.

3. The BSP A can transfer to many others BSP B, C, D, etc. up to the the quantity described above

4. The transferred quantity of the BSP A for respective product will be subtracted from the contract of BSP A. This transferred quantity will be added to the total contracted quantity of the supplier B. The price of transferred quantity cannot be modified (auction price).

5. BSP A always initiate the transfer. BSP B could validate or reject the transfer. TSO could reject transfer validated by BSP B in 30 minutes (configurable) from that validation, otherwise the transfer is accepted automatically

5. The quantity transferred from the BSP A to BSP B can be also transferred by BSP B to another BSP but it must be done until the deadline for transfers. The deadline for any transfer is 1 hour(configurable) before the day of delivery of the respective product..

4.4 Procurement of balancing energy

4.4.1 High level process overview

The high-level process is presented in Figure 10. Based on aggregated BRP schedule data and the load data of the transmission network in Moldova, MMS shall calculate the balancing energy needs for all settlement time period of the following delivery day. This is followed by gate opening of energy balancing market, who are to submit their balancing energy offers to MMS.

Based on the forecasted balancing energy needs or in case of an unexpected need for balancing activation during real time operation, MMS shall run an optimisation calculation to select those balancing energy offers, which satisfy all balancing and system operation requirements and takes the actual availabilities of BSPs into account. Activation is either executed automatically by SCADA-EMS/MMS, or manually by Moldelectrica MMS Operator. In case of unexpected unavailability of BSP, a new availability declaration shall be sent to MMS by BSP. The fulfilment of activation is tracked.

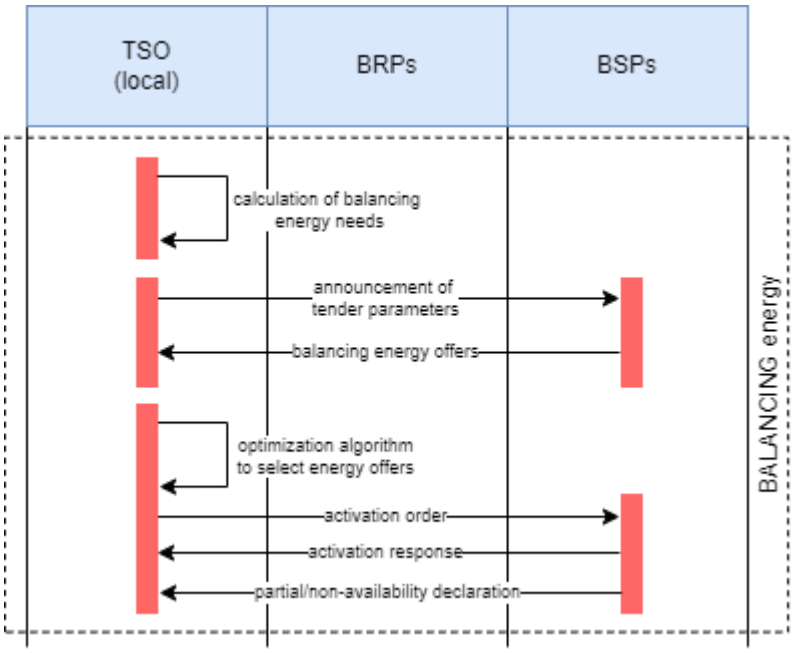

Figure 10. Balancing energy procurement high level overview

4.4.2 Calculation of balancing energy requirements

MMS shall be able to calculate the balancing energy requirement for all settlement time periods of delivery day. This calculation shall be based on the aggregated planned TSO schedule and the forecasted system load. Based on this balancing energy requirement, MMS shall be able to run a clearing algorithm to select balancing energy offers which cover balancing energy needs for all settlement time period of the delivery day at the least cost for Moldelectrica. In real time Moldelectrica MMS Operator shall enter the required balancing energy into the MMS that will run the activation optimization function to select the offers to be activated. MMS shall allow for the selection of product type, direction (upward/downward), type of activation, reason for activation, etc.

4.4.3 Balancing energy product definitions

MMS shall provide the capability to handle balancing products in compliance with ENSTO-E *standard* balancing energy product definitions and *specific* balancing energy products in Moldova.

MMS shall make it possible to run electronic tenders for the following balancing energy products:

- Automatic Frequency Restoration Reserve (aFRR) – separate products for upward and downward directions
- Manual Frequency Restoration Reserve (mFRR) – separate products for upward and downward directions
- Replacement Reserve (RR) – separate products for upward and downward directions

As a principle, the standard balancing energy products to be handled by MMS are defined in the following way: The product exchanged in Common Platform for Replacement Reserves is the standard product for balancing energy from RR. The product exchanged in Common Platform for Manually Activated Frequency Restoration Reserves is the standard product for balancing energy from mFRR. The product exchanged in ENTSO-E Automatic Frequency Restoration Reserve Process is the standard product for balancing energy from aFRR.

In addition to the standard products, MMS shall be able to handle specific products defined by regulations in Moldova.

4.4.4 Management of balancing energy tenders

MMS shall be capable of managing the complete business process of ENTSO-E balancing processes according to IEC 62325-451-7:2021 for Moldova balancing market. The timing of processes shall be driven by a suitable gating mechanism, which makes it possible to flexibly configure the gate parameters to meet the requirements of local market rules in Moldova as well as the rules of European integrated electricity markets.

MMS shall provide the possibility for Moldelectrica MMS Operator to configure balancing energy tenders by setting the following parameters:

- Gate openings/closures related to the tender
- Contracting time period
- Type of balancing product/direction
- Default required total balancing energy to be procured
- Limitations in offer price
- Free text field

MMS shall provide a dedicated UI for Moldelectrica MMS Operator to overview the planned tenders with their timing and actual statuses. It shall also be possible to view and modify the parameters of specific tenders selected on this overview with sufficient user privileges.

4.4.5 Submission of balancing energy offers

MMS shall automatically manage the tender opening ang closing gates for balancing energy tenders according to configured parameters.

MMS shall make it possible for BSPs to submit their balancing energy offers (Reserve Bid Document according to IEC 62325-451-7) to the MMS platform in an electronic way. The MMS function for the submission of BSP balancing energy offers shall be fully compliant to IEC 62325-451-7:2021.

Balancing energy tenders shall be organised for several contracting time periods in MMS. The contracting periods of balancing energy tenders shall be configurable.

MMS shall implement dedicated gates for the submission of balancing capacity offers by BSPs. It shall be possible for MMS users, according to their user privileges, to submit, view, create, cancel and modify offers within the time frame given by gates for offer submission and modification. MMS shall make it sure, that only those BSPs can submit offers for a given balancing energy product, whose balancing capacity offers were accepted by MMS for the product and for the time period. In case a BSPs has not submitted its offers, MMS shall automatically generate offers for that BSP with predefined parameters.

Offer submission in MMS shall be possible for the balancing energy products defined in chapter Balancing energy product definitions Balancing energy product definitions above. Submission of BSP offers shall be possible in the following ways:

- dedicated web service
- direct XML file upload to MMS
- dedicated MMS user interface for manual offer submission

MMS shall support the updating of submitted offers, always the latest version of the offers shall be available in MMS. All changes to the offers shall be tracked by MMS in a way, that allows to track the offers throughout its life cycle.

The user interface for manual offer submission shall provide means to user friendly data entry from external spread sheets and with autofill features. Also, the UI shall provide all necessary features to enter any specific data related to an offer type. MMS shall provide a feature for user to check the correctness (formal syntactical check) of the offer to be submitted.

In case of XML file upload MMS shall also provide a feature for MMS user to check the correctness (formal syntactical check) of the offer to be submitted.

The offer document shall be in xml format and shall comply with the IEC 62325-451-7:2021 "reservebiddocument" format.

Offers submitted by BSPs, shall contain at least the following information:

- BSP's ID
- Production/consumption unit ID
- Version of offer
- Tender ID
- Time interval for offer validity

- Time resolution
- Offered quantity (MW/h)
- Offered price (MDL/MW/h)
- Location of the offer
- Divisibility of offer
- Direction of offer (upward/downward)
- Step increment (if offer is divisible)

MMS shall execute syntactical and semantical validations on submitted offers. Validations must be clearly documented in detail and as far as possible configurable by MMS system administrator. It should be possible for MMS system administrator to configure new validations, modify or delete existing ones in case market rules change.

Syntactical validations shall verify all important rules of the XML schema defined. MMS shall give reason information to the user on the identified errors for supporting the correction process.

MMS shall also provide features to run several semantical validations on submitted data. These validations shall check the submitted offer values and shall provide notifications to the MMS user about the results and the reason of errors.

The following validations shall be implemented in the MMS for balancing energy offers as a minimum:

- authorization to submit offer (based on pre-qualification data)
- checking against gate closure/open times
- checking against minimum quantity, qualified quantity, generation schedule and availability declarations of dispatchable generating units/storages or consumptions
- checking against minimum/maximum price if any. Minimum price/maximum price could be fixed values or dynamic values based on configurable calculation algorithm.

As a response to offer submission, MMS shall automatically send an acknowledgement in the form of an Acknowledgement Document respecting the ENTSO-E format IEC 62325-451-1. The other actions of MMS as a response to the results of validations shall be defined in the detailed design phase of the MMS implementation project.

During the tendering phase MMS shall also receive all necessary constraint information (e.g. network capacity constraints) for the operation of the optimization function for the selection of balancing energy offers.

4.4.6 Selection and Clearing (Activation optimization)

Following offer submission gate closure, MMS shall establish a merit order list of the offers that can be activated based on required balancing energy demand inserted by MMS operator. MMS shall execute an optimization activation algorithm to determine which offers meet balancing needs and to assign the offers to the needs for every settlement time period of the calculation run, per balancing energy product type, per direction. MMS shall also determine the clearing prices of the selected offers on a "pay as bid" basis or "marginal price", according with configuration by MMS Administrator. The optimization activation algorithm shall take into account the actual availability information of the generating/consumption units registered in MMS and also related (network) constraint information for the handling of internal network congestions..

Default reason for activation is "Balancing". Moldelectrica MMS operator should have the possibility to select specific balancing units / offers for activation for the purpose of congestion management and also for "Emergency help delivery" in manual mode. MMS shall provide the feature to define the reason for the activation.

4.4.7 Activation of balancing energy

As a result of clearing, MMS shall deliver the list of balancing energy offers, that are to be activated, as well as the amount of satisfied balancing needs in comparison to the total balancing energy needs.

MMS shall be able to send out activation orders (Activation Document according to IEC 62325-451-7) to BSPs to activate the delivery of a certain balancing energy offer. In this context, "activation" means, that Moldelectrica MMS Operator manually or the MMS automatically issues an order to the BSP to activate the reserves that have been offered through a balancing energy offer, for the delivery of balancing energy. This is different from real-time control command orders that may be sent by e.g. a SCADA-EMS system. In case of aFRR product, MMS shall send offer data of selected aFRR offers to Moldelectrica's SCADA-EMS system, which executes the aFRR activations automatically or MMS shall send to SCADA-EMS the list of selected units (basepoints and quantities) to provide aFRR

In a situation when no generating units are available to provide upward balancing energy, Moldelectrica MMS Operator shall have the possibility in MMS to activate other, not pre-qualified generating/consumption units to ensure the safe and secure operation of the power system. MMS shall be capable of handling such an event with storing all relevant activation information (e.g. name and EIC code of the activated participant, the time and the volume of activation, reason for activation, instruction from the operator, etc.). In this case MMS shall provide a possibility for a manually initiated clearing, where offers from not pre-qualified BSPs are also considered by means of a related setting of the clearing run. For the purpose of this clearing, not pre-qualified BSPs shall have predefined default balancing offers in MMS (defined by Moldelectrica) for their whole generation capacity range. The volume of offers in both directions that are available for a given time period, shall be defined by MMS automatically, based on the actual planned schedule of not pre-qualified BSPs. The clearing algorithm shall always give priority for offers of pre-qualified BSPs against the offers of not pre-qualified BSPs. This means, that clearing algorithm shall always select offers of pre-qualified BSPs first, and offers from not pre-qualified BSPs can only be selected, if no more offer from pre-qualified BSPs are available for the time period.

MMS shall be able to receive an Acknowledgement document from BSPs as a response for the activation order. The execution of the activation command shall be monitored by MMS based on measurement data from BSPs.

MMS shall make clearing results and activation related data available to other MMS modules (e.g. Settlement, reporting, etc.) and Moldelectrica's other business applications for further processing.

4.5 European balancing platforms

4.5.1 ENTSO-E Automatic Frequency Restoration Reserve Process

MMS shall establish the business process defined by ENTSO-E Automatic Frequency Restoration Reserve Process, adapted to the actual situation of Moldelectrica as a system operator and LFC operator. MMS shall be able to create and provide all input data in the required format to the European common platform for Automatic Frequency Restoration Reserve Process.

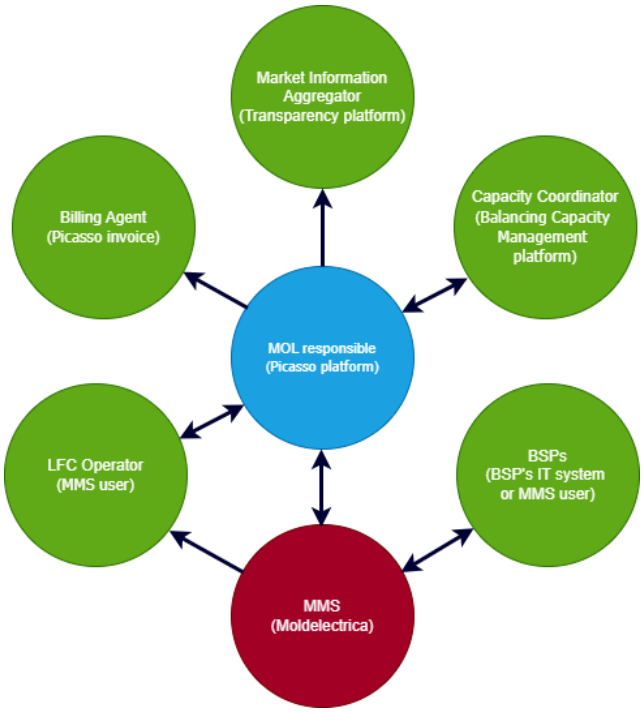

Figure 11. Data exchanges within the common European aFRR platform

MMS shall be able to receive and process all data in the required format from the European common platform for Automatic Frequency Restoration Reserve Process/Imbalance netting process Figure 11 highlights the main data exchange interfaces of MMS with external systems playing an important role in the Picasso process. High level list of data exchanged between MMS and the common platform can be seen in Table 5.

Table 5. List of data exchanged between MMS and Picasso platform

#	Sent to Picasso platform	Received from Picasso platform	Comment
1.	Local Merit order list		MOL of submitted balancing offers; can be updated
2.	Bid unavailability information		Flag to indicate offer's availability
3.		Successful Merge Confirmation	Conformation on merging LMOLs into a CMOL
4.		Common Merit Order List – CMOL	
5.	Cross-border capacity limits (TSO)		Export/import limits per cross-border
6.	Cross-border profile limits (TSO)		Profile limits for export/import per cross-border
7.	aFRR demand		sum of the already activated aFRR and the FRCE
8.	aFRR/IN participation		to define which TSOs are to be considered in the optimization step for aFRR/IN
9.	Cross-border capacity limits (LFC operator)		
10.	Cross-border profile limits (LFC operator)		
11.	LFC input		Required LFC
12.	Activated aFRR		already activated aFRR for the LFC area
13.		FRCE	Frequency Restoration Control Error at each optimization cycle
14.		Cross-border marginal price	aFRR settlement price used for BSP-TSO and TSO-TSO
15.		aFRR power interchange	Resulting aFRR interchanges on cross-border intersections
16.		Corrected demand	
17.		Correction value for FRR	1 correction value per optimization cycle
18.		Correction value for IN	1 correction value per optimization cycle
19.	aFRR request		aFRR control request to BSPs
20.		Cross-border flows	
21.		TSO-TSO settlement reports	

4.5.2 Common Platform for manually activated frequency restoration reserves

MMS shall establish the business process defined by ENTSO-E Common Platform for manually activated frequency restoration reserves, adapted to the actual situation of Moldelectrica as a system operator and LFC operator. MMS shall be able to create and provide all input data in the required format to the European Common Platform for manually activated frequency restoration reserves.

Figure 12. Data exchanges within the common European mFRR platform

MMS shall be able to receive and process all data in the required format from the European common platform for manually activated frequency restoration reserves. Figure 12 highlights the main data exchange interfaces of MMS with external systems playing an important role in the MARI process. High level list of data exchanged between MMS and the common platform can be seen in Table 6.

Table 6. List of data exchanged between MMS and MARI platform

#	Sent to MARI platform	Received from MARI platform	Comment
1.	Balancing energy bids		balancing energy bids for the standard mFRR product
2.	Cross-border capacity limits (TSO)		Export/import limits per cross-border
3.	Cross-border profile limits (TSO)		Profile limits for export/import per cross-border
4.	AC constraints		Constraints related to AC links
5.	AC schedules		Schedules for AC links, where constraints were submitted
6.	mFRR demand		demands for balancing energy for scheduled and direct activations
7.	Disconnection/decoupling		To request disconnection of decoupling from platform
8.		Satisfied demands and bids to be activated	
9.		Cross-border flows	border flows resulting from scheduled and direct activations
10.		Net position	net position for LFC/scheduling area as resulting from scheduled and direct activations

#	Sent to MARI platform	Received from MARI platform	Comment
11.		Remaining cross-border capacity	cross-border capacity that remains unused after the optimization of the scheduled and direct activations
12.		Clearing prices	
13.		Settlement prices	settlement prices for direct activations
14.	reasons for changes to bid availability		Detailed reasons for changes to bid availability
15.		TSO-TSO settlement reports	

5 Procurement of Grid Losses (GL)

5.1 General process overview

The aim of this MMS module is to support an auction-based tender process of Moldelectrica for the procurement of electric energy to cover transmission grid losses (GLs). This MMS module shall implement a competitive procurement process, respecting the principles of transparency and non-discrimination and shall be compliant with the market rules in Moldova.

The process overview presented in Figure 14 describes the key steps involved, followed by a clear and methodical approach, with the roles and actions of the Transmission System Operator (TSO) and the auction participants.

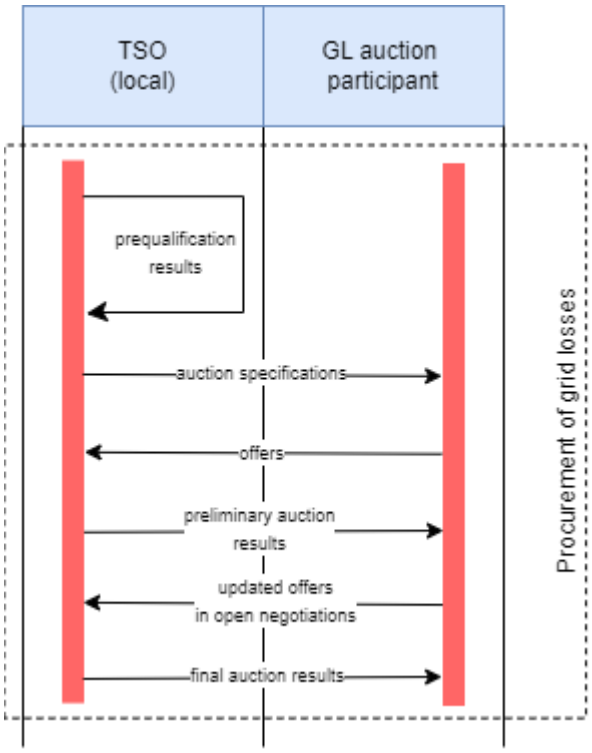

Figure 14. Process overview – Procurement of grid losses

As a result of prequalification, a list of prequalified suppliers will be generated by Moldelectrica, outside of MMS. This registration data shall be entered into MMS. MMS shall maintain a central repository for storing and maintaining market participant data of prequalified suppliers. The GL module shall use and reference always the actual version of this standing data to maintain consistency with other MMS internal modules and MMS external market parties. Further requirements related to this topic can be found in chapter 7 Market Participant Registration and standing data (MPR).

The next phase involves the preparation and announcement of the auction specification to the prequalified suppliers. TSO creates detailed auction specifications, including e.g. the types of products (e.g., base load, peak load) and delivery time frames, etc. The specifications provide clear guidelines for the auction process. TSO then publishes the tender specifications on its official website and MMS sends auction announcements to all prequalified suppliers. This ensures that all potential participants are informed and can prepare their offers accordingly.

Suppliers submit their offers at MMS according to auction specifications and MMS validates the offers. Following the submission of offers to the auction, the process moves to the evaluation of results. MMS evaluates each offer based on criteria such as price and energy volume. MMS identifies and selects offers that result in the least cost for the procurement, and satisfy the energy volume requirement.

MMS then sends these preliminary auction results to the auction participants, who then have the possibility to decrease their offer price by submitting new updated offers to MMS. After the closure of this "open negotiation" phase, MMS runs a final evaluation of offers and publishes the final auction results to auction participants.

The MMS process for GL procurement shall be driven by a related gating mechanism, which allows for flexible scheduling of the related business processes. Gates shall be configurable by Moldelectrica MMS Operator with relevant privileges.

5.2 Product definitions

MMS shall provide functionality to auction different energy delivery products to cover grid losses. The products will be procured for several time frames, and MMS shall provide the capability for users with related privileges to flexibly configure the auction time frames. The following time frames (TFs) shall be configured within MMS as a minimum:

1. Annual tenders
2. Quarterly tenders
3. Monthly tenders
4. Weekly tenders

The time frame (TF) of a tender represents:

a) a calendar year or 12 consecutive months for annual tenders

b) a quarter of a year for quarterly tenders

c) a month for monthly tenders

d) a week for weekly tenders

Within all time frames, the following products shall be procured:

1. Base load
   a constant MW value for a period TF
   The base load is a standardized block energy product for the physical delivery of electricity, the supply of which starts on the first day of period TF at 00:00 and ends on the last day of the period TF at 24:00.

2. Day load
   a maximum MW value for a period TF
   The daily load is a specific daily profile of the energy product for the physical delivery of electricity, the delivery of which starts from [07.00] h to [22.00] h on each working day of the period TF
3. Night load
   a maximum MW value for a period TF
   The night load is a specific daily profile of the energy product for the physical delivery of electricity, the delivery of which starts from [00.00] h to [07.00] h and from [22.00] h to [00.00] h on every non-working day of the period TF. On non-working days, the profile is that of a basic product

Regarding the volume of electricity offered, MMS shall differentiate between the following product types:

- Fixed volume - e.g. basic product 10 MW,
- Flexible volume – defined by the minimum quantity, as well as the step size
- no volume – This is used in an invitation for market testing purposes to define, that TSO wants to buy a certain profile (base, peak or semi-peak for a certain period). Auction participants are to submit quantity and price pairs.

5.3 Registration of eligible auction participants

Market participants, who want to participate in the competitive tender process to deliver energy covering transmission grid losses, must go through a prequalification procedure. The prequalification itself is run outside of MMS, but the data related to the results of the prequalification shall be registered in MMS, in a central repository for storing and maintaining market participant and market related standing data.

The central repository of MP data shall contain information on the eligibility of market participants to participate in GLs tenders. MMS shall ensure, that only the eligible market participants (MPs) are allowed to take part in GLs tenders. Moldelectrica MMS administrator shall be able to modify the registry data according to the actual status of MP eligibility. The MMS module for procurement of GLs shall use and reference always the actual version of this standing data to maintain consistency with other MMS internal modules and MMS external market parties.

Further requirements related to this topic can be found in chapter Market Participant Registration and standing data (MPR) Market Participant Registration and standing data (MPR).

5.4 Announcement of tender specifications

MMS shall establish an automated auction process for the procurement of electric energy to cover transmission grid losses. TSO MMS supervisor shall also have the right to manually drive the tender process in MMS if necessary or run the whole process outside of MMS.

In addition to the publication at TSO's official website (not MMS scope), a tender specification shall be sent out by MMS to all prequalified service providers (auction participants) of energy to cover GLs. The specification should contain at least the following information:

1. Auction schedule (e.g. offer submission/evaluation/result publication time frames) including testing procedures, if relevant
2. Products
3. Delivery period
4. Volume of electric energy
5. Details of the offered price and currency, if relevant (e.g. maximum price)
6. Details of financial guarantees, if applicable
7. Load profile to be covered by delivered energy
8. Buyer's contact person(s)
9. Other auction related information required, e.g.
    9.1. Source of electricity (from own power plants, through purchases on the electricity market, through import with the indication of the country of origin)
    9.2. Transmission capacity allocated to the respective interconnections during the contract period, in case of electricity importers
    9.3. Proof of availability of power and sufficient amount of electricity
    9.4. Proof of holding sufficient volume of fuel during the contract period
    9.5. Proof of absence of debts towards fuel suppliers
10. The draft of the contract with service providers;
11. Qualification criteria
12. Offer evaluation rules and criteria.

Auctions can be organized simultaneously for several types of products. In this case, the Auction Participants shall submit separate offers for each product.

5.5 Submission of offers

After the start of offer submission time period, MMS shall make it possible for auction participants to submit their offers within MMS to deliver energy covering GLs. According to their MMS user privileges it shall be possible for auction participants, to submit, view and modify GLs offers within the time frame given by gates for offer submission and modification. MMS shall also provide a feature for MMS users to check the correctness (formal syntactical check) of their offer to be submitted to MMS. During the offer submission period, auction participants can update their previously submitted offer. Only the last accepted offer is considered as final and taken into account by MMS when determining the winners of the auction.

Submission of GLs offers shall be possible in the following ways:

- dedicated MMS user interface for manual offer submission

The user interface for manual offer submission shall provide means to user friendly data entry from external spread sheets and with autofill features. Also, the UI should provide all necessary features to enter any specific data related to an offer (listed in chapter Announcement of tender specifications Announcement of tender specifications). MMS shall provide a feature for auction participant user to check the correctness (formal syntactical check) of the offer to be submitted to meet all auction specific requirement announced in the auction specification.

MMS shall support the versioning of submitted offers. All versions of offers shall be stored in MMS for a period of 5 years and shall be directly accessible by MMS user.

In all auctions, tenderers may submit up to 3 independent offers for each product. In case of "no volume" auctions (for testing) tenderers may submit up to 5 independent offers for each product.

Individual offers submitted by auction participants should include information to specify if the offered volume is not divisible. Otherwise, the offer shall always be considered as divisible in volume by MMS. Offers shall be submitted always for the whole duration of the auctioned time frame.

GLs offers for each product shall include the offered fixed volume of energy or the offered profile of energy delivery in MW and the price in national currency (or currency, specified in the specifications)/MWh rounded up to 2 decimal places.

5.6 Publication of preliminary tender results

After the closure of offer submission time period defined in the auction specification, MMS shall evaluate the submitted offers automatically.

By this time, only formally correct offers meeting all requirements of auction specification are available within MMS. Offer are ordered into a merit order list with ascending offer prices. If there are several offers with the same price, the offer submitted earlier will take priority in the merit order list. The first offers in the merit order list with the lowest price, which together fulfil the volume requirement of the action specification shall be selected by MMS as winning offers. In this selection process, divisibility of offers shall also be taken into consideration by MS.

After the selection of winning offers MMS shall announce the preliminary auction results to all auction participants separately.

5.7 Open negotiations

After the announcement of preliminary auction results, MMS shall allow auction participants to update their offers in terms of price. In this phase, MMS shall allow only the price information to be updated by MMS users. MMS shall ensure, that new price value submitted in the negotiation phase is lower than the one submitted in the initial offer submission phase and announced in the preliminary auction result.

5.8 Publication of final tender results

After the closure of offer submission time period defined for open negotiations, MMS shall evaluate the submitted final offers automatically.

The selection of winning offers is run in the same way as for the preliminary auction results. After the selection of winning offers MMS shall announce the final auction results to the auction participants. The notification will contain the price and contracted quantities for each auction product for the auction participant.

Settlement related data of winning offers shall be available within MMS for the settlement module.

5.9 Changes to the auction specification

It shall be possible in MMS to extend the deadline for submission of offers under specific predefined conditions. The extension of the deadline for submission of offers shall respect the rule, that for auctions products longer than one month, the offer submission deadline must be at least 30 days before the expiration of existing electricity procurement contracts. The changes in auction specification shall be announced by MMS to auction participants with the relevant condition for the change.

It shall also be possible in MMS to cancel the entire action procedure under specific predefined conditions. The TSO is allowed to cancel the auction if

1. no offers have been submitted;
2. less than three pre-qualified suppliers submitted offers for each individual product until the end of offer submission period;
3. if the Buyer considers that the purpose of the auction has not been achieved.

The auction cancellation shall be announced by MMS to auction participants with the relevant condition for the change.

If the auction is cancelled, MMS shall allow to hold a repeated auction. The repeated action announcement shall reference the original action, that is repeated. The repeated auction implements the same process in MMS as the original auction.

In the repeated auction held for products with a term of more than three months, the buyer can select the winner if bids were submitted by at least 2 participants, with the exception of repeated auctions organized by the system operator, in which case it is allowed to select the winner with only one offer.

Under special circumstances, TSO MMS supervisor shall be able to manually initiate the rerun of the evaluation of final offers. This can be initiated in a situation, when the winning auction participant is not willing to sign the contract with Moldelectrica. In this case TSO MMS supervisor shall be able to exclude its offer from the evaluation and MMS shall select the winners considering only the remaining final offers.

6 Market Participant Registration and standing data (MPR)

MMS shall maintain a central data repository for storing and maintaining market participant and market related standing data. In contrast to time series data, values of standing data do not regularly change during everyday market operations. Standing data are typically characterised by entity types with attributes and can have relationship(s) with other entity types. All MMS modules shall use this data during the execution of their business processes in order to realize a single source of standing data throughout the MMS.

In addition to the central market participant data repository, MMS shall have specific user interface to make market participant registration possible through entering/viewing/editing standing data. The registration process in MMS shall follow the concepts of ENTSO-E documents, especially the ENTSO-E role model. The main goal of the different registers is to provide as much data as necessary to fulfil the market related business procedures of Moldelectrica, which can be conducted and monitored in a convenient way. The period of validity of registration data shall be specified within MMS (e.g. by the concept of "effective dates"), and the changes of data shall be tracked in an auditable way. MMS modules shall always use the standing data values valid for the time period of the executed MMS business process.

Based on user profiles/privileges it shall be possible in MMS to enable users to register market participants for specific market activities (balancing, scheduling, etc.), roles (BRP, BSP, etc.) and products (aFRR, mFRR, etc.), etc. by entering all necessary data for the operation of the related MMS modules. During data entry specific data validations shall be executed automatically by MMS to eliminate data errors. During the registration process, the Moldelectrica MMS Operator user interface shall follow a standard workflow requiring the MMS operator to enter the relevant information and the correct entitlements, which are then applied to the register. It shall be possible to create multiple users per market participant.

It shall be possible to create new registrations and update existing registration through import of data. All market participant shall have the right to view and export its own registered data.

The underlying standing data required and its structure shall be precisely defined during detailed implementation phase of the implementation project through a close cooperation with the selected solution provider.

The standing data shall meet the following main functional requirements:

- MPs should be able to submit data for new resources as well as updates to their existing resources electronically using the UI. The UI should also provide a system level interface API so that MPs can submit and obtain data.
- Standing data registration shall have some basic validation rules to check incoming data.
- MPs shall be able to view and download approved data and expanded data reports.
- Moldelectrica MMS Operator shall be able to modify the contents of the standing data, by adding or removing specific types of data as resource requirements change.

- Operators shall be able to manually modify standing data values using the UI.
- The standing data tool should support the following:
    - Upload of Data in XML format;
    - Download of Data in Excel, .CSV and XML format;
    - View History Data;
    - Query the Status of Submittal;
    - Display effective Date Change.

MPs will review their own standing data for accuracy and provide updates as needed. After receiving the data, MMS Operator validates and accepts the data before it is made effective for use by the various MMS applications. The process will conclude with a notice to the affected MP regarding the status of the requested change and its effectiveness.

The Contractor should define the required registries in order to ensure all the MMS functionalities. The list of registries will include as well the registries defined in this chapter.

6.1 Registry data for scheduling

Standing data related to the MMS module "Scheduling" shall contain at least the following data items:

- Control area ID
- Balancing area ID
- Balancing group ID
- BRP ID for coordinator of the balancing group
- Market participant ID (legal person)
- BRP Contact details
- date and registration number of the balancing contract;
- the identification code of the connection point(s) for which it has assumed balancing responsibility;
- Limit value for maximum generation for an individual generating unit/group of generating units/power plant with limitation type (e.g. stand-by, reserve provision, congestion resolution, regulatory order, etc.)
- Limit value for minimum consumption for an individual consumption unit with limitation type (e.g. stand-by, reserve provision, congestion resolution, regulatory order, etc.)

The following actions shall be possible in MMS related to scheduling standing data:

- BRP registration, modification, cancellation
- Changing balancing groups
- MPs can view and export MP registration data
- Make data available for market participants and Regulator (Agency),
- Extract information about registry data changes

6.2 Specific registry data for cross border capacity

Standing data related to the MMS module "Cross-border capacity" shall contain at least the following data items:

- LFC area ID
- Capacity coordinator ID
- Cross-border sections
- Capacity trader/Interconnection trade responsible ID
- Capacity products
- Capacity limits
- Market participant ID (legal person)

6.3 Registry data for balancing market

Standing data related to the MMS module "Balancing" shall contain at least the following data items:

- EIC code of generating/consumption/storage units
- Metering point ID of the unit
- Minimum/maximum power
- Ramp rate for increasing/decreasing generation/consumption
- time to synchronise the unit to the power system
- calculation formulas related to the unit
- BRP ID
- Balancing capacity product types
- Balancing energy product types

6.4 Registry data for procurement of grid losses

Standing data related to the MMS module "Grid losses" shall contain at least the following data items:

- the name and contact details of the electricity producer/trader
- Unique MP identification number
- the identification code of the BRP that assumed balancing responsibility for that MP
- max power

6.5 Registry data for settlement

Standing data related to the MMS module "Settlement" shall contain at least the following data items:

- Market participant bank accout details
- Limitations on credit cover

7Settlement (ST)

7.1 General description

The settlement module of MMS serves as an overall solution for all settlement activities related to financial transactions associated with Moldelectrica's electricity market activities.

The Settlement module shall be a complete and integrated solution within MMS. The key design requirements for the system are flexibility, configurability, and performance. It shall employ leading edge technology and meet all the requirements of Moldelectrica.

The Settlement module must be flexible for design changes and must integrate with the rest of the MMS as well as the existing accounting systems of Moldelectrica. The Settlement System must be capable of providing, but not limited to, the following products and services:

- Processing of both charges and revenues;
- Periodic billing;
- Publication of settlement files with charges and payments to MPs via secure web access;
- Preliminary and final settlement runs, and reruns;
- As required resettlement for final and other rerun requirements;
- Configurable settlement engine that allows custom definition of settlement data, settlement and billing rules, invoice formats, and reports;
- Ad--hoc queries, and report functions with a user--friendly interface;
- Graphical analysis tools including time interval graphs, statement comparisons, and trend analysis;
- Industry standard interface layer to facilitate data transfer to other systems.

The Settlement module shall support market reconciliation as a standard function. The Settlement module shall also store all settlement inputs and outputs to meet audit and rerun requirements. Outputs must be referenced to the specific settlement or billings runs in which they were produced. The settlement system shall provide the possibility to configure the market execution timeline following evolving Market Rules. The Settlements System shall provide a very flexible environment to configure settlements calculation as per market rules.

The Settlement System should support the following business processes:

- Settlements: This is the function that actually calculates the charges and payments to MPs using specific formulas, reference data, market results, and meter data. These charges and payments are reported to settlements analysts for validation and review before publication. Settlements can run multiple times with different versions to verify settlement results and when recalculations are required due to updated market results or meter data. Settlements can be monthly or yearly depending on the configuration of charges and payments. It should be possible to run the settlement process for a shorter than one month period (defined by MMS Administrator), e.g. if the Market Rules were changed in that period that requires division of the monthly settlement period in shorter periods.

- Billing: After settlements are verified, one or more settlement runs can be incorporated in a billing run. The billing run sums up the charges and payments in each settlement run for the period and type of the bill, and produces a summary bill for each MP. Billing can run multiple times with different versions if errors are found.

The business processes for settlement shall follow the high-level process described below:

1. Collecting input data
2. Validating data inputs
3. Executing settlement calculations
4. Reviewing settlement results
5. Publishing preliminary settlement data
6. Manage disputes (reconciliation)
7. Correcting/updating settlement results
8. Publishing final settlement data
9. Provide billing data (input for invoicing)

7.2 Scope of settlement

The Settlement system shall execute the settlement calculations listed below, according to the actual regulations in Moldova regarding TSO settlements. The system shall flexibly enable the modification of settlement calculations and the creation of new settlements in order to accommodate changes arising from the legal environment. The following types of settlement calculations are in the scope of MMS:

1. Imbalances
   1.1. BRP Imbalances
   1.2. System imbalances
2. Balancing services with BSPs
   2.1. Balancing capacity
   2.2. Balancing energy
3. Grid losses procurement with suppliers of energy to cover grid losses

4. TSO-TSO settlements (FSKAR process support, Imbalance netting process, MARI process, PICASSO process , settlement of emergengy help, day-ahead market coupling, intra-day market coupling)

Settlement of electricity transmission services, offered by TSO to market participants (shall be provided as optional functionality with a separate price). Moldelectrica is responsible for development and specification of settlements at the formula level, this information will be provided in Detail Design Phase The migration of the formulas and their transformation into the form required by the MMS system is the responsibility of the Contractor. Due to legislative changes, settlement formulas are constantly changing. It applies to all settlements formula, that the Contractor must enter the settlement formula into the MMS system with the version provided by Moldelectrica at the start of the implementation phase.

7.3 Settlement system interfaces

7.3.1 Settlement system internal interfaces

The Settlement System shall function as an integrated part of the MMS architecture. The expected data connections of the settlement system are presented in the schematic diagram below. The settlement system exchanges data with Moldelectrica internal systems within and outside of MMS domain. The settlement module, as all other MMS modules, will reference the standing data repository for market participant related registration data. Both users from Moldelectrica and market participants have access to the settlement system with dedicated privileges.

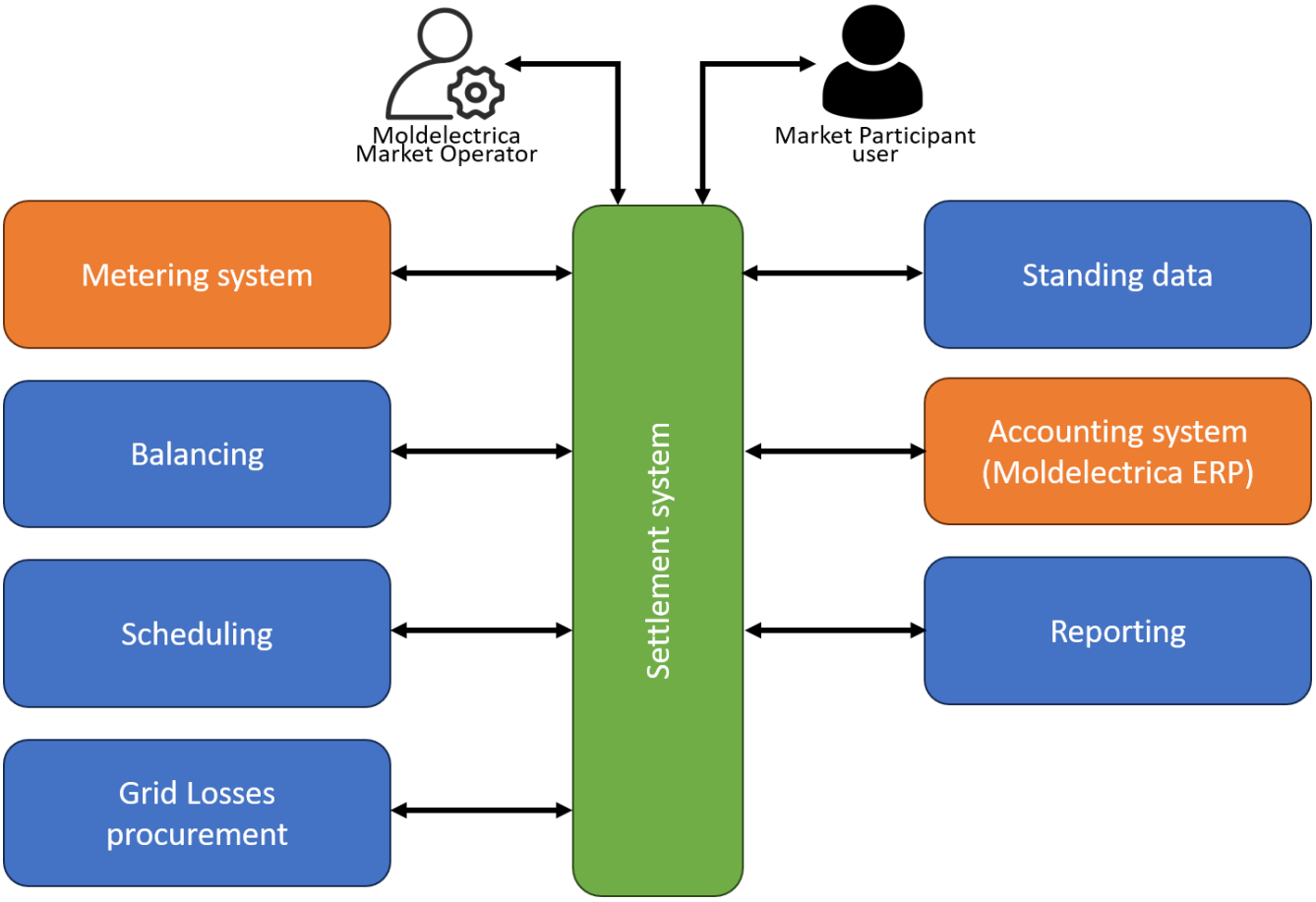

Figure 15. Settlement system interfaces

MMS shall be capable of receiving and displaying meter data from Moldelectrica's Metering Data Management system, in connection with the operation of MMS. Data interface between MMS and Metering Data management system shall be provided by the contractor in a way, that meets the requirements of Meter Data Management system. Moldelectrica MMS Operator and market participants shall have access to meter data in MMS according to their user privileges.

7.3.2 Settlement system interface with **Metering System**

The MMS interface with Metering System (MS) should be performed by MS API

The API serves as a bridge between the two independent IT systems. MMS shall be able to connect to MS via API to receive data in JSON or other agreed format, ensuring efficient and secure data communication.

API Key Features:

RESTful Architecture: The System will follow REST (Representational State Transfer) principles, ensuring scalability, simplicity, and ease of integration.

Data Format: The data will be transferred in JSON or XML formats. The JSON data schema will be well-defined, ensuring consistency and clarity. A sample schema might look like this:

```
{
  "id": "string",
  "timestamp": "string",
  "value": "number",
  "metadata": {
    "source": "string",
    "type": "string"
  }
}
```


Authentication and Security: The API will implement secure authentication mechanisms such as OAuth 2.0 or API keys to ensure that only authorized systems can access the data. Data transmission is encrypted using HTTPS protocol.

Documentation: Comprehensive API documentation will be provided, including endpoint descriptions, request/response examples, authentication methods, error codes, and usage guidelines.MMS should allow also for manual input of data from MS in the agreed format.

7.4 Functional requirements

7.4.1 Main settlement functions

7.4.1.1 Loading input data

The settlement system shall read the basic settlement data from the partner systems. Input data scanning can be initiated by partner systems, by the Settlement system automatically, or by users of the Settlement system.

7.4.1.1.1 Change of input data

Input data may change for different settlements runs. During processing, MMS shall incorporate the changed data so that the data has a validity period.

At a given calculation run, the settlement must always use the latest, valid values. For each run, it should always be possible to determine which version of the input data was used.

If a change in the basic data affects the status of the settlement runs that use it, a signal indicating a change in the basic data should appear on the calculation instance.

7.4.1.1.2 Calendar

The start and scheduling of settlement runs must be supported by a calendar function. It shall be possible to add processes to the calendar on the scheduling interface. In addition to the scheduler, it should also be possible to directly add a process to the calendar, or to transfer a scheduled task to the calendar freely or with specific authority. Based on the calendar configuration, there should be special properties (e.g. holidays) that are taken into account by the workflow and the scheduler.

When setting up the scheduler, it must also be possible to set the subject period for which the settlement will run. For example, a settlement that runs on the 4th of every month should run for the previous full month or for the previous 3 days. Deactivation of settlements configured in the calendar shall be possible for a period.

7.4.1.1.3 Scheduled data scan

In the calendar function it shall be possible to schedule data scans relative to the scheduled start of the related settlement run.

7.4.1.1.4 Checking data scans

A suitable interface shall be provided to Moldelectrica Settlement user for browsing the input data that comes into the system. User should see the received data, their validation and processing status, and the date of their arrival on a clear interface. The system shall notify the user during processing if a formal or content validation error is detected. The problematic data areas must be marked on the interface, and they can be filtered and sorted.

The content of the basic settlement data must be displayed in the system. It must be possible for the user to compare input data from different versions, the system shall highlight the changes. It shall be possible to export this data to Excel, and to download the source file directly.

7.4.1.1.5 Executing settlement runs

Users shall be able to control the execution of settlement calculation groups defined by the configuration and containing calculations by creating settlement processes. The settlement system will be used by a wide range of users through different settlement process. Settlements are run on a schedule according to a calendar, manually started, or controlled by a system process. User groups can run and browse only those the settlements, that are available to them based on their privileges.

7.4.1.1.6 Settlement runs

Each executed instance of a group of settlement calculations is a settlement run. Run statuses shall be assigned to settlements, which indicate their position in the settlement process. The statuses shall be set automatically by the workflow or directly by the user.

If a settlement run uses the results of another settlement as input data, the system shall check whether the input data have not changed since the last run of the used group. User intervention is required to determine whether a re-run of the previous settlement is required.

In the case of such "linked" settlements, it shall be possible to specify the status of the results of a previous settlement that can be used. In the case of independent settlement groups (not linked), the parallel execution of settlement runs shall be possible, without affecting each other's processing time.

7.4.1.1.7 List of settlements

Already executed settlement calculations should be saved by the system, and all partial results should be available from the interface. They can be sorted based on the metadata of the run (e.g. unique run identifier, type, run date, subject period, status, etc.).

The system shall indicate if there has been a change in the input data used in the given run since the execution of the settlement, thus informing the user that the results were not generated from the most recent input data.

7.4.1.1.8 Settlement business processes

It shall be possible to define user activities through process control. Process steps shall include settlement runs, automatic control functions, control steps requiring user activity, approvals, notifications, settlement status changes, creating reports, starting input and output interfaces, and calling any service available by the system. T shall be possible to build conditions and branches into the process.

Authorization settings shall define whether a user can start the given workflow.

The business processes are expected to be implemented by setting up a workflow engine that also exists as an independent product. The process shall be created and edited with an operator role without development within the capabilities of the workflow engine.

The use and visibility of settlement processes shall be controlled by user privileges. The Moldelectrica Settlement operator with specific privileges shall be able to see all scheduled settlement processes.

7.4.1.1.9 Test runs

The settlement formula model shall be versioned. It shall be possible to create a formula model for testing purposes, on which formula changes can be checked by switching the user to the test formula model.

It shall be possible to run settlements for a time period in the past using master data, input data and formulas being valid for the time period in the past specified for the settlement run.

7.4.1.2 Settlement Periods

The settlement shall always be run on the latest, valid input data (not for test runs). The input data can refer to any time interval, and the calculations and aggregations can be defined for any interval in the formulas. The typical business processes require handling of daily, monthly and their related correction settlements.

7.4.1.2.1 Daily settlement

Daily settlement runs on input data for one day, producing daily or higher resolution results. Typically, the runs are scheduled, the entire settlement process is automated, requiring user interaction in the event of an error.

Contents:

- data collection with daily frequency
- automatic check
- scheduled running of daily calculations
- automatic report generation and publication to external/internal partners
- automatic data provision
- automatic data connection to Moldelectrica internal or external systems
- indication if input data of a previous run has been updated
- manual restart by user

7.4.1.2.2 Monthly settlement

Monthly settlement runs typically on input data for a monthly interval. If monthly settlement is linked to daily settlement results, it shall be possible to specify the status of linked settlements that can be used in the monthly settlement. The system shall check whether the status of the used results is correct, and whether there is no signal due to a change in the input data of the used settlement run.

Contents:

- data collection with monthly frequency
- automatic detection of input data changes
- re-run of affected calculations
- scheduled running of monthly settlements
- generation of internal reports
- finalizing monthly settlements
- report publication, data provision
- transmission of settlement data for invoicing, generation of invoicing notification

If the Market Rules were changed during the month, the settlement process should be able to be adjusted as to run different shorter periods with of different rules for the corresponding periods.

7.4.1.2.3 Correction run

Market partners may submit an appeal against the settlement results within a predefined time period, or input data may change. This requires the correction of a previous settlement and invoice. The task of the Settlement System is to re-run the settlement based on the corrected input data and to transmit the new settlement results to Molelectrica's accounting system.

The report, publication, data provision and other interface processes after the correction run may differ from the normal monthly run of the same settlement.

7.4.1.2.4 Special settlements

MMS shall be able to execute the following special settlement calculations:

- Running total function (e.g. for quota monitoring).
- Carrying out simpler statistical analyses (e.g. monthly evolution of control energy/balancing energy balance, monthly evolution of balancing energy financial income)

7.4.1.3 Management of calculations

Regardless of how the calculation engine decomposes the formulas configured by the user and according to which algorithm it executes them, users must be provided with an interface to enter and review the formulas. The Settlement System should provide an opportunity to create new settlement formulas, with the help of which legal and regulatory changes affecting settlement formulas can be transferred by users with the necessary privileges.

7.4.1.4 Building blocks of calculation formula

7.4.1.4.1 Input types

The inputs of a calculation can be the following:

- Bill determinant (BD): settlement input data from an external system or master data, on which calculations have not yet been performed.

- Charge: partial or final result, which is created as a result of a calculation

The bill determinant is the direct output of processing of the input data, transformed into a form that can be processed by the settlement system. Its representation and use is the same as that of a charge. The requirements defined for the charge also apply to the bill determinant.

7.4.1.4.2 Creating a bill determinant

The configuration required for the generation of bill determinants (e.g. set of bill determinants, their attributes, static data) shall also be defined and maintained from the MMS interface, controlled by user roles, in accordance with the master data model and charges.

7.4.1.4.3 Representation of Charge

For the purpose of calculations, there is no difference between a bill determinant and a charge, they must be represented in the same way.

A charge is a time series matrix in which the value belonging to a time stamp are characterized by a set of attributes. A numerical value is therefore characterized by a time stamp and a certain combination of attributes. These characteristics can be considered together as an index matrix, which clearly designate a row in the vector of numerical values.

The operations defined in the formulas are interpreted for matrices, but these are not classical matrix operations. For example, A x B is not a matrix multiplication in settlement, but an element-by-element multiplication of vectors containing the values of A and B. Those elements of A and B for which there is a matching row in the index matrix of A and B (a matrix consisting of timestamps and attributes) must be multiplied with each other.

A timestamp is actually the starting time of a time interval (closed from the left), and the length of the interval is defined by an attribute.

7.4.1.5 Representation of formula hierarchy

A graphical display of the entire formula hierarchy is required. For each formula, the parent and child formulas, input and output attributes, summation and filtering rules, operations should be visible.

7.4.1.5.1 Drill down feature

It shall be possible on the user screen, that the settlement results can be drilled down from the final result down to the very initial input data. In case of an input data, the data source shall be marked according to data source (e.g. input from XML / static data), but the data source shall not be distinguished in any other way. During drilling down, the formula and the time series calculated by the formula should be visible when examining the given interim result. The number of the interpreted interval should also appear in the time series. The time series may also be a large table (e.g. a charge not too far in the hierarchy from a BD), a user-friendly solution shall be provided to display this. The drill-down should also work in the case of nested/linked formulas from several different settlement groups.

Similar to browsing the formula hierarchy, the system should help the user in moving up and down by showing the parent and child formulas simultaneously.

7.4.1.5.2 Representation of the scope of formula

In order to make the interdependencies of formulas clear, by selecting an interim result (charge), the settlement system should create a directed graph that contains all charges down to the basic settlement input data level that affect the selected interim result and all additional charges that are affected by the selected interim result.

For each interim result, the system shall list all settlement basic input data that influence the value of the interim result based on the formula hierarchy. In the same way, the system shall list all final charges (a charge not followed by further calculations) resulting from this interim result.

7.4.1.5.3 Settlement data export

During the display of any bill determinant/interim result (or during drill down), it shall be possible to export the currently displayed time series into Excel or CSV format. Exports shall work correctly, without trimming decimals after the decimal point, even in the case of localization different from English.

It shall be possible to perform filtering and sorting operations in the exported tables.

7.4.1.6 Definition of Settlements

7.4.1.6.1 Calculation formula

The formula defined by the user shall provide all necessary operators, which are needed to perform settlement calculations in an ENTSO-E TSO environment. It shall be possible with in a formula to link several operators.

An example for a formula in which the value of an attribute and the timestamp are referenced:

C = (A * B) + DayOfWeek(Timestamp) - Ref(Attribute5)

7.4.1.6.2 Definition of Formula

It should be possible to define formulas from the user interface, where all settings of the formula can be made.

7.4.1.6.2.1 Graphical support for definition of formula

The creation and modification of formula should be supported by a graphical interface so that all the settings and calculation operations affecting the formula can be specified on one interface:

- Charge basic input data (e.g. name, validity period, formula version).
- Formula editing area, which gives the opportunity to add calculation operations.
- Selecting operands (charges, bill determinants) from a list or by dragging them onto the editor. Displaying basic information about them (e.g. name, formula, attributes).
- Actions can also be selected from the user interface
- Setting filter conditions
- Grouping, aggregation operation selection, attribute operations
- Changing the time resolution and associated aggregation and de-aggregation operations
- Starting formula validation and displaying results
- The system shall display the calculation tree, updating it during the formula definition and shall display the parent and child relationships, as well.

7.4.1.6.2.2 Bulk formula export and import

It should be possible for the user to load formulas in balk, with filtering of errors, supported by clear error message descriptions. Settlement module shall manage the versions and validity period of the formula. This function should also support formula synchronization between different system environments (e.g. operational, test, development systems) in such a way that formula can be exported from one environment and can be imported into the other environment as a bulk export/import.

7.4.1.6.3 Linking Charges

There should be no restrictions on which interim result can be used in another settlement formula (e.g. settlement calculations defined in different groups).

7.4.1.6.4 Settlement groups

It is required, that settlement formulas can be organized into execution groups, that they can be executed separately. The users responsible for the settlement groups belong to different organizations within Moldelectrica, and authorization according to user roles shall define the control of settlement runs and the visibility of settlement results of the settlement group.

The formula of a given settlement group can use the results of formula calculated by other settlement groups without technical restrictions, taking into account the status of settlement runs.

7.4.1.6.5 Time resolution

During settlements, it is necessary to manage several time resolutions. Typical time resolutions are 1, 5, 15, 30, 60 minutes, daily, weekly, monthly, X daily, X weekly, X monthly, yearly. Aggregations for different time periods shall be realised by applying a combination of these time resolutions.

7.4.1.6.6 Results by attributes

Summaries for different periods (e.g. daily, monthly) shall be calculated for any related attribute and displayed on the user interface. The system shall make it possible for the user to determine the final settlement result, which, for example, requests a monthly final settlement result broken down by BRPs, market participants and generation unit level at the same time.

7.4.1.6.7 Formula validity period

The validity period for each formula shall be specified and tracked in the system. In this way a charge shall have several versions for disjoint validity time periods.

It shall also be possible to find the validity period of a formula. This provides the opportunity for the user to examine e.g. what settlement results the system would have generated with a different settlement configuration being valid at a certain time in the past.

7.4.2 Settlement Interfaces

7.4.2.1 Data input interfaces

The Settlement System performs calculations based on master data and time series data from external systems. The Settlement System shall be able to process input data arriving in a standard XML file format according to IEC 62325-451/CSV/JSON/

In relation to the interface solution, it is required that loading of a file containing new data in a standard format can be set up by means of configuration or parameterization. This can be done by a suitably qualified settlement operator without support from a software developer. The configuration process, the software tools required and method of implementation shall be well documented.

The system must ensure the synchronization of data input interface configurations between MMS system environments (e.g. through export and import of data input interface configuration).

7.4.2.2 Data output interfaces

The task of the Settlement System is to generate the data that Moldelectrica transmits to internal partner systems and to external systems (e.g. basic data of purchase and sales orders for the Accounting System, sending/receiving basic data in international collaborations).

The system shall have a standard and secure interface (API) through which MMS external systems within Moldelectrica can connect and request data from the Settlement System. It shall be possible to query any final or interim settlement results and input data, including the possibility to specify filter conditions for the period and attributes, as well as for relevant metadata related to the results (e.g. settlement/invoicing main group, settlement /invoicing run number, settlement status).

The API should be well documented by giving the following information:

- General description of the services
- API reference: exact description of services, call method, definition of input data structure, interpretation of parameters, definition of response data structure
- help for interface developers: example call and response for each use case

The API should have authentication/authorization capabilities to control access.

Linked to a settlement process or status, the settlement system interface shall also be able to call an external service, with which it indicates to a partner system that a settlement has reached a specific status.

7.4.2.3 Overview of interface processes

The interfaces must have a monitoring/logging tool, with which the user can monitor the history and current status of the interface runs and access the XML files sent/received via the interfaces.

The system shall store the received/sent XML files and shall allow to browse them by their main parameters and processing status on tabular display with a filtering feature. The user interface and filtering options shall contain data related to the data connection (e.g. when the file was received and sent) and characteristics taken from XML (e.g. Business Type). It should also be possible to view the contents of the files in a readable way, on an interface that organizes the structure of the XML into a tabular form, and to compare them with different versions.

In the case of data connections initiated by the Settlement System, resending of any process through user intervention shall be possible.

7.4.2.4 Interface service

The Settlement System shall provide an interface service through which partner systems can exchange data with the Settlement System. In addition, it shall be possible to process XML files sent via an SFTP connection in the Settlement System, so that the SFTP sending target folder is constantly checked by the Settlement System, and the received XML file is automatically processed in case of changes.

7.4.3 Settlement Reports

7.4.3.1 Integrated operator reports

Operator reports shall support the work of users of the Settlement System. These are screens integrated directly into the system and the user interface. As a data source, operator reports shall be connected to the transaction database tables of settlement system, the settlement results shall be immediately visible within the reports without a scheduled delay. Operator reports display the data of settlement results in tabular or graphical form. The table columns can be filtered.

The definition of the report shall also be supported by a report configuration tool in the system, in which the user can create customized reports to be shared with other users. Creating and querying operator reports shall be controlled by user privileges. Both the report definition and the display should be a built-in function of the software, the use of an external reporting tool is not acceptable.

The outputs of the report screens shall be exported into CSV and Excel formats.

7.4.3.2 Report database

The data source of the reporting system should follow a denormalized logical structure that makes the definition of reports easy. The reporting system shall connect to the report database via a standard connection (e.g. ODBC, JDBC).

The cooperation between the report data source and the report tool must be implemented in such a way that the results of a settlement that has been run and delivered to the appropriate status can be used in the reports in close to real time, i.e. the transfer of the report database is also handled by the process control of the system. It is unacceptable that the user has to wait for a scheduled job that runs periodically.

The scope of data accessible by reports via the report database may contain input data, any settlement results (interim or final), data attributes, master data, basic data / statuses of settlement runs. User management shall also control the range of data available to a specific user.

7.4.4 Configurability by Settlement Operator

One of the most important requirements for the settlement system is that it can meet the constantly changing settlement and data provision requirements flexibly, exclusively with the work of Moldelectrica settlement operator/user. The configuration flexibility does not only apply to the creation of new formula, but also to the creation of new data inputs/outputs, the inclusion of relevant master data, and the configuration of new reports.

7.4.4.1 Configurability of input data structures

In the event of a new settlement, new input data may be processed by the system, containing new types of data points, even with a different time resolution. The processing of these new data structures shall also be possible to be solved through configuration by the operator.

7.4.4.2 Validation and processing rules

On the one hand, the input data must be checked and, on the other hand, it must be prepared for running the calculations. Formal verification is basically done during schema validation, while content verification results from business logic. Settlement system shall use a solution in which the validation and processing rules can be added and changed by operator configuration.

7.4.4.3 Modification of settlement related master data

The settlement related master data model has a central role in the interpretation of system input data and its preparation as settlement base data. It is a fundamental requirement that adding new accounts with an operator role can be implemented without development, so as part of this, a tool for manipulating the master data model must be provided, with which the trained operator can edit the master data model.

7.4.4.4 Setting Bill Determinants

Bill determinants shall be created in the user interface. In the case of a new data point to be incorporated, a new bill determinant can be created, or an existing one can receive a new attribute. The settlement system shall be able to be handle these changes by configuration work through the user interface.

7.4.4.5 Formula

The authorized user must be able to create new formulas with the set of tools explained in the Calculation section.

7.4.4.6 Configurability of output data structures

In case of new settlement results, it is necessary to create new outputs.

In the case of XML-type output, the configuration of the output interface shall be possible, which connects the elements of the XML structure with the charge results. It is necessary to implement this with configuration according to the parameterization of output interfaces requirement.

It shall also be possible to create new report definitions by means of configuration.

7.4.4.7 Copying of system configuration

It shall be possible to export and import system configuration settings as a bulk export/import. This feature shall make it possible to create a new system environment identical to the existing one. Following the installation of the basic settlement software, coping of system configuration to the new installation shall result in a new system environment, which is identical to the original one.

7.5 Imbalance Settlement

Settlement formulations in this chapter serve only for a high-level understanding of calculations, the detailed formulations will be provided during Detailed Design Phase.. The settlement system shall cover imbalance settlement calculations related to the following two types of imbalances:

1. BRP imbalances

2. System imbalance

7.5.1 BRP imbalances

The BRP imbalance payments are calculated for a BRP or for a balancing group and for every settlement time period. The BRP imbalance payment is calculated as a product of BRP imbalance volume and price of balancing energy per actual BRP balancing status (shortage or surplus) of the given settlement time period.

MMS should allow to change the imbalance payment calculations.

Imbalance payment = Imbalance volume$_{BRP}$ x Imbalance energy price

7.5.1.1 Imbalance energy price

Settlement system shall calculate any of two imbalance energy prices according with MMS administrator configuration:

a) "Dual Price":

- Price for surplus of electricity – this is the price used for payment of positive imbalances;
- Price for shortage of electricity – this is the price used for payment of positive imbalances;

b) "Single price":

- The same price is used for payment of negative imbalances and for positive imbalances; . For every settlement time period where single price is outside some limits, then "Dual price" has to be calculated

MMS should allow to change the imbalance energy price calculations.

MMS should calculate estimated imbalance prices on the latest available information as well as update the imbalance prices, as soon as the initial data would change.

7.5.1.2 Imbalance volume

The BRP imbalance volumes are calculated for a BRP or for a balancing group and for every settlement time period, on the basis of the measured net electricity exchange of BRP and the nominated net physical position.

Imbalance volume$_{BRP}$ = measured net position$_{BRP}$ – contractual net position$_{BRP}$

The measured net position is defined as the difference between the aggregated net production and consumption:

measured net position$_{BRP}$ = Aggregated net production$_{BRP}$ – Aggregated net consumption$_{BRP}$

The contractual net position is defined as the sum of energy exchanged with other BRPs, the energy exported/imported and the total balancing energy contracted/delivered (according with MMS admninistrator configuration) by the BRP in the given settlement time period.

contractual net position = (SALE$_{BRP\ internal}$ - PURCHASE $_{BRP\ internal}$) + (SALE $_{BRP\ external}$ - PURCHASE $_{BRP\ external}$) + Balancing energy$_{BRP}$

The balancing energy contracted/delivered by the BRP in the given settlement time period is defined as the sum of total balancing energy contracted/delivered by the BRP for FCR, aFRR, mFRR and RR balancing products both in the upward and downward directions in the given settlement time period.

The balancing energy delivered should be calculated according with Moldelectrica procedure

$\text{Balancing energy}_{BRP} = \text{Energy}_{UPWARD} - \text{Energy}_{DOWNWARD}$

7.5.2 Compensation schedule for Transnistrian region

There is a special derogation for Transnistrian region, under which an in-kind compensation mechanism is applied for imbalance settlement. This mechanism is described in WEM Rules (Annex 2), and implies the calculation of a compensation schedule. The compensation schedule shall be defined between 2 special BRPs (a BRP in Transnistrian region and a BRP in Moldelectrica's region) and MMS shall be capable of calculating the compensation schedule based on the net position of the BRP in the Transnistrian region and the related meter data. The resulting compensation schedule will be provided to abovementioned special BRPs and Moldelectrica MMS operator.

7.5.3 Technological consumption

The technological consumption can be calculated by the following formula:

$\text{technological consumption}_{TSO}$ = energy fed into the network – energy taken from the network

7.5.4 Power System imbalances

The system imbalance, is a summary imbalance of the power system in Moldova in each settlement time period.

Power System imbalances formulation in this chapter serve only for a high-level understanding of calculations, the detailed formulation are defined during Detailed Desgn Phase

D = (MV - SV) - AR + BEx, where

D = imbalance volume

MV = sum of measured flows over all interconnectors

SV = sum of scheduled flows over all interconnectors. It should include all planned exchanges, hence also balancing energy exchanges. HVDC ramping should not be included.

AR = activated reserves within a control area/block

AR = RR + mFRR + aFRR + IN - kΔf

BEx = TSO-TSO energy exchange due to balancing and/or other purposes (e.g. emergency energy delivery, redispatching)

IN = Imbalance Netting

kΔf = frequency bias factor * frequency deviation = estimated FCR activation

Calculation of AR may be based upon volumes requested for activation by TSO when metered volumes, as actually delivered by the BSP(s), are not known to the TSO by the submission deadline.

AR>0 means net up regulation

AR<0 means net down regulation

D>0 means surplus

D<0 means deficit

MV>0, SV>0 means export direction

MV<0, SV<0 means import direction

BEx>0 means that TSO has a surplus of balancing energy compared to its local needs

BEx<0 means that TSO has a deficit of balancing energy compared to its local needs

With reference to GL EB article 54.6, deficit is equivalent to negative imbalance while excess is equivalent to positive imbalance.

Note: By default data shall be published by imbalance area, which in the majority of cases coincide with scheduling area. Imbalance area may differ from

7.6 BSP Settlement

Settlement formulations in this chapter serve only for a high-level understanding of calculations, the detailed formulations are defined during Detailed Desgn Phase

7.6.1 Settlement of balancing energy

The payment made to BSPs for delivering balancing energy is based on the delivered/contracted energy per direction and the offered energy price/marginal price.

The settlement shall take into account the delivery parameters (fully/partially compliant, not delivered) of the provision of balancing energy. The following settlement actions are to be executed within this group of settlements:

- Monthly settlement
- Verification and validation of actual provided balancing energy
- calculation of contracted volume per direction, per product type (aFRR, mFRR, RR)
- Calculation of penalties for partial or non-delivery per direction, per product type (mFRR,RR) if Balancing energyBRP is calculated using balancing energy delivered
- Content of settlement sent to MP
- Provide data to invoicing/receive invoicing data

In case of specific BSPs, metered data at the metering point shall be converted to metering values of connection points. In these cases, the transformation shall be done through a predefined formula being specific to the given BSP. MMS shall carry out the meter data transformation to the connection point and settlement shall be based on these transformed meter values.

7.6.2 Settlement of balancing capacity

The payment made to BSPs for providing balancing capacity is based on the capacity provided(should be calculated according with Moldelectrica procedure) per direction and the offered capacity price/marginal price depending on configuration

7.7 Additional costs or revenues from balancing

Settlement formulations in this chapter serve only for a high-level understanding of calculations, the detailed formulations document will be provided during Detailed Design Phase..

Settlement shall be able to execute the following calculations related to the additional costs/revenues from balancing:

- Calculation of energy for internal congestion management
- Calculation of share of costs/revenues related to system balancing and internal congestion management

7.8 Grid losses procurement with suppliers of energy to cover grid losses

Settlement formulations in this chapter serve only for a high-level understanding of calculations, the detailed formulations will be provided during Detailed Design Phase.

This settlement shall be based on validated internal schedules and the energy price set out in the contract of supplier of energy to cover grid losses. Imbalances arisen from this delivery shall be settled according to the BRP imbalance settlements. For not delivered energy according with the contract, penalities will be calculated for such supplier.

7.9 FSKAR process support

MMS Settlement module shall support the FSKAR accounting process related to the unavoidable deviations between the intended exchange and the actual physical flows of interconnectors between TSOs. The process is managed by an external Coordination Centre Operator (CCO) and MMS shall be capable of providing, receiving and assembling related information in the required format, as well as validating related information. MMS shall implement this function according to related ENTSO-E guide lines (ACCOUNTING AND FINANCIAL SETTLEMENT OF KF, ACE AND RAMPING PERIOD (FSKAR) IMPLEMENTATION GUIDE).

The high level FSKAR process steps from the perspective of MMS are the following:

1. Receiving validated meter data for the interconnectors from Moldelectrica's Meter Data Management System
2. Calculating accounting data and assembled into a SOMA message
3. Sending accounting data (SOMA/SOAM message) to neighbouring TSOs

4. Receiving accounting data (SOMA/SOAM message) from neighbouring TSOs
5. Validating accounting data from neighbouring TSOs - based on role assignment
6. assemble SOVA (System Operator Validated Accounting) document
7. Sending SOVA message to CCO
8. Receive settlement report from CCO
9. Verify settlement report

MMS should implement the full FSKAR related process including all sub-processes (e.g. acknowledge, correction, etc.).

MMS shall support the FSKAR process both for the daily and monthly time frames.

7.10 Imbalance Netting Process

MMS Settlement module shall support the Imbalance Netting Process even prior to Moldelectrica access to Picasso as full member.

Daily processes of Imbalance Netting work like daily FSKAR process but one virtual tie-line have to be defined in tie-lines registry instead of real tie-line.The values for SOMA message will be received from SCADA. MMS shall support the Imbalance Netting process both for the daily and monthly time frames

7.11 MARI and PICASSO Process

The implementation guides of both projects are available at https://www.entsoe.eu/publications/electronic-data-interchange-edi-library/ , Electricity Balancing Processes item.

MMS Settlement module shall support Moldelectrica participation in MARI and PICASSO project and to execute at least following calculations for each process:

TSO-TSO settlement

Imported energy for balancing Moldovan Power System and its monetary value

Exported energy for balancing of other Power Systems and its monetary value

Local activated bids energy and its monetary value

Settlement formulations in this chapter serve only for a high-level understanding of calculations, the detailed formulations document will be provided during Detailed Design Phase.

7.12 Settlement of Emergency Help delivered/requested

For any time resolution period of emergency help delivered/requested will be possible to insert into the MMS system the price (Eur) of the respective quantity. MMS should be able to calculate the source data for the invoices of the Emergency Help

7.13 Settlement of day-ahead market coupling/intra-day market coupling

MMS Settlement module shall support the day-ahead market coupling and intra-day market coupling and to execute at least following calculations for each process:

a) If Moldelectrica is the shipper on particular border:

   Settlement of the cross-border exchanges resulted from market coupling

   Calculation of cross-border congestion revenue

b) If Moldelectrica is not the shipper on particular border

   Calculation of cross-border congestion revenue

MMS shall support day-ahead market coupling/intra-day market coupling for the daily and monthly time frames

Settlement formulations in this chapter serve only for a high-level understanding of calculations, the detailed formulations document will be provided during Detailed Design Phase.

7.14 Settlement of electricity transmission service (shall be provided as optional functionality with a separate price)

Settlements of electricity transmission service, provided by TSO to market participants, shall be performed (but not limited) by methodologies published in Regulations issued by Moldova's NRA. Settlement algorithm should also include checks/validation of the measured/aggregated data at least on the TSO-DSOs borders, as well as others interim calculation checks.

Settlement of the services of electric energy transmission algorithm shall allow, but not limited to implementation of the following calculation logic:

The calculation formulas, as described in Moldova's NRA Regulation on the Connection to Electric Networks and the Provision of Electricity Transmission and Distribution Services. The settlement algorithm shall validate/check the data for the calculation of the amount of services provided via special mechanism.

1. ***Formula for Transmission Service Charge to Suppliers***

Determines the quantity of electricity subject to transmission service billing for each supplier.

- Based on the energy exported, and the energy consumed by end-users connected to both transmission and distribution networks.
- Adjusted by deducting quantities of electricity delivered into the distribution network by:
  - distributed generators connected to the same distribution network under procurement contracts with the supplier;
  - End-users benefiting from net metering or other support schemes;

- The formula also includes proportional allocation of energy for producers who have supply contracts with multiple suppliers or system operators.

2. ***Formula for Allocation of Producer Energy to Suppliers***

Defines how the quantity of electricity delivered by a producer is proportionally allocated among multiple suppliers or system operators.

- Allocation is calculated according to each supplier's share of total electricity procured from that producer during the delivery month.

3. ***Formula for Transmission Service Charge to Distribution System Operators (DSOs)***

Calculates the quantity of electricity subject to billing for transmission services provided to DSOs.

- Based on the technological consumption and network losses within the distribution system.
- Deducts the quantities of electricity delivered to the distribution network by producers with whom the DSO has purchase contracts.
- Applies proportional allocation when a producer sells electricity to multiple DSOs or suppliers.

4. ***Formula for Allocation of Producer Energy to DSOs***

Defines the proportional share of energy delivered by each producer to a DSO.

- The share is determined by the ratio between the energy procured by the DSO from the producer and the total energy delivered by that producer to the distribution network during the delivery month.

Special Mechanism Data Validation Logic

1. For each distribution network zone (e.g., Premier Energy Distribution, RED Nord, etc.), the algorithm shall determine the amount of electric energy transferred across the interface between the Transmission System Operator (TSO) and the Distribution System Operator (DSO) based on metered data.
2. The calculation shall be performed using energy measurements at the circuit breakers of transformers operating at 6 kV and 10 kV, where metering is installed near the TSO–DSO boundary.
3. For each zone, the algorithm shall compute:

$$E_{TSO-DSO} = E_{measured\ at\ transformer\ feeders} - E_{TSOconnected\ consumers} + E_{distributed\ generation\ at\ the\ same\ buses}$$

where:

- $E_{measured\ at\ transformer\ feeders}$ is the total energy recorded at transformer outgoing feeders at 6 kV and 10 kV;
- $E_{TSOconnected\ consumers}$ is the energy consumed by end-users directly connected to the TSO network at the same 6 kV or 10 kV buses;
- $E_{distributed\ generation\ at\ the\ same\ buses}$ is the energy generated by distributed generators connected to the same buses.

4. The energy consumption of end-users directly connected to the TSO network at 6 kV or 10 kV buses shall be adjusted for line and transformer losses on assets belonging to the consumers.

The adjustment shall bring the metered values to the boundary of ownership (balance boundary) between the consumer and the TSO.

8 Reporting (RS)

8.1 Main reporting requirements

The Reporting module is responsible for generating and sending all reports required by local or international regulations (e.g. ENTSO-E Transparency Platform, REMIT). It will support Moldelectrica's daily market management activities. Report information will be shared with market participants and regulators and will also be published on Moldelectrica's official website.

The reporting module should facilitate the data reporting and publication requirements from the MMS platform. Thus, it should provide the capability to develop and publish necessary reports, diagrams and charts or modify existing ones.

The reporting module should provide users with sufficient flexibility in developing various report modules in order to create professional quality reports with formatting suitable for management style reporting. The user shall be able to schedule periodic reports, direct a report to a display, preview a report on a display, print a report and archive a report using a report scheduling display. The report scheduling display shall enable entry of the following parameters, with default values provided where appropriate:

- Report name;
- Report destination (e.g. printer or archiving device);
- Time the application should produce the report;
- Conditions to be met before report is generated (e.g. following a specific gate closure).

The user shall be able to examine and modify the contents of reports using displays.

Specific requirements related to reporting module shall also include:

- The MRS should provide a friendly and intuitive interface making use of drop-down lists and menus where possible to improve usability.
- The MRS shall include helpful error messages for the users.
- Consistent naming conventions shall be used throughout the application.
- For report creation and modification, the edit and manual overrides functions shall be achievable from all screen layers with audit trails (including time, date, user who modified and reason for modification) and visual override indicators.
- Modified fields shall be displayed in a different colour on the screen to draw attention to them if necessary.
- reporting functions shall be categorized and made available to users through toolbars and menus.
- Drill down screens and linkages shall be provided to assist in the ease of navigation.
- Development of new reports or the modification of existing ones that require opening of many windows (especially data and textual entry windows) shall not cause control of the applications or other screens/windows to "lock up" or otherwise become unusable.

- The system shall allow users to navigate between reporting module and multiple other applications easily and quickly.
- The reporting module should offer easy user navigation through the data by drilling--down, pivoting, scrolling and formatting alert capability to spot important aspects of these data.
- Report output formats should support csv, Excel, XML and PDF.
- Graph formatting capabilities, printing with zoom.
- Capability to publish the reports also as Web pages, in a controllable presented format.
- Complex data selections in attractive graphs, tables, and crosstabs.

A set of default templates for reports shall be created during the Detailed Design Phase.

The reporting module should provide for internal reports for Moldelectrica MMS operator (such as generation schedule, load, interchange, etc.) as specified during the Detailed Design Phase of the Project. MMS shall allow for new reports definition as well as adjustment of the existing ones.

8.2 IT Requirements for reporting module

The reporting module should provide a reporting environment with formatting features which allows users to select and link the data that are stored in the MMS database. Such reports can be provided by products like Oracle Reports, JSP (Java Server Pages) with Presentation beans, JSF (Java Server Faces), MS .NET products, Crystal Reports and others equivalent.

The reporting module should cover all MMS applications.

The reporting module should secure the structured reports, report engines and other resources are accessed by users only with appropriate permissions. It should also offer the capability of incorporating Web reports.

All reports shall have export capabilities to CSV, Excel spreadsheet, XML, PDF. Also reports are required to be able to be specified for delivery from all MMS modules for the purpose of viewing and analysing related data and information.

The Contractor will undertake all required setups/configurations for effecting data exchange with ENTSO-E Transparency Platform and REMIT.

8.3 Report Publishing

Publishing modules are required for the delivery of all MMS reports for the purpose of viewing related data and information.

The publication modules will publish specific MP information that is not available to other MPs, as well as general information available to all Participants. The main recipients of such reports are the MPs, the Public, Moldelectrica operators and analysts and external professional organizations such as ENTSO E and ACER.

Report publishing includes publication on Moldelectrica's website and transmission of Data to ENTSO E Transparency Platform. The reporting module shall be capable to produce the required files in CIM/XML format for all the relevant data items. In addition, the reporting module should support the REMIT requirements on the Registered Reporting Mechanism, and establish connections with one or more of the under REMIT supported interfaces (WebGui, Webservices, SFTP, etc.).

8.4 Reports for ENTSO-E Transparency Platform and REMIT

The information to be provided to these platforms includes but is not limited to the following:

- National Load Information;
- Day Ahead Load Forecast;
- Week Ahead Load Forecast;
- Month Ahead Load Forecast;
- Year Ahead Load Forecast;
- Transmission Infrastructure;
- Congestion Management;
- Existing Capacity Installed;
- Planned Capacity Installed;
- Total Generation Forecast;
- RES Generation Forecast;
- Generation Unavailability;
- Actual per Unit Generation Output;
- Aggregate Generation Output;
- RES Generation Output;
- Balancing Rules;
- Reserves Contracts;
- Reserves Prices;
- Accepted balancing capacity/energy Offers;
- Activated Balancing Energy;
- Prices for Activating Balancing Energy;
- Imbalance Prices;
- Imbalance Volumes;
- Financial Balance;

The information is not exhaustive and will be finalized during the Detailed Design Phase of the Project.

8.5 Reports defined by regulation in Moldova

The information to be provided under this category includes but is not limited to the following:

- Electricity production
    - hourly electricity delivered to networks by the production units with an installed power greater than or equal to 1 MW – published as close as possible after the time of delivery;
    - scheduled unavailability of production units with an installed capacity greater than or equal to 50 MW (start and completion dates of planned repairs, unavailable capacity) published every year for the following year and periodically updated as soon as new information is available;
    - planned/accidental unavailability of production units with installed capacity greater than or equal to 50 MW (start and end dates of outages and realized unavailable capacity), published as soon as available/as close as possible to the time of production scheduled / unscheduled accidental unavailability event;
    - the total programmed (notified) production of electricity delivered (hourly values), published after the validation of the physical notifications after the closing of the DAM but no later than 20:00;
- interconnection capacities
    - the allocated and available transmission capacities of the interconnections;
    - forecasts for the next year of the available interconnection capacities, by weeks, delineated by peak load and off-load hours, with monthly update;
    - forecasts for the next week of available interconnection capacities, by hours;
    - the information on the net capacity of the interconnection, the available capacity of the interconnection and the distribution of the available capacity of the interconnection on the different auction sessions in accordance with the provisions of the Regulation on access to the electric transmission networks for cross-border exchanges and the management of congestion in the electricity system, approved by the Agency, published in advance for each auction period, for each direction (import or export) and for each group of interconnection lines;
    - the total number of applications submitted and the requested capacity for the allocation of interconnection capacities, for each direction (import or export) and for each group of interconnection lines;
    - the capacity allocated to the participants in the auction and the closing price, for the allocation of interconnection capacities, for each direction (import or export) and for each interface with other power systems or for interconnection separately, as appropriate;
    - the available interconnection capacities for the next day, by hours, resulting from the conduct of explicit auctions;

- the hourly quantity of declared exports and declared imports for each border trading area, published after the validation of physical notifications after the closing of the DAM, but no later than 20:00;
- the hourly physical flows of energy on interconnections published each week, for the previous week;
- details of scheduled and accidental shutdowns of interconnection capacities immediately after occurrence, details of when the affected components are expected to be restored;
- description of the reasons and effects of the actions carried out by the TSO that had an impact on cross-border transactions, including the reduction of the rights to use previously allocated capacities, for each hour, with the publication of flows and effects immediately after the occurrence of the event and other information on the following day;
- revenues resulting from the auctioning of interconnection capacities;

- electricity consumption
  - forecast total net consumption and peak load at least for the next year (and up to 10 years in advance);
  - the hourly net consumption forecast by TSO for the next 7 days, published daily;
  - net consumption of the previous days, published daily;
- balancing market
  - the hourly reserve forecasted by the TSO for the next day, determined as the difference between the available capacity determined according to availability statements and the sum between the consumption forecast and the export/import balance at the system level, published daily;
  - the required reserve, separately for each type, published immediately after the final verification of offers for the day of delivery;
  - available bandwidth for the automatic frequency restoration, published immediately after the final verification of the daily offers for the delivery day;
  - the amount of available balancing electricity corresponding to the manual frequency restoration process and the reserve replacement process, published immediately after the final verification of the daily offers for the delivery day;
  - the total amount of balancing electricity, separated by type and direction, selected (committed) in each dispatch interval for balancing the system, published no later than one hour after the end of the dispatch interval;
  - the total amount of balancing electricity, separated by type and direction, actually delivered in each dispatch interval for balancing the system, published at the end of settlement on PEE;

- the total amount of balancing electricity, separated by type and direction, selected in each dispatch interval for internal congestion management, published no later than one hour after the end of the dispatch interval;
- the total amount of balancing electricity, separated by type and direction, actually delivered in each dispatch interval for congestion management, published at the end of settlement on PEE;
- the prices for the selected balancing electricity corresponding to the process of automatically restoring the frequency of power increase, respectively power reduction, published within one hour after the end of the dispatch interval;
- the price for the selected balancing electricity corresponding to the process of manual restoration of the power increase (decrease) frequency, published on the day following the dispatch day, for each dispatch interval;
- the price for the selected balancing electricity corresponding to the process of replacing the power increase (decrease) reserves, published on the day following the dispatch day, for each dispatch interval;
- prices of imbalances positive/negative on each dispatch interval, published at the end of settlement on PEE/PR imbalances;
- the total imbalance of the power system for each dispatch interval, published at the end of the settlement on the PEE;
- the aggregate values of the positive and negative imbalances of the BRPs in each dispatch interval, published at the end of the settlement of the BRPs imbalances;
- information on the monthly financial balance of the PEE/PREBRP (PRE) imbalances, before redistribution (additional costs/revenues related to the balancing of the PS), published at the end of the settlement on the BRP imbalances;
- information on the electricity exchange registered with the Transnistrian region of the electricity system specified by dispatch intervals.

- system services
  - the amount of system services procured;
  - technological consumption and electricity losses in the electric transmission network;
  - the quantities of system services requested by the TSO (OST)
  - the quantities of system services purchased by the TSO (OST), published no later than the day following the trading day on which the system services were purchased;
  - the price(s) for the system services, published no later than the day following the trading day on which the system services were purchased.
  - total expenses regarding the acquisition of system services;

- statistical information on the amount of reserves contracted based on auctions (separated by type and period);
- assessment of the adequacy of reserves to PS (SE) needs;
- description of cases of non-fulfilment of dispatcher instructions related to the provision of system services;
- concrete proposals regarding the improvement of programming and management of system services.

MMS should offer public web-page for public reports. The list of public reports will be configurable by MMS Administrator.