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UPGRADE, SUPPORT AND MAINTENANCE of MULTISITE CONTROL CENTER GEN/SEL

TECHNICAL SPECIFICATION **(Tehnična specifikacija)**

CONFIDENTIAL

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ABBREVIATIONS

AD	Active Directory (domain)
AT	(Acceptance Test)
AGC	Automatic Generation Control
ANSI	American National Standards Institute
API	Application Programming Interface
CBBE	Check Back Before Execute
CIM	Computer Interface Module
CIP	Critical Infrastructure Protection
CV	Center vodenja/Control center
DB	Data Base
DE	Data Engineering
DMS	Distribution Management System
DMZ	Demilitarized Zone
EES	Elektroenergetski sistem/Power System
ELES	Elektro Slovenija
EMC	Electromagnetic compatibility/Emergency Backup Center
EMS	Energy Management System
ENTSO-E	European Network of Transmission System Operators for Electricity
EPRI	Electric Power Research Institute
ESB	Enterprise Service Bus
ESP	Electronic Security Perimeter
FAT	Factory Acceptance Test
FE	Front-end
FIM	File Integrity Monitoring
GEN	Gen energija Krško
GMS	Generation Management System
GUI	Grafical User Interface
HE	Hydro Power Plant (HPP)
HESS	Hidroelektrarne na spodnji Savi
HIDS	Host Intrusion Detection System
HMI	Human-Machine Interface
HSE	Holding Slovenske elektrarne
HW	Hardware
ICCP	Inter-Control Center Communications Protocol (Tase.2)
IDS	Intrusion Detection System
IEC	International Electro Technical Commission
IEEE	Institute of Electrical and Electronic Engineers
IoT	Internet of Things
IS&R	Information Storage and Retrieval
ITU	International Telecommunications Union
LAN	Local Area Network
MCB	Miniature Circuit Breakers
NERC	North American Electric Reliability Council
NIDS	Network Intrusion Detection System
NM	Network Manager
NSPF	"No Single Point of Failure"
NTP	Network Time Protocol
OTS	Operator Training Simulator
OPC	Open Platform Communications
ORDBMS	Object-Relational Database Management System
PAC	Provisional acceptance certificate
PCU	Process Communication Unit
POSIX	Portable Operating System Interface
PSE	Power System Explorer
QA	(QAS) -Test System
RDP	Remote Desktop Protocol
RTU	Remote Terminal Unit
SAT	Site Acceptance Test
SCADA	Supervisory Control and Data Acquisition
SDB	Source Database

SCOM	Microsoft System Center Operations Manager
SCH	Schedule
SCHR	Schedule Regulation
SEL	Savske elektrarne Ljubljana
SIEM	Security Information and Event Management
SLO	Slovenia
SNMP	Simple Network Management Protocol
SQL	Structured Query Language
SW	Software
TCP/IP	Transmission Control Protocol/Internet Protocol
UCTE	Union for the Coordination of Transmission of Electricity
UDW	Utility Data Warehouse
VPN	Virtual Private Network
VVC	Voltage Var Control
XML	Extensible Markup Language
WAMS	Wide Area Measurement System
WAN	Wide Area Network
WWW	World Wide Web

1 INTRODUCTION

Gen energija (GEN) d.o.o. and Savske elektrarne Ljubljana (SEL) d.o.o. as the Client (in document often referred as Customer or Purchaser) decided to launch a tender for an upgrade of the existing GMS in multisite control center GEN/SEL in both locations, at GEN and SEL.

The main purpose of the introduction to the Technical Specification Document is to fully support the Contractor in preparing an adequate tender for deliveries/services needed to fully meet the Client's requirements. Additionally, the introduction gives an overview of GEN/SEL GMS organization, environment, specific user requirements and overall GMS operational requirements.

1.1 IMPORTANT GUIDELINES

The subject of procurement is an upgrade of the complete NM environment in multisite control center that must be comprehensive integral solution of a long-term dedicated product with visions of future developments in power utility surroundings.

It is Client's decision to purchase respective hardware separately, in consolidation with the Contractor before ordering. Contractors' Hardware requirement is not obligatory for Client's purchase, although, the recommendations will be taken into account when ordering.

Software or services not explicitly itemized in this document but necessary for parameterization, settings and maintaining to make the upgraded GMS complete and operational, with associated licenses, must also be provided by the Contractor.

In general, the functional and operational requirements, as well as previous design of existing NM are acceptable as basis for the upgrade, but all field proven new solutions that improve performance by state-of-the-art and experienced techniques will be accepted.

Following major modifications in the system are requested and must be fully integrated into the system during upgrade:

1. Upgraded system will be installed on assigned hardware (mostly on virtual environment (VMware - or Hyper- V),
2. Integration of QAS - test system
3. Implementation of the new SCADA/GMS PSE UI interface for operation and Engineering replacing WS500 HMI and PED500
4. Implementation of hierarchical enhanced AGC to support Automatic Frequency Restoration Reserve, aFRR functionality (including: mFRR - Manual Frequency Restoration Reserve, FFR - Fast Frequency Reserve, FCR - Frequency Containment Reserve). AGC must support Technology types such as Hydro, Storage, Renewables (wind, solar)
5. Implementation of VVC,
6. Implementation of the OPC UA complete client/server functionality,
7. An upgraded NM environment must be prepared for implementation of future smart grid application modules related with demand consumption management as well as others.

Besides above listed major modifications also some minor modifications are requested that are described in these Specifications and must be implemented by the Contractor.

Upgrade must be performed with adequate field proven state-of-the-art tools that will support automatic transition into an upgraded environment to avoid possible human errors.

Cutover procedures must be carefully prepared to avoid any disturbances in operation of existing control centers that must operate without interruption 24/7.

The Contractor must carefully examine the Specification and prepare adequate Tender to fulfill all the requirements that will have to be demonstrated during acceptance tests.

1.2 EXISTING ORGANIZATION AND FUNCTIONALITIES

GEN as a power production group consists of NPP Krško, TPP Brestanica and remotely controlled HPP's on Sava River that are controlled by multisite control center GEN/SEL (GEN: lower Sava HPP's, SEL: upper Sava HPP's). Multisite control center is dedicated for:

- GEN group production optimization,
- remote control of power production units,
- providing services_for system frequency restoration reserve

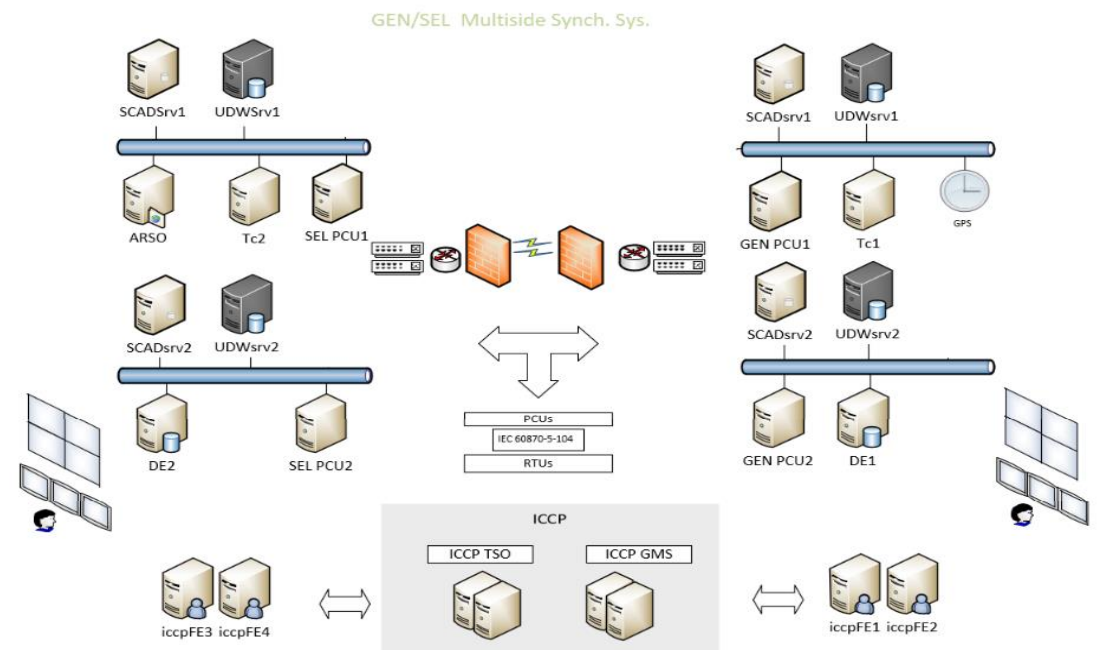
1.3 EXISTING CONTROL CENTERS ENVIRONMENT

The latest Multisite control center upgrade was implemented and fully operational in 2019 on NM platform to 9.3 version, that also represents the current status.

All communications between power plants and control centers are IEC 60870-5-104 based and are using mainly GEN/SEL private telecommunication network. Multisite control center locations are interconnected with private WAN. ICCP communication protocol is used for communication with other control centers in Slovenia (transmission system operator ELES and other production company HSE).

SCADA functionality supports all already mentioned functionalities of multisite control center, where also video walls are used as user friendly HMI.

All HPP's are unmanned and are remotely controlled by multisite control center.



1.4 CUTOVER REQUIREMENTS

Existing multisite GMS operates on 24/7/365 basis and no interruption of operation is tolerated also during cutover.

As the multisite control center operates without interruption (24/7, 365 days) and as there is multisite in fault tolerant configuration it is expected, that during cutover process upgraded system on new hardware platform will be installed in listening mode, while the original system still fully operational. When the upgraded system is completely verified and operationally meets the requirements, then control commands can be tested in the upgraded system. During these tests, the existing systems must be still fully operational and able to take (switch) over when needed.

2 ESSENTIAL FUNCTIONAL REQUIREMENTS FOR UPGRADE

2.1 SYSTEM CONFIGURATION

- Architecture would consist of two similar synchronized system sides (GEN and SEL). We intend to add a QA system, which SW could operate on either system side, or be split into both. We will use Hyper-V and VMware as a virtual environment. Engineering databases (presumably oracle) will be installed on stand-alone physical servers. DBs licensed SW must be included and provided by Contractor.
- Synchronization and DB replication must be carried out by appropriate tools, such as DBVisit application. Technology should create a standby database, available for failover at any time. The Contractor shall ensure the functional operation and delivery of the licensed application.
- QA System should comply with the client's requirements in terms of performance and efficiency. Appropriate training and documentation regarding configuration and trouble shutting must be included in the Offer.
- System split-mode functionality with merging data after split-mode will be used. Data merging must not be subject to additional billing. Adequate documentation should be provided. Operational specifics, if any, will be determined at the System design phase.
- Time synchronization (see chapter TIME SYNCHRONIZATION)
- Use of interactive visualization application e.g., Grafana.

This upgrade must include all features for future NM versions when available.

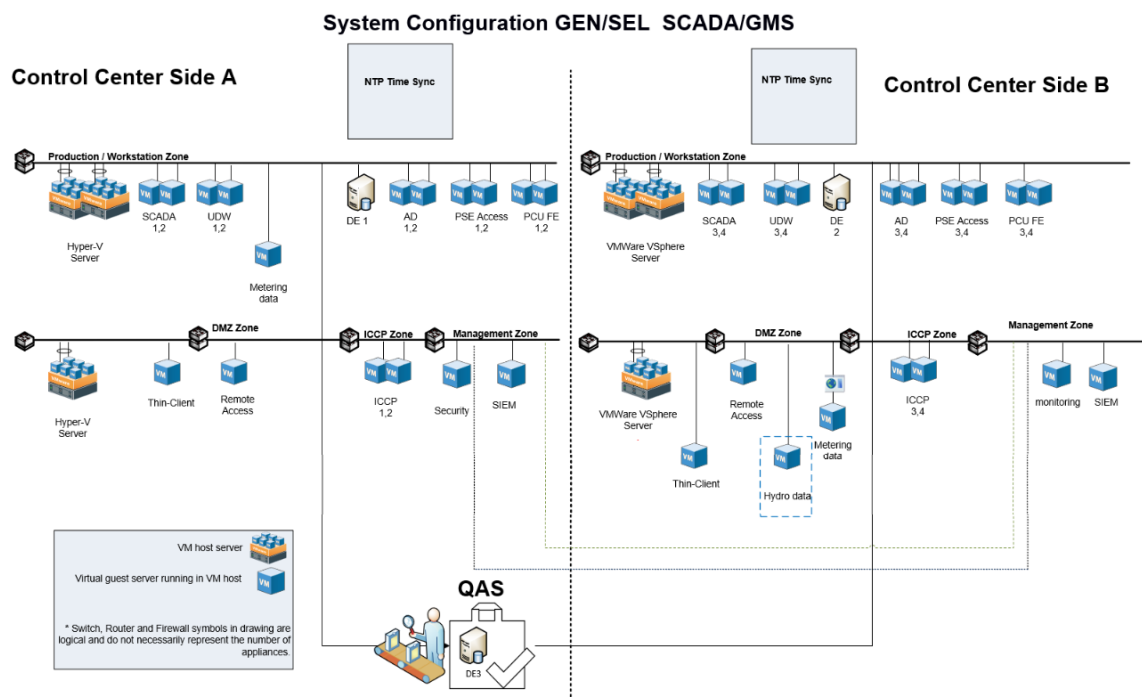


Figure 2.1-1: simplified new GMS environment

2.2 USERS BASIC REQUIREMENTS

It is the intention that all displays, printouts, logs and interactions with the system remain unchanged with the exception of improvements and agreed modifications due to translation to a new PSE environment. All characters of Slovenian alphabet must be as such supported.

2.3 COMMUNICATIONS

All existing communications will be used also for the upgraded system.

Existing ICCP communications must be implemented in ICCP FEs and should support secure ICCP also and as such fully tested. Additional ICCP links will have to be implemented for connecting other partners (e.g.: Distribution Control Centers/respective Distribution System Operators - that can be used also for Smart Grid applications).

RTU communications: IEC 60870-5-104 protocol is used as communication standard, conversion to IEC-101 must be enabled. The upgraded system must handle redundant RTU communications to PCUs onto both Control system sides, concerning all functionalities.

OPC UA between SCADA and PCU should be included as well as all communication protocols for wind, solar and storage systems with the necessary dedicated licenses.

2.4 SCADA

Upgraded GMS must support existing SCADA functionalities as well as all upgraded features conformant with ENTSO-E guidelines.

Existing WS500 user interfaces must be transformed to Power system explorer (PSE)- one common GUI for Operation and engineering and as such fully integrated into NM environment. Dashboard functionality related to real-time applications must be also implemented. All existing WS500 functionalities must be enhanced and migrated to PSE environment (e.g., use of declutters, layers, SPL monitoring and management...)

Use WS 500 GUI as alternative:

although flawless operation of the PSE system is required, system rollback to WS500 or coexistence of both should be possible.

2.5 PRODUCTION SCHEDULES

Daily production schedule must be based on 15 minutes interval, displaying current and next day, Long-term planning for seven (7) days should be possible.

Respective error corrections must be automatically calculated, and remedial actions must be automatically proposed that operator can further validate (yes/no) for immediate execution.

Schedules must correspond to the AGC functionality (see chapter Automatic Generation control - AGC)

2.6 VVC

VVC functionality must be operational in the upgraded NM conformant to ENTSO-E and ELES (TSO) guidelines, considering the existing control command approach.

2.7 OPC

NM must fully support the implementation of the OPC UA complete client/server functionality.

2.8 APPLICATIONS

Existing API's must be integrated into upgraded NM with no changes in overall functionality and performance (related to specific applications as well as to all other functionalities in GMS's environment).

All relevant upgrades must be performed in such a way that no application is degraded. Only improved (or equal) performance is acceptable by the Client.

The following applications that are already integrated into existing GMS must be considered:

- ARSO (Environmental agency)
- Metering system
- Control center for protection
- CSV2AVANTI
- ORACLE2SQL
- DCI
- SOUP2UDW

Any other application not listed here but operational in current NM, must also be considered and supported by the new PSE environment. New external applications such as Analytics or interactive visualization tools (e.g. Grafana) that would need plug-ins for dedicated or exclusive data sources should also be considered. API licenses should be included in the offer.

The application List would be presented in the System Design phase.

2.9 CYBER SECURITY

Malware security protection/ detection must consist of all state-of-the-art modules to comply with the Contractor's cyber security policy. Whitelisting and patch management systems must be implemented.

All updates must be approved and provided by the Contractor.

In order to upgrade the overall system cyber security, modelling of threats with testing must be performed during or after the completion of the upgrade process. Security Information and Event Management (SIEM) must be supported. The system must support commercial SIEM 3rd party tools (i.e., Industrial Defender, Splunk, AlienVault) as provided by the Client using syslog, SNMP and agent-based log collection.

In addition, Host Intrusion Detection System (HIDS), Network Intrusion Detection System (NIDS) and Antivirus and Malware protection must be supported for SIEM integration.

System hardening procedures need to be presented to the customer before FAT to approve functionality before SAT. It must be implemented with mutual (customer and contractor) effort before SAT testing on site. SAT testing needs to be done with a hardened system implemented.

2.10 PARAMETRIZATION

All user interfaces (e.g.: DE400, PED500, WS500, AGC, Authority explorer, etc.) must migrate into Power System Explorer.

In general, there must be equal or better performance with respect to all implemented functionalities when this migration occurs. Also, adequate training must be included.

In the procedure of migration there must be scarcely any manual work included as automatic procedures of migrating databases, parameters and displays must fully prevail to avoid human mistakes.

PSE interface must support all features of the latest WS500, e.g., Declutter and Layer operation, DFK (dynamic function keys), SPL management, ARTC - parameterization in Matlab, power calculations, etc.).

All Symbols from the current PED500 & WS500 library must be imported to the PSE environment and could be reused with extended functionalities.

2.11 DATA BASE

The existing database management system must be upgraded to the latest PostgreSQL DBMS release, supported by the contractor.

All Issues from the previous release must be resolved.

In the procedure of migration there must be scarcely any manual work included as automatic procedures of migrating data bases with all attributes/aspects must fully prevail in order to avoid human mistakes.

All respective elements that are due to control center configuration allocated to multisite control center must be on both locations the same.

Data engineering databases must be synchronized and controlled by the corresponding tool (3rd party possible). Appropriate tests and training must be included.

All permanent licenses for databases in the synchronization tool must be included in the offer and delivered by The Contractor

2.12 DATA STORAGE AND RETRIEVAL

The upgraded system must support configuring all types of archiving of all single and multiple data points. Functionality must not depend on the data source (process, applications, or archives) and several data type values must be definable.

For information storage/archiving and retrieval at least the following must be implemented:

1. Automatic storage/archiving (e.g., time or event or calculation result dependent "trigger", etc.) and
2. Storage/archiving on request - Real Time Snapshots (e.g., operator, function).

Data will be obtained from different sources:

1. the real time database,
2. application program results or
3. operator manually entered data.

All respective metadata must be stored accordingly as well. The trigger event that initiated the data collection must be saved with the respective time stamp. Provisions for transfer, on demand or automatically, to respective storage devices for further elaboration must be implemented.

Existing logs must be transferred to the upgraded system. For measurements and set points the following logs definitions must be considered:

Storage interval	Retention period in DB
1 s average	1 y
1 min average	1 y
5 min average	1 y
15 min average	5 y
1 h average	5 y
1 d average	5 y
1 m average	5 y

For accumulators the following logs definitions must be considered:

Storage interval	Retention period in DB
15 min	1 y
1 h	5 y
1 d	5 y

For indications the following logs must be considered:

Storage interval	Retention period in DB
1 s	5 y

Time stamps must be implemented according to UTC format requirements.

System must support backup to external device (tape) via backup function.

2.13 TIME SYNCHRONIZATION

Existing equipment for universal time (UTC) synchronization must be used and integrated into an upgraded system for overall GMS equipment synchronization on all locations. The same synchronization must be used also for all software-related time synchronization in the upgraded system. Upgraded system must maintain a common system time across all servers and devices, including network devices and all logging and event archiving systems. The upgraded system must support different synchronization sources (e.g., GPS, NTP).

Each system side will use its own synchronization manner, connecting to common - reliable external time source in case of split-mode.

Daylight-saving time switchovers must be supported automatically as well and updated all functions and programs appropriately. The capability and performance must be the same or better as in the existing system.

3 HARDWARE

In general hardware can be divided in following categories:

1. Workstations (Operator, Administrator, Insight, Planner),
2. Servers (SCADA, UDW, DE, PCU, ICCP, PSE, Access, QAS, Backup, etc.),
3. IT equipment (switches, routers, firewalls, gateways, cables).

New hardware will be used for implementing the upgraded system and this hardware is not part of the Tender. New hardware will be purchased and installed by the Client. Virtual environment Hyper-V and VMWare must be supported.

However, the Contractor must prepare all necessary proposals to the Client, that the Client can order this equipment from eligible source in due time. When the hardware items are fully identified, then it is the obligation of the Contractor to finally verify the item list in all details.

The Client intention is to install the new hardware on both locations:

1. GEN Vrbina (Krško) and
2. SEL Medvode.

The client will be responsible for providing the IT equipment (switches, cables, routers, firewalls etc.), operational. This equipment will establish and maintain functional communications among GMS hardware equipment.

The contractor will submit a list of hardware and software equipment with all technical specifications compliant with the new upgraded NM application in order to enable the purchase by the Client as previously specified. All other software including licenses, not being part of the delivered NM application, will be provided by the Contractor but the intention is that the Client provides a virtual environment and all MS software including installation.

4 HUMAN MACHINE INTERFACE (HMI)

Contractor will prepare a list of workstations (based on existing configuration) with dedicated role in GMS system (operator, engineering, insight and planning). According to these roles, adequate system software will be installed.

The contractor will be responsible for establishing functionality on all workstations. New features, related to upgraded/new NM system, will be implemented after the discussion with the Client. In

case some features have to be modified due to upgraded NM, these features will be implemented as such by the Contractor. The Contractor will specify such cases already in his Tender.

The functionality of workstations must not be downgraded. Responding rates of the application must improve compared to the existing system.

Application menus for operating personnel (Operator workstations) should be translated in Slovene language, while the rest of workstations would have application menus in English.

It is requested that updates and software fixes will be dispatched and installed from one location (presumably SCOM system), after workstations are restarted. Dedicated system software will be installed according to AD rules.

The contractor will obtain and prepare a list of 3rd party applications and client applications, that will be reinstalled in the upgraded NM system. Compatibility check will be confirmed by Contractor. System licenses for HMI have to be increased, due to complex use of new PSE environment by 2 system licenses for UI PSE to each system side, according to current Software License Certificate.

Also following improvements have to be implemented:

1. Alarm/event filtering:
 - a. plant/subsystem,
 - b. filter into the list,
 - c. filter out of the list,
2. default Trend to include process value and measurand,
3. remember filter when back to an alarm/event list,
4. combination of alarms from several sources,
5. historical and real-time trend view,
6. optimization of operator workflows,
7. common tool to model, build displays and operate from,
8. completed the new UX development,
9. generation control dashboards,
10. generation system overview.

Data base and display maintenance must be implemented based on new tool:

1. replacing DE400, IDES and CIM DE,
2. graphical editor for DB and display maintenance,
3. tabular view for parameters and mass data entry,
4. structure browser for fast overview and organization,
5. flexible importers from GIS, CIM, CSV/XML, etc.

5 COMMUNICATIONS

Client will provide functional communication paths, based on the Network topology configuration of GEN/SEL GMS system. This involves communication with plants (RTU's, PCU's...) based on IEC104 (or IEC 101) protocol for each location 16 communications and interconnected partners/control centers (HSE, ELES) based on ICCP or secure ICCP for each location 4 communications. The contractor will be responsible for implementing all relevant communications in the upgraded system in the NM environment.

Client will provide all necessary IT infrastructure and equipment Client is also responsible for overall communication equipment (not part of NM environment) parametrization and maintenance tasks. IT infrastructure will support different kinds of system protocols, mostly based on TCP/IP connections (ICCP, IEC104, Ethernet and NTP) and other protocols needed for normal functional operation of GMS.

The contractor must provide all licenses for protocols and protocol related applications, supplied with the upgraded system.

The contractor will provide parametrization and support assistance for implementing all protocols related to the upgraded system.

Security policy scenarios will be provided and maintained by the Client, according to their internal policy requirements.

Also, IEC 61850 interfaces have to be supported.

6 SCADA

In general, SCADA functionality must be upgraded as a whole, using automatic procedures to avoid human errors. Also following improvements have to be implemented:

1. Alarm help,
2. Audible block by priority,
3. Improved calculations:
 - a. process values to ARTC Calculations, quality data of data point values,
 - b. predefined calculation can start SPL program,
 - c. SPL can issue multi line alarms,
4. Stale data (using also quality data of data points),
5. Dynamic poke point connected to an event/alarm,
6. Data migration tool,
7. NMTAB Translation Tool
8. Run SCADA in split-mode
9. RTU in test mode
10. Display calculated values on RTU template,
11. Tool for saving/restoring alarm/event comments after cold start,
12. Locate dialog with history of objects,
13. Blocking dialog from alarm/event list,
14. Health monitoring (loss of updates, loss of communication towards audible software),
15. Show up to four tag symbols per object,
16. Automatic interlock on isolators,
17. Redundant data values,
18. DCI new alarm,
19. Limit scaling,
20. SPL enhancements:
 - a. Number of point groups, sequences, elements per point group should increase as well as monitors per SPL or to be at least as it is in the current system,
 - b. New built-ins (dialog yes/no, control of validation, etc.).
21. Load shed enhancement.
22. Scada application server switch-over must not cause ICCP data loss, therefore it must be possible not to switch ICCP front ends when switching Scada application servers.
23. Analytics or interactive visualization tools, e.g., Grafana plugins (API)

Also, additional graphical user interface improvements have to be implemented:

1. Open end coloring,
2. Expanded Appended Symbols,
3. Enhanced dynamic coloring – tagged lines and limit violations.

All Issues from previous release must be resolved.

7 AUTOMATIC GENERATION CONTROL – AGC

New functionalities, functions and features of AGC and correspondent schedule interface, must be preliminary presented and discussed with the customer to determine if they can be used as new feature or improvement for system upgrade.

AGC should support multiple area control as well as per-unit regulation with ENTSO-E regulatory compliance.

NERC functionalities should be removed from the upgraded system.

AGC functionality should be enhanced to support balancing capacity for frequency maintaining and restoration Reserve (aFRR): FCR,FFR,mFRR,

AGC controls for local regulations must support:

- Generation applications (but not limited to):
 - Economic Dispatch
 - Reserve Monitoring
 - Production Costing
 - Hydro Auto Pilot
 - Hydro Chain Control
 - Merit order module
- Technology types supported:
 - Conventional hydro
 - Storage (pumped hydro, compressed air storage, batteries – BESS)
 - Renewables (wind, solar)
 - Fossil fuel (oil, natural gas)

AGC should be able to control battery the same way as regular generation unit, or Battery energy storage systems for system services such as primary/secondary control and it has to support two setpoints operation: basepoint and delta setpoint.

AGC should be able to pre-start the power production unit in SCH or SCHR mode, considering required start up time. It must also be able to start /stop production units, automatically according to the needs of the system.

Automatic introduction of short-term production schedules in AGC correction mode must be implemented. Daily production schedule must be based on 15 minutes interval, displaying current day and day ahead. Input of Unit regulation margin setpoint (upwards & downwards) must correspond as delta setpoint value.

Quality coding should be used also.

At least twelve (12) AGC control areas should be implemented (or set of licenses if more economical). The Production Schedule interface area control must correspond.

AGC functionality along with tuning parameters and new features that the Customer could benefit from, must be presented at the System design phase. Then final AGC functionality will be determined, approved and documented in implementation specification, tested at FAT and fine-tuned on SAT tests. On-side support from the Contractor during SAT and fine-tuning test must be available.

7.1 Program Response Time

AGC cyclic period must be between 2 and 4 seconds, response time should not differ in low or high system activity state. Alarm response (audible and visual indication) time rate should be less or equal to 1 second.

The system performance requirements from this Section have to be tested and confirmed during execution of Factory Acceptance Test (FAT) and Site Acceptance Tests (SAT).

8 VOLTAGE/VAR CONTROL

Voltage control has an impact on reactive power flows in the network and as such can be controlled indirectly also by upgraded GMS. It is expected that requirements to maintain the specific voltage or reactive power will be calculated by transmission system operator (ELES).

Manual voltage/var control is supported also remotely using the existing GMS to set references on generators after selection of respective mode of operation.

The objective of upgraded voltage/var control is to establish automatic procedures when adequate requests are issued by Transmission System Operator (ELES). Procedures must take into account the following:

- a. Primary equipment restrictions (generators, transformers, busbars, etc.) and
- b. Operational restrictions (in operation, available for operation, maintenance, revision, etc.),

The automatic VVC module in the upgraded GMS system represents the control automatic regulation. Based on adequate input data, application algorithms, parameters, restrictions and with direct influence on reactive power sources engagement must in real time completely support automatic voltage control.

The Contractor shall provide the functionality to monitor, coordinate, and schedule the requirements for specific modes of operation. Also, the VVC scheduling function shall be implemented that will be executed automatically on a periodic basis (initially every hour) or upon user demand. The voltage scheduling outputs shall be the desired bus voltages in specific power plants. The Operators shall also be warned of any potential voltage problem.

Automatic VVC in closed loop operation executes control commands that change adequate set points for respective busbar voltage or reactive power production depending on preselected mode of operation. Also, the auto and manual modes of operation have to be supported.

Operator must have always overview over node voltage statuses and over momentary engagement of reactive power sources engagement in the process of voltage control. In normal conditions the results of automatic calculation can be satisfactory, and the operator will just monitor automatic regulation execution. In case of not achieving the requested value or status, VVC functionality adequately notifies (message, alarm) operator and the last state of reference value setting is saved, and their manual setting is enabled.

In case of a manual correction of individual source or a group of sources is needed, operator must have a possibility to replace values with manually set reference values.

Upgraded VVC must enable a complete overview and data editing using HMI. It must enable clear overview as well as parameters setting of all regulation elements together and more detailed for every individually. These displays must show color mark for every individual regulation element separately if element takes part in the automatic VVC or not. Element restrictions and momentary engagement as well as reserves must also be displayed. HMI must display all restriction settings.

Graphical and tabular displays must be adjusted to implemented VVC functionality. In case manual mode is selected also such selection must be displayed together with controllable elements in power plants. Displays must clearly visualize respective voltage deviations and limit violations of individual elements in power plants.

9 IMPLEMENTATION REQUIREMENTS

9.1 GENERAL

To ensure the timely and successful design, integration, testing, delivery, installation start-up and operation of the upgraded GMS system, the Contractor must follow the project implementation requirements as defined in this Section.

9.1.1 Units of Measurement

All units of measurement must be indicated in SI-System (Système International d'Unités).

9.1.2 Standards and Recommendations

For this project relevant latest editions of ISO standards, EN standards and/or IEC recommendations are requested. If any of these standards and recommendations in no case can be applied, then for such cases an advance approval by the Client is requested.

9.1.3 Language

Technical specifications are in English. During the meetings Slovenian and English will be used. Documentation must be prepared either in Slovenian or English language as further requested. All Operators displays, messages, pop-up windows, command dialogs, toolbars, logs, reports, etc. and operation Documentation must be in Slovenian language.

9.1.4 Identification System

Identification of equipment and documentation must be in accordance with Client's Technical Standards.

9.2 TASKS AND RESPONSIBILITIES

Successful project implementation is crucial responsibility of the Contractor, where all the requirements with respect to Client's full ability to master the upgraded GMS must be respected. In order to master the upgraded GMS accordingly:

- a) The Client will appoint adequate number of technical personnel to the project to collaborate with the Contractor during project implementation. The same personnel will later work as system administrators of GMS and should be able to maintain, troubleshoot and implement needed changes in GMS due to changes/upgrades in local power plant control systems, remote ICCP partners, other systems influencing GMS. Adequate training should be provided preferably as workshops at contractors' facilities. The Contractor shall make maximum use of available Client's personnel on site; to assist and observe for on-the-job training.
- b) The Client and the Contractor will mutually define which activities/tasks will be performed by the Contractor and Client's specialists – if applicable.
- c) The Client can decide (accept or reject) about Contractor's specific engagements.

9.2.1 Client's Tasks

Client will provide the following items and/or services of the upgrade project:

DOCUMENTATION:

- a) Collaboration with Contractor when defining Work statement.
- b) RTU and other communication detailed description.
- c) Review and approval of the submitted software design documentation, user's guides, logs and displays, report formats, documentation procedures, drawings, progress reports, acceptance tests and related documentation, support service procedures and documentation of the as-built System.

INFRASTRUCTURE:

- a) Adequate space in due time to accommodate Contractor's technical personnel on site during project implementation will be ensured.
- b) Environmental conditions.
- c) Remote connection to the System for Contractor remote activities during project implementation.

IMPLEMENTATION ACTIVITIES:

- a) Collaboration on specific tasks under full control of the Contractor using adequate tools, complete verification of the results rests with the Contractor.
- b) Support of site work, such as: installations, site tests that will be performed on Client's sites according to project schedule.

TRAINING, MAINTANANCE AND WARRANTY:

- a) Informing the Contractor about failures during warranty period and during the time of the maintenance contract.
- b) Provide classroom space for on-site training.
- c) Confirming upgrade of any software modules to be made by the Contractor if new release will be published before final taking over.

The above Client's tasks do not relieve the Contractor from providing a system in complete accordance with the Tender requirements.

9.2.2 Responsibilities of the Contractor

The Contractor shall assume all costs and complete responsibility for the design, integration, testing, successful start-up and operational performance of the upgraded system regardless of any omissions, or statements not set forth herein. Specifically, the Contractor's responsibilities include but are not limited to the following items and/or services:

DOCUMENTATION:

- a) Definition of the Work statement by Collaboration with the Client.
- b) Preparation and submission of all documentation for the project, including instruction manuals, operation manuals, maintenance manuals, drawings, software design and user documentation and other appropriate material for fully defining the furnished system and for allowing the Client to install, to deploy, to use and to operate the software.
- c) Delivering of all adequate software licenses including 3rd party, for the entire lifecycle of the upgraded system

INFRASTRUCTURE:

- a) Office space and facilities at the Contractor's premises for Client staff assigned to the Contractor's site and working on the project.

IMPLEMENTATION ACTIVITIES:

- a) Active planning and managing of all activities (Contractor and Client) based on agreed project schedule.
- b) All System engineering, software design, integration, development, system generation and software build. This includes guidelines of system software tuning/setup and implementation of applications software to satisfy all requirements as specified. Start-up of the system, balancing and tuning of software and guidelines of tuning the hardware.
- c) Implementing relevant security provisions
- d) Active involvement in resolving of any technical problems arising from the use of existing hardware and software interfaces delivered by the third-party suppliers such as RTU suppliers, video wall suppliers, other control systems, other control centers, telecommunication equipment and other equipment – on if needed basis.
- e) Technical verification of Client's equipment (HW and SW) as needed for successful integration/connection into project.
- f) Implementation of display pictures specifics requested in the additional guideline documents.

- g) Converting existing data bases, existing displays and existing reports to the new system.
- h) Transferring archive data from existing system to the new system.
- i) Adequate integration of all printers that will be supplied by the Client and previously coordinated with the Contractor.
- j) Adequate integration of all video wall displays.
- k) Performing adequate cutover procedure (different locations, existing system in operation, parallel operation of new and existing system, possible immediate switchover existing/new system in case of malfunctions of existing/new system) – following the cutover requirements.
- l) Complete deployment and fulfilment of the Acceptance Tests including resolution of all Discrepancy Reports to Client's satisfaction. Acceptance Tests must be performed on all specified locations,
- m) Assistance during Trial Run and Warranty period and correction of all defects discovered during these periods.

TRAINING, MAINTANANCE AND WARRANTY:

- a) Training of Client's personnel so that they will be in time fully capable of performing/supporting any task (e.g.: data engineering, troubleshoot, etc.) and further on effectively maintaining and operating the system.
- b) Warranty and correction of defects as requested for functioning and operation of system.
- c) Remedy of all latent software deficiencies discovered after warranty period free of charge.
- d) One-year warranty, starting on the day of successful provisional taking-over (PAC issued) of the system.
- e) Tuning of all tuneable software during warranty period due to its verification in all network conditions.
- f) The Contractor shall upgrade any software modules if new release will be published before final taking over.

9.3 PROJECT CONTROL AND COORDINATION

Described procedures must be followed to ensure successful implementation.

9.3.1 Correspondence

All correspondence shall be addressed to the Client and shall be prepared, codified and numbered in accordance with the agreed procedure in the latest version of MS Office software.

9.3.2 Contractor's Organization

Contractor must prepare, maintain and continuously update complete organizational scheme of manpower. Contractor must nominate (already in the Tender) quality control manager for this project. Client must be always informed in written and in due time about any change concerning Contractor's organization.

9.3.3 Work Statement

Prior to contract award, Client and Contractor will negotiate a mutually acceptable detailed Work Statement (most important part of the Contract), based primarily on the Tender Requirements and the Contractor's exceptions and clarifications as accepted by the Client. The resulting Work Statement shall become a formal contract and shall be used as the basic project document and shall be binding on both parties.

The Work Statement shall be a complete document from which the proposed system shall be upgraded, containing a functional description of each operational capability with enough details provided to make clear the designed approach. It shall include a detailed project schedule and define all milestones. The Work statement shall clearly describe the responsibilities of both parties. If any point remains unclear due to not being covered by the Work Statement, then the Tender Requirements shall be deemed final.

If a point in question is not covered in the Work Statement, then previous documents shall be consulted in a defined order of precedence as follows (i.e., a document takes precedence over the following one):

1. Client's Tender Requirements.
2. Other documents by date including:
 - a. Minutes of meetings,
 - b. Email, telefax or submittal correspondence and
 - c. Submitted technical brochures or respective www addresses.
3. Contractor's Tender.

9.3.4 Project Schedule

Contractor must prepare adequate project schedule and respect it fully throughout the project life cycle. It must clearly define:

- activities (contractor/client),
- activity duration,
- activity interrelations and
- delivery dates.

Key dates and key activities must be clearly indicated. All respective delivery dates and time needed by the Client to review the documentation must be indicated as well. This project schedule must be monthly updated. Project schedule must be detailed especially regarding cutover procedures.

9.3.5 Monthly Progress Reports

By the fifteenth day of each month throughout the duration of the project, the Contractor must submit a progress report. This report must contain project status information (reflects any advances or slippages of schedule), identification of problem areas (whether or not they are resolved), major decisions made during the month, major tasks performed during the previous calendar month and a list of Client's and Contractor's open action items. It is intended that this report shall be of major assistance in detecting any potential problem areas as far in advance as possible.

9.3.6 Client's Staff at Contractor's Facilities

The Client can station two (2) staff members at the Contractor's facilities. Continuous stationing of individual member is limited to maximum 1 week. The primary purpose will be on the job training. The client staff may actively cooperate with the Contractor's personnel during upgrade customization. The Contractor shall make available information to ensure that the designated members of the Client may achieve a full knowledge and appreciation of the design and allow access to information and draft documentation as available. Assistance to Client's personal to become fully familiar with all aspects of the upgrade.

The Contractor shall provide sufficient work space.

9.3.7 Project Review Meetings

Project Review Meetings shall be held at varying intervals throughout the duration of the project. Meetings shall be held at the Contractor's facilities and at the Client's facilities. These meetings shall be held at the discretion of the Client's Project Manager, but in no case shall they occur less frequently than every 60 days or more frequently than every 30 days.

The Contractor shall keep the minutes of these meetings and submit them to the Client for review within two working days after the meeting. After approval by the Client, the minutes shall be accepted as official records.

9.3.8 Technical Discussion Meetings

Technical Discussion Meetings shall be held on an as-needed basis between the Client and the Contractor. The meetings may be called by either party with the approval of the Client's Project Manager.

A proposed in advance submitted agenda is requested and must suggest which project members should be present at each meeting.

9.4 QUALITY MANAGEMENT

9.4.1 General Requirements

The Contractor must follow internal QM procedures.

9.4.2 Software

The Contractor shall utilize specific written procedures that prescribe the standards of performance of work in design, development, implementation, and documentation of the software segment of this procurement till final taking over by the Client.

9.4.3 Inspection

Client's representatives shall have free entry into the workshops and access to the Project records and documentation of the Contractor at all reasonable times while implementation and testing of the specified equipment and software is being performed. The Contractor shall provide Client's representative(s), free of charge, all reasonable facilities necessary to demonstrate that the material and software is in accordance with the Contract requirements.

9.5 IMPLEMENTATION PROCESS

Implementation process consists of:

1. hardware testing – verifying its functionalities,
2. parameterization activities,
3. testing activities – in sequences and
4. cutover activities.

Major project implementation activities will be performed on sites. Implementation process will be tailored to the optimal parameterization and performance, cutover and testing with regards to optimal human resources management. Activities that are purely related to the factory work taken by the Contractor are not discussed in this chapter.

Foreseen activities of the implementation process are:

1. New HW of equivalent performance compared to Contractor's recommendations will be delivered by the Client. HW will be evaluated and installed in Client's premises.
2. Conversion of the complete NM environment from the existing into the new HW must be made,
3. After all the functionalities (including all redundancy support functions) are assessed and verification approved by both parties, then the new/upgraded systems on both locations are connected to existing communications in sequence (SEL/HESS HPP's, NPP Krško, TPP Brešanica and ICCP) in listening mode,
4. After all the functionalities as listed in previous point are successfully completed and verification approved on both locations, then upgraded system can take over also control command – during this step, the existing GMS is turned to listening mode and can take over also all other functionalities in case if needed.
5. After successful completion of previous step some preselected point to point tests can be started – during this step, the existing GMS is still in listening mode and can take over also all other functionalities in case if needed.
6. After successful completion of previous step trial run will begin – during this step, the existing GMS is still in listening mode and can take over also all other functionalities in case if needed.

9.6 TESTING

9.6.1 General

The established levels of sequential testing must verify the upgraded performance of the system. Compliance with the requirements shall be verified by means of demonstrations and tests. Final Taking-Over will be granted only after all equipment has been fully successfully upgraded and in operating condition and after all final documents have been received.

Prior to every software deployment/installation into the system or its part Contractor must prepare all necessary documentation for software security checking and also perform security checking. Only elements that successfully passed this checking can be deployed/installed what must be accompanied with respective Contractor's documentation.

The tests will start at Contractor's facilities after Product system verification and conclude with the trial run as sequentially requested. Project Design phase, tests, installation, and start-up are sequenced as follows:

1. Project Kick-off,
2. System Design phase,
3. Pre-FAT procedure
4. FAT Procedure (with an emphasis on new AGC functionalities and features)
5. Commissioning phase:
 - System validation
 - o Instalation and start-up
 - o Nm and 3rd Party software installation
 - o On – Site system configuration readiness test
6. Cyber Security functions commissioning & security policy testing
7. Site Acceptance tests (SAT):
 - a. Upgraded GMS tests offline
 - b. Upgraded GMS tests in listening mode
 - c. Upgraded GMS including control commands
 - d. Preselected data point tests
 - e. Communications tests
 - f. Functionality test & on-line operating mode, including QA system, system failover,etc.
8. Trial run.

Prior to every conducted test Contractor must prepare all documentation for equipment to be evaluated, functions to be tested, additional test equipment needed and test procedure details that will be followed as requested as well as for expected results.

The Contractor's costs associated with the tests are included in the Contract's price.

9.6.2 Software Security Checking

Each software module that will be installed in the system must undergo security checking. Such security checking must:

- a) detect insecurities,
- b) verify that only known source software is applied,
- c) display the results.

Requested test documentation must be prepared and submitted to the Client as well.

9.6.3 Hardware Test

Contractor will perform necessary hardware tests in Client's premises (using HW and SW tools) to establish the full functionality of hardware equipment and operating system prior to upgraded software implementation. This test shall consist of visual inspection of the equipment and performance of standard hardware diagnostic programs and all special diagnostic programs used by Contractor.

9.6.4 Factory Acceptance Tests (FAT)

All acceptance tests (AT's) shall be conducted with Client's representative in attendance. The purpose of Factory acceptance test is to ensure that upgraded system will perform the required functions in accordance with the specifications. The Contractor shall notify the Client three weeks prior to the test, that the equipment is ready for Acceptance Test. Should the Client's representative decide not to attend certain of the tests, the test shall be carried out under the direction of the Contractor's Quality Manager, who shall forward to the Client's Project Manager duly certified copies of the test results, when the tests have been successfully completed. The copies of the successful test results' will be duly certified by the Contractor's Quality Manager. Approval of these tests by Client's representative shall in no way relieve the Contractor from the responsibility for correct operation after installation.

The tests shall exercise every specified function (simultaneous testing of two or more functions should be generally avoided) of the upgraded system under site normal environment and shall include, but not be limited to the following:

- a) Demonstration of the upgraded system generation (initialization), with source media supplied by the Contractor. The source media shall be given to the Client for later test purposes.
- b) The computers including peripheral equipment and all software shall be demonstrated to be operational. Functions of system hardening shall be presented to customer and each functionality shall be assessed.
- c) User and other support interface functions shall be demonstrated.
- d) All relevant displays, logs, user procedures and other attributes in the data base must be shown to be implemented.
- e) Demonstration of adequate conversion tool functionalities that convert Client's existing data bases and displays into new data bases and displays during data engineering,
- f) Creation and handling of all possible errors and device failure conditions (including LAN failures, workstations failures, communication failures, etc.).
- g) Simulation of failure conditions for computer/server and automatic switching to its backup computer/server.
- h) Demonstration of system power fail-restart.
- i) Demonstration of system software facilities, including compiling, linking, modifying, and executing new programs. On-line program debug facilities shall also be demonstrated as well as DB modification.
- j) Demonstration of data link configuration switching.
- k) Demonstration of the proper operation of all data acquisition, communication, and support programs, using whatever necessary simulations (input and others).
- l) Demonstration of all hardware and software diagnostic capabilities.
- m) Demonstration that the source media provided with the computer/server system corresponds to the executable on external memory.
- n) Verification of data acquisition and control.
- o) Verification of data communications.
- p) Verification of SCADA functions.
- q) Verification of HMI functions.
- r) Verification of application's functions on individual application basis.
- s) Verification of process data storage facility.
- t) Demonstration of operation and execution of all specified functions including time synchronization verification.
- u) Testing the behaviour of the system in various failure modes including:
 - servers fail over,
 - system to RTU's/other control systems/other control centers communication fail over,
 - time synchronization failure,
 - LAN interruption,
 - communication error recovery, etc.
- v) Whenever testing will be performed, testing time shall be provided to allow the Client's representatives to exercise/conduct the system test
- w) Tests must show that all regular database modifications, display constructions and similar software updates have no negative impact on the system operation. However, no software "patches" or changes will be allowed to bypass failed modules during the test.
- x) Testing of the data base modification and coordination procedures.
- y) After successful completion of all the above tests, a 48 hours' continuous run shall be completed without loss of any function, any hardware or software failure, or any fail over

(except manual fail over). Test time shall also be used for additional testing by Client's representatives.

All discrepancies found during AT must be documented and maintained by the Contractor in a Problem Log file. The subsequent correction shall be described, and proper operation shall be certified by representatives of the Client and the Contractor's Quality Manager.

If any significant function (major discrepancies) causes a temporary interruption, failure and/or malfunction, the whole test shall be rechecked.

FAT will be considered successfully completed only when upgraded system has successfully passed all predefined tests.

Extensive FAT testing would be necessary due to required system solutions and AGC functionalities.

9.6.5 Installation and Start-up

Responsibility for installation of new equipment and its interfacing and interconnection with other equipment (LAN, power supply, RTU, other control systems, other control centers and telecommunication equipment) rests with the Client and will be verified by Contractor. This responsibility also includes the powering up and its starting up. The Contractor will have to upgrade the systems in several stages as the existing equipment must remain in operation till AT is completed.

The Contractor will install (all locations must be respected), apply power, initialize the system or parts of it (according to project schedule) and place it in service under Client's supervision prior to the formal Acceptance Tests within one (1) week of receipt of written notice from the Client that the equipment has been received and is ready for upgrade installation. The date of commencement of the formal Acceptance Test shall be mutually agreed upon by the Client and the Contractor.

It is the responsibility of the Contractor to make all implemented functions operational and completely tuned.

9.6.6 Site Acceptance Tests (SAT)

Acceptance test (SAT) shall be conducted on client sites with Client's representative in attendance. The Contractor shall notify the Client three weeks prior to the test, that the equipment is ready for Acceptance Test.

Before starting of the Acceptance Tests upgraded system must be operational and tuned.

The Contractor will have to perform system verification tests, confirming that system components, are working correctly as required without any SW defects,

System hardening should be up and running. Following the successful start-up, Contractor's and Purchaser's personnel will proceed with tests, which will be identical to the Factory Acceptance Tests with addition of all respective tests that could not be tested during FAT. It shall be also demonstrated, that the system's response time is as required, measured and remains the same in case of low or heavy load.

Due to expected implementation process, there will be more than one stage of AT's. AT testing consists at least of (but not limited to):

- a) Upgraded GMS tests offline.
- b) Upgraded GMS tests in listening mode.
- c) Upgraded GMS including control commands.
- d) Functionality test & on-line operating mode; including QA system, system failover, etc.

All tests have to be documented.

The system must be connected indirectly (by means of telecommunication equipment) to all available equipment (RTU's, other control systems, other control centers). Following the successful start-up, Contractor's and Client's personnel will proceed with tests.

Any problems encountered during this test will be brought to the attention of the Contractor for correction, at the Contractor's expense.

If the system fails to pass any of the Acceptance Tests within the ninety (90) days period or within a longer period, as may be mutually agreed by the Client and the Contractor in writing prior to the commencement of the Acceptance Test, Client may, within thirty (30) days after such period, select one of the following options:

- a) The Client will immediately discontinue and cease its use and operation of the system and terminate the Contract.
- b) The Client may negotiate with the Contractor an extension of the Acceptance Period with proper compensation by the Contractor to Client for the costs incurred by Client due to the delay.

All discrepancies found during AT must be documented and maintained by the Contractor in a Problem Log file. The subsequent correction shall be described, and proper operation shall be certified by representatives of the Client and the Contractor's Quality Manager.

If any significant function (major discrepancies) causes a temporary interruption, failure and/or malfunction, the whole test shall be rechecked.

SAT will be considered successfully completed only when upgraded system has successfully passed all predefined tests.

9.6.7 Preselected Point to Point Tests

GMS must be tested with respect to preselected data points (not all data points needed to be tested) that are connected to RTU's and/or other control systems/centers. This must be achieved with preselected Point to point tests, where adequate Client's personnel will be deployed in plants and locations of other control systems. In the plants testing will include activating of individual process data point as well as monitoring of control outputs activation by control commands from Control system.

In the control systems, testing will include monitoring of activated individual process data point (measurements, alarms and switchings) from RTUs on all relevant displays, lists as well as issuing of individual control commands.

Detailed project schedule for point-to-point tests will be agreed between the Client and the Contractor during the project development.

Point to point tests can be started only after upgraded system is fully operational and all respective test documentation is submitted and adequately coordinated.

9.6.8 Communications Tests

GMS's must be tested with respect to following type of communication links:

- a) ICCP and secure (ICCP)
- b) IEC 61850.

Test must show how each type of data can be selected for specific communication in order to show that functionality is successfully implemented. This test must be performed and witnessed with the Client's presence. Test must be performed in such a way that enables Client's personnel for further use of this functionality.

Detailed project schedule for this test will be agreed between the Client and the Contractor during the project development.

This test can be started only after upgraded system is fully operational and all respective test documentation is submitted and adequately coordinated.

9.6.9 Trial Run and Warranty Period

After the completion of the Acceptance Test and successful Technical Examination the system will operate during Trial Run for a ninety (90) day period. During this time period the Client can proceed with same tests that are identical to FAT/SAT.

After the system will pass the Trial Run, Provisional Taking-Over Certificate will be issued and upgraded system will be under warranty for a twelve months' period. Any defects encountered in

software as well as necessary software tuning will be promptly corrected by the Contractor without additional Client's charge.

9.7 DELIVERY

Delivery consists of software (with adequate licenses) and documentation. The Contractor shall prepare and deliver all external systems, including third-party applications that are not part of the basic NM delivery and necessary for system operation: databases, operation tools, system management and engineering tools with all necessary licences for the entire System life cycle.

9.8 CUTOVER

Contractor must prepare detailed plan for cutover based on proposed implementation process and acceptance procedures as described in the document.

It is the intention of the Client that existing system remains in operation till the upgraded system is fully operational. Therefore, immediate switchover to the existing system (and vice versa), must be enabled by the Contractor.

All tests that are needed to ensure full functionality of upgraded GMS must be previously completed successfully to finish the cutover process.

Contractor must also prepare all respective documentation to deploy the complete cutover procedure with utmost care.

9.9 WARRANTY PERIOD

9.9.1 General

This Section specifies the requirements for the warranty period.

For HW maintenance the Contractor bears no responsibility.

The Contractor shall guarantee the availability of upgrades, technical support for all upgraded software, and announcements of software releases applicable to the system during warranty period.

The Contractor shall discuss with the Client any potential installation issues that software releases or patches may cause when installed.

To meet the service demands with the best possible quality of service, it is essential that all factors adversely affecting the quality of service should be detected and service restored as quickly as possible.

The Contractor must establish the infrastructure for completely reliable and secure remote access for remote service purposes.

9.9.2 Service during warranty

9.9.2.1 Emergency service

In case of emergency problems to ensure the continuation of System operation the Client will contact the Contractor's expert by the phone or e-mail (Hot line).

The Contractor must identify the root of the problem as reported by the Client. Furthermore, the Contractor must provide advice on emergency measures and restore the system after disturbance identification. In case that disturbance cannot be solved remotely, the Contractor is requested to provide experts on the Client's sites. The Contractor must work on the problem until the problem is solved.

The contractor will provide the availability of the system specialist during working days.

Contractor should provide availability for any non-emergency works on the System.

9.9.2.2 Visits to Client's sites

Contractor should provide availability for working on specific tasks on Client's sites.

9.9.2.3 Client's Maintenance tasks

Client's maintenance personnel will be mainly responsible for:

- a) preventive maintenance (all visual checks, hardware and software tests, diagnostics, adjustments and calibrations – as necessary for periodic maintenance and as such proposed by the Contractor) and
- b) simple corrective maintenance (according to the level of knowledge gained during trainings and following the procedures and instructions prepared by the Contractor).

The Contractor must fully instruct the Client's personnel to be able to support such maintenance.

The Client and Contractor shall keep records of all maintenance tasks performed.

9.9.3 SW support for HW upgrades

The Contractor may propose modifications to the intended hardware upgrade to easily meet with demands of the Client.

9.9.4 Support during warranty

The Contractor must offer 1st line of technical support during warranty period, provided during normal working hours, and outside these 7 days/24 hours with telephone technical support. If the support cannot be carried out remotely, the Contractor shall provide assistance at the Control Center location itself, even outside normal working hours according to necessity. Telephone response time will be a maximum of 1 hour and 4 hours to get to the Client's location.

The Contractor shall consider offering 1st line of support also for a 48- month period after Warranty under the same support conditions.

9.9.5 Installation of Patches

Whenever a software change ("update", "modification", "release", or "patch", or similar itemized product) is released to correct a security-related error in the code or to close vulnerability, the Contractor shall take immediate steps to test, confirm, and install the software change on the upgraded GMS.

The Contractor shall develop and test security related software changes against a "base line" software environment to minimize the testing time required on Client's system(s).

The Contractor shall notify the Client as soon as practical that a security software change is forthcoming, to allow the Client to allocate resources to implement the software change when it is released.

Whitelisting and patch management system must be implemented.

The initial testing for Client's configuration shall be done in an environment that is operationally similar to that of the upgraded GMS. Testing shall have the goal of confirming that the patch indeed corrects the published error and does not introduce any new errors.

The implementation and testing of all patches shall follow the established configuration management and change control processes. This includes the execution of test procedures where the change is deemed "significant". Installation and testing of patches for the period of 4 years after final taking over is part of this Contract.

9.10 MAINTENANCE AFTER WARRANTY

Within the Network Manager Licensed Software release the following scope of Maintenance services for 4 years is part of this Tender:

9.10.1 Service Description

Processing of product defect errors by Product Development:

The Client must be entitled to unlimited bug reporting

Reported errors should be duly addressed to and processed by Contractor's Product Development as part of the product development planning process. Prioritization and classification of errors must be processed according to the agreed terms.

Corrections:

The Client has to be eligible for all corrections of the Baseline version within the licensed Network Manager Software. This includes corrections on verified errors by the entire Client community of Network Manager.

The Client must have access to all applicable corrections through standard hotfixes, service packs and/or upgrades. Upon Client's request, the corrections have to be made accessible using a suitable media with all applicable documentation.

Future releases

The Client is eligible to future releases of the licensed -installed software.

This service enables Updates and upgrades of the installed system and protecting the business value of the system.

New functionalities:

The Client is eligible to all development of new functionalities and enhancements of the installed software, increasing the business value of the system.

Influence on Product planning:

Influence future release planning process through Client Advisory Boards, User Group meetings and Special Interest Groups arranged by Contractor's Product Management.

Release information:

The Client must be eligible for, and be informed of the release notes, presentation of new release functionalities and software road maps. The Client has to have access to a product web portal which includes Major and Minor release updates (incl. info about corrections) through release notes and the latest release presentation.

Insight to road map, future enhancements and new functionality enables an efficient planning regarding implementation of future product releases and functionality.

User Conference/Special Interest Groups (SIG):

With the subscription of Factory Baseline Maintenance, the Client became part of a larger community, that offers many opportunities for interaction and knowledge sharing. This includes entitlement to participate in annual User Conference or Special Interest Groups (SIG)

9.10.2 Contextual information on Network Manager Releases

Major release contains strategic development to enhance our product according to our road map. Type of changes allowed:

1. Major changes to the data model,

2. Changes of operating systems and third-party product versions,
3. Restructuring of existing interfaces and
4. New functionality.

A Major release is identified by the first digit e.g.: Rel N.

Minor releases are:

1. Minor releases include all defect fixes which have been fixed and tested since the release of the previous minor release,
2. Minor releases will always include all fixed base line issues and
3. Minor releases will include as many defects fixes as possible; normally defects are fixed on a priority basis.

A Minor release is identified by the second digit (n) e.g., Rel N.n.

For purposes of clarification: On occasion Contractor Issues Maintenance Releases. A maintenance release is identified by the third digit (m) e.g., Rel. N.n.m. Such maintenance release typically only contains a few minor defect fixes. In all other aspects the definition of a Minor Release is applicable.

9.10.3 License Extensions

If the Network Manager license is expanded, the annual Factory Baseline Maintenance Fee is adjusted accordingly. Hence, the annual fee is based on the accumulated license of Network Manager.

9.11 SUPPORT AFTER WARRANTY

Within the licensed and configured Network Manager System, running in the applicable and by Contractor recommended or recognized system environment (database, hardware, operating system) at the premises of the Client, the following scope of Customer support services for 4 years are part of this Tender:

9.11.1 Service Description

Support Service Desk Web Portal, email and Telephone Hotline Number, Remote Service, Desk Services:

Direct access to Technical Support Engineers at the service desk during Office hours for incident reporting/communication and support. Client gets direct access to skilled engineers for assistance. Client gets Full access to customer support hotline and webportal, enabling efficient registering new support tickets, on-line tracking of incident/support tickets, verify status of defect, corrections, access documentation, information about upcoming releases and submit product enhancement requests. Access for Named Users to log error reports via Service Desk web portal access (the web portal is open 24/7 except during service periods), email service, or designated phone number for hotline access.

Infrastructure for Remote Dial in Connectivity on Contractor's side:

Remote trouble shooting and resolution of reported incidents through remote connection services e.g., VPN. Reported problems should be quickly analyzed and resolved in a live environment by Technical Support Engineers and systems. A customer's incident/request should be fast targeted.

All required equipment and applications on the Contractor's side are included.

Development and Test Environment:

Network Manager source code, development environment and Client's system replica maintained at Contractor's premises. Recommended actions and corrections from service desk to be tested in relation to client request. The Client System Replica is made available for the Client visiting the Contractor premises. However, these systems are safeguarded in accordance with high IT security rules and normally kept isolated (identical copies), and hence not accessible remotely. In the unlikely event of a serious total system failure, the Client system replica can be made available to support the

Client rebuilding the production system (work effort is not part of this Tender). The Client will maintain recommended backups as a prioritized method to recover the production system, in case of an unlikely total system failure.

Client Advocate:

Access to a designated and experienced Client contact with a good understanding of the Client's installation. The Client Advocate oversees, facilitates and escalates as needed all reported issues submitted to Service Desk. The Client Advocate maintains ongoing contacts for relevant issues to help safeguard against potential systems interruptions.

Error fault tracing and assessment of correction:

This service includes remote error fault tracing and investigation of reported errors in the Network Manager Client System.

Relevant Corrections must be adapted, tested and implemented to the Client System environment in coordination with Client. Severity 1-2 are normally implemented as hot fixes; Severity 3 and 4 corrections are either delivered through hot fixes or in the next release upgrade.

Verification of corrections in Development and Test environment:

Recommended corrective (in relation to the reported error, if applicable) actions and/or error corrections from Service Desk are tested in the development and test environment prior to deployment in the production environment. This service should secure a minimum of disturbance in the Client's running production environment.

Security Patch Management:

Report for third party announced security aspectsService ensures continuously monitors security aspects of the system.

Contractor should submit monthly reports listing of :Microsoft, Red Hat VMWare and (Hyper-V) patches that had to be tested and verified in an NM to not cause problems for the NM system. The List must contain reference of the patches facilitating for customer to download from the third-party provider web site to install the patches into the NM system.

Report must provide the results of patch testing of all applicable security patches identified. Reports, should be published at least twice a month and should include all known issues and possible work-arounds, if any.

Emergency Service:

In case of emergency problems to ensure the continuation of System operation the Client will contact the Contractor's expert by the phone or e-mail (Hot line).

The Contractor must identify the root of the problem as reported by the Client and/or provide advice on emergency measures and restore the system after disturbance identification. In case that disturbance cannot be solved remotely, the Contractor is requested to provide experts on the Client's site.

The contractor will provide the availability of the system specialist during working days.

If a part of Emergency Service is not covered by the scope of support services, Hourly pool of Technical assistance could be used.

Hourly pool of Technical Assistance:

Prepaid hourly pool is to be used for technical or emergency services.

The Client requests 60 hours annually, for a four-year period of support assistance service.

This service must provide possibility for reconfiguration/enhancements of the system, based on clients needs . Hours not used in then current year should be transferable to a following year, or could be used for other services that contractor provides throughout entire support period.

9.11.2 Delivery of Product Defect Corrections

Reported and verified errors in the Network Manager System will be processed and prioritized according to following definitions as part of the Client System Maintenance scope:

Documented defect classified: **Critical**

1. Fixes shall be issued to Client via the Contractor's Service Desk Center in the form of an 'emergency patch' or 'hot fix'. Due to the urgency of this type of issue, emergency patches/hot fixes receive less testing prior to release than would be expected for a normal defect.
2. It is required that Client and Contractor's Service Desk Center work closely to replicate the issue and provide each other all necessary information and replication steps to expedite the clarification of the issue.
3. All such fixes shall be 'rolled-into' the next maintenance release to be issued by the Contractor for the Product.

Documented defect classified: **Major**

1. Fixes can be issued to Client via the Contractor's Service Desk in the form of an 'emergency patch' or 'hot fix' unless agreed otherwise.
2. It is required that Client and Contractor's Service Desk Center work closely to replicate the issue and provide each other all necessary information and replication steps to expedite the clarification of the issue.
3. All such fixes shall be 'rolled-into' the next maintenance release to be issued by the Contractor for the Product.

Documented defect classified: **Minor and Low**

1. These defects will be fixed on a priority basis and shall be included in a subsequent maintenance release (see below).

9.11.3 Required Information on Error Reports

Before the Service Desk can work on an error report, information regarding the nature and location of the issues is required. Upon logging a request, the following information is required to be provided:

1. Client name and address
2. Technical contact information (name, telephone number, email, fax, etc.)
3. Client dial-in information, if necessary (for remote dial in access)
4. Relevant product(s) and version numbers
5. Client environment on which Product(s) is installed, including hardware and operating system
6. Product error number and/or messages
7. Detailed description of the issue, including steps to reproduce problem and frequency of occurrence
8. Severity of issue and impact on Client's business. Severity shall be agreed between the Contractor and Client and shall be based on the classifications described below.

The Service Desk team responds and starts the assessment and resolution process to all error reports based upon a priority assignment methodology (refer to section: Standard Targets for Response Time and Status Reporting). The response targets define the time in business hours in which a Technical Support Engineer professional shall at the latest start the assessment and resolution process and communicate with Client, either by telephone or electronically. The more critical the business impact, the higher the priority. The Service Desk shall continuously communicate in line with the response targets specified in this Tender.

9.11.4 Incident or Error Report Classification

Each error report or incident is assigned a Severity level, which is an indicator of the impact to Client's business. Severity 1-Critical can only be assigned to an error report or incident identified in the Client's Production Environment.

Severity Level	Short	Definition
1-Critical	Prevents business critical function from being used	A reported incident with an effect that causes impairment of critical system functions or unrecoverable data loss, and no workaround solution exists. On production systems the normal operation of the function is not possible. For the Client, the defect could cause loss of life, loss of production, loss of process or serious safety violation.
2-Major	Major loss of function	A reported incident with an effect that causes impairment of a system function, but a workaround exists. Typically, these incidents affect functionality, produce erroneous or unexpected results, or prevent the function from completing. A workaround may allow the function to continue and does not prevent further progress in other areas. On production systems, work continues with a workaround. For the Client, the incident could cause significant instability for a function, extra effort for the workaround or result of The Client requirements not being met.
3-Minor	Minor loss of function	A reported incident with an effect that causes minor loss in a system functions. Typically, these incidents produce erroneous or unexpected results. An easy workaround allows the function to continue and does not prevent further progress in other areas. For the Client, the incident means that a product requirement is met but causes inconvenience.
4-Low	A problem not affecting the actual function, e.g., a misspelling	A reported Incident with an effect that causes minor inconvenience or annoyance. Typically, these are more of a cosmetic nature, such as documentation corrections, changes to labels, data presentation or colors (provided they are not key to the functionality). For the Client, the incident means that there are inconsistencies in product behavior that do not adversely affect function or usability, cosmetic changes, or some documentation problems.

9.11.5 Service Desk

All reported errors or incidents shall be attended as per agreed service level targets:

Severity: 1-Critical:

1. These issues take priority over all other issues and Contractor shall use reasonable endeavors to provide a resolution for the incident as soon as possible.
2. It is required that Client and Contractor's Service Desk Center continuously work closely to replicate the incident if possible and provide each other all necessary information to expedite the understanding of the issue.

Severity: 2-Major, 3-Minor and 4-Low:

1. The issues shall be given the attention required in accordance and agreement between Client and Contractor.

9.11.6 Target Response Time and Status Reporting

The following Service Level targets must be part of the Tender:

Severity	Response time	Status and progress reporting	
1-Critical	6h	Continuous ad hoc reporting	Min. daily
2-Major	8h	Regular ad hoc reporting	Min. weekly
3-Minor	16h	Regular reporting at scheduled meetings	Min. monthly
4-Low	24h	Regular reporting at scheduled meetings	Min. quarterly

Targets are measured against Service Desk availability hours, e.g., Office Hours.

Any target deviation or Client feedback on the service level provided shall be documented in writing or in minutes of meetings.

Optional enhancement of target response time (option):

The targets can optionally be improved from standard response time 6/8/16/24 to:

1. Ultimate: Response targets 2/4/8/16 with reporting bihourly/daily/weekly/monthly
2. Premium: Response targets 4/6/12/16 with reporting bihourly/weekly/monthly/bimonthly

Any enhanced response time level beyond and above target , shall be agreed and specified separately between the Parties.

9.11.7 Incident or Error Report Escalation

If necessary, an error report may be escalated. Automatic escalation occurs when a reported error has not fulfilled the service level targets set forth in this Order. An error report may also be escalated by a named User with a call to the Service Desk. The Contractor's escalation path is:

1. Technical Support Engineer/Client Advocate
2. Team Manager Product Maintenance & Support
3. Director Client Maintenance & Support
4. Vice President of Global Maintenance & Support

9.12 LICENSES

The Contractor shall submit all needed permanent licenses for complete upgraded system (including 3rd party). All licenses to be provided and such are as part of the Contract, must be listed in the Contractor Tender.

9.13 TRAINING

Contractor must provide all necessary training for Client's personnel to efficiently perform data engineering, to assist test and installation procedures and further on to operate and maintain the upgraded system.

At least 20 working days of training must be included in offer and should be given before the FAT.

9.13.1 General Requirements

The Contractor must make available training courses for the Client's personnel, either at on-site location (operators) or at the Contractor's premises as required by the course type and available facilities. To improve the efficiency, the Contractor must organize also delta training for all Client's personnel already experienced in using NM products that will focus only on differences between existing NM and upgraded NM. The Client reserves the right to contract for any, all, or no training

and to approve the location of the training. Courses must be designed to ensure that all respective Client's personnel achieve a full knowledge and appreciation of the data engineering, testing, operation, fault tracing, trouble shooting and maintenance of the supplied software. The Contractor is responsible for the provision of office accommodation, documentation, appropriate equipment and teaching staff. Each trainee must be provided with a workstation in a way 1 for one for quality training.

All related courses for maintenance personnel can be in English.

The Contractor shall provide a detailed program of training of each course for the approval by the Client at least six weeks prior to the start of training. At this time, participants shall receive also individual copies of the training documentation.

Details of the proposed courses shall be fully documented in the Tender, scheduled in a staggered manner, so that one person could participate in all of them. The training schedule shall take into consideration the need for properly trained personnel to be available, by the time the equipment, that they'll have to use and maintain, is operational.

One to 10 persons may be scheduled for each class session. Courses listed in the following sections shall be provided as a minimum.

Courses	Estimated Number of Participants
A. SOFTWARE ORIENTED TRAINING COURSES:	
1. Delta training (upgraded NM version)	6
2. Data engineering.....	6
3. SCADA.....	6
4. NMTAB.....	6
5. Database API.....	6
6. OPC UA.....	6
7. AGC.....	6
8. UDW, PostgreSQL.....	6
9. Data communications	6
10. SW Maintenance management	6
11. Diagnostics, fault tracing, trap list	6
12. QA	6
B. OPERATOR'S ORIENTED TRAINING COURSES:	
1. Operator's oriented training – GEN level	12
2. Operator's oriented training – SEL level	12

Table 9.13.1-1: Suggested training plan and estimated number of participants

9.13.2 Data Engineering Training

For the Client to make effective use of the system, Contractor must provide training on the upgrade procedures related to database structure, data entry, database generation, database edit and database management. This training shall also include instructions on the upgrade procedures related to display creation, report/log creation, storage and editing concepts and procedures including picture build, creation and use of graphic symbols and other display building techniques and database linkages to the displays. Besides "per point" creation also conversion tool for massive data input must be explained.

9.13.3 Software Training

These courses are intended to give the Client's software personnel sufficient knowledge of the software so they can perform all required software modifications and maintenance of upgraded system. This includes all implemented upgraded software.

Courses will be organized to cover the following areas (covering differences with respect to existing):

- a) Programming and system SW,

- b) Data acquisition/communication and control SW,
- c) Application SW and
- d) Supervision/diagnostic SW.

The intention of the Client is to define which courses are to be prepared in Slovenian language during relevant project stage.

9.13.4 Operator Training

The Contractor must provide training for all operators (repeated at least two times for operators on different shifts) intended to familiarize operators with all differences with respect to existing system about normal and abnormal system operation, including VDU displays and logs, use of console modes, restart procedures and diagnostics. This training shall be given at the Client's facilities (Gen & SEL) in Slovenian language.

9.14 DOCUMENTATION

9.14.1 General Requirements

The objective of this section and other specified items is to ensure that proper documentation is provided by the Contractor for different supplied services and for each upgraded software item. The intent is to require the Contractor to provide sufficient documentation to describe the upgraded system and to facilitate data engineering, installation, operation, maintenance, modification and expansion of the system or any of its individual components.

The Contractor must provide a Documentation Plan that meets the requirements, with its recommendations and deadlines for delivery of each of these documents.

The documents will be delivered in English and part of documentation in Slovenian language what will be defined later by the Client. The Contractor will prepare and hand over all documents written in last version of Microsoft Office. The exchange and submission of documents must use the Internet facilities.

The documents are arranged according to the function of the different portions of the system, units or subsystems, thus making them easy to use.

The Contractor must provide as a minimum the following documentation:

1. Master Documents Directory,
2. Software documentation:
 - a) Operating system software references manuals.
 - b) Data Acquisition and Data Communication software design manuals.
 - c) Supervision and diagnostic software manuals.
 - d) Application programs functional specifications (for each application separately).
 - e) Data base(s) description.
 - f) Software support manuals.
 - g) Software implementation Schedule.
3. Maintenance documentation:
 - a) Preventive maintenance and testing.
 - b) Fault tracing and trouble shooting.
 - c) Diagnostic programs.
 - d) Maintenance equipment documentation.
4. Cutover documentation.
5. Test documentation:
 - a) Test plans and procedures (Security checks, Acceptance Tests – including preselected Point to Point Tests).
 - b) Inventory lists.
6. Manuals.
7. Reports (not limited to the following):
 - a) Minutes of Meetings (as applicable).
 - b) Monthly progress reports.
 - c) Hardware test report.

- d) Acceptance tests reports.
- e) Other test reports.

9.14.2 Documentation Review and Approval

The requested documentation must be submitted by the Contractor to Client for review and approval.

The Contractor must also ensure that documentation is submitted early enough prior to the date required for review to permit corrections and comments to be made and the documentation re-submitted for approval without delaying the project.

The Contractor is responsible for any discrepancies, errors or omissions in the documentation and other particulars supplied by him, whether such documentation has been approved by the Client or not.

Documents submitted by the Contractor to the Client for reviewing shall be returned to the Contractor, bearing the Client's stamp of revision, or any remark he may have, within fifteen (15) calendar days of them being received at the Client's office.

Should the Client deem a longer period necessary for checking certain documents, he shall inform the Contractor to that effect in writing and within ten (10) days after receiving them.

When documents have to be resubmitted to the Client, then every revision shall be shown by number, date, and subject, in a revision block. After the third submission of any of the documents for review, the costs incurred by the Client for the review procedure shall be borne by the Contractor.

The Contractor shall leave a blank area of 100 mm x 70 mm on all documents for the Client's review stamps.

9.14.3 Software Design Documentation

The software Design Documentation must provide a comprehensive and detailed description of all software necessary for the operation and maintenance of programs.

In particular, it shall include:

- a) A high-level system overview using text and diagrams to illustrate the major functions and the interrelationships among subsystems and data structures.
- b) For each data base included a detailed description covering content, structure and access method and the format and purpose of each data base item.

9.14.4 Software Implementation Schedule

After approval of the complete Software Design Document, a detailed Software Implementation Schedule on a module level shall be developed and submitted for approval.

9.14.5 Parametrization

Parametrization instruction documentation shall be provided for all software. All applications software shall be well structured and adequately commented such that the Client may make modifications. The purpose and function of each callable routine or main program shall be shown with comment statement, along with definitions of calling sequences. All input and output variables, local variables and global variables for each module shall be identified and defined.

9.14.6 Test Documentation

9.14.6.1 Test Plans and Procedures

The Contractor shall prepare and submit for Client's approval written test plans for the testing programs. Client can modify or adjust any test procedure as well as add or delete one or more test

procedures, what must be fully respected and performed by the Contractor. Test plans shall contain, but not be limited to, the following:

1. Test objectives.
2. Test schedules.
3. Test requirements for:
 - a) prerequisite testing,
 - b) facilities,
 - c) equipment,
 - d) configuration and
 - e) software.
4. Test procedures description.
5. Test evaluation criteria.
6. Cross reference between the specification and the test plan and subsequent procedures.
7. Test personnel.

The final test plan and procedures included in Security checking's, AT's (also preselected point to point tests) shall be based on functional and performance requirements and any subsequent agreed modifications.

Test plans shall be submitted to Client at least 30 days prior to the start of actual testing.

The results of each test shall be documented in an appropriate test report.

9.14.6.2 Acceptance Test Procedures Document

The Acceptance Test Procedures Document shall contain the description of each structured test to be performed. The following shall be included for each subtest:

1. test identification number,
2. test name and description,
3. a description of the procedure required to perform the test, broken down into logical steps,
4. a description of any preliminary hardware or software test required,
5. a list of the system inputs required to perform the test,
6. a description of the system response anticipated which will verify the completion of each logical step,
7. space for recording the results of the test, time and date,
8. approval (signed by both parties).

The Client requires a minimum of 30 working days to review the Acceptance Test Procedures Document after it has been submitted for approval.

9.14.6.3 Acceptance Test Reports

The Acceptance Test Reports shall record the results of each test using the format established by the Acceptance Test Procedures Document (produced by the Contractor). In addition, the reports shall include narrative data as described below:

- a) Maintenance Data - Records of maintenance performed on the equipment during the Acceptance Test, including preventive maintenance, corrective maintenance, failure and repair reports, maintenance time and problem fixes.
- b) Engineering Data - Technical reports and analyses produced in support of the test; technical data produced from the measurement and recording of specific parameters and performance characteristics of the equipment; special test procedures, equipment specifications and related standards.
- c) Software Data - All related software/operator interface performance information, computer printouts indicating software problems, input data anomalies, program errors, equipment downtime or idle time associated with software utilization (e.g. improper program loading, illegal instructions, etc.).

9.14.6.4 Other Tests Procedures Documents

As requested also for all other tests - including trial run - procedure documents must be prepared.

That includes System hardening procedures, that shall be prepared, documented and delivered to customer prior to other tests.

9.14.6.5 Other Tests Reports

As requested also for all other tests - including trial run - reports must be prepared.

9.14.7 Cutover Documentation

Contractor is requested to submit cutover documentation 30 days prior to begin of any cutover activity.

The Contractor shall prepare and submit for Client's approval written cutover plans for all steps of cutover. Client can modify or adjust any step or proposed procedure, what must be fully respected and performed by the Contractor. Cutover plan must contain, but not be limited to, the following:

1. Cutover objectives.
2. Cutover schedules.
3. Data migration plan
4. Requirements for:
 - a) possible testing during cutover,
 - b) preparation as needed to be performed by the Client,
 - c) facilities,
 - d) equipment,
 - e) configuration and
 - f) software.
5. Cutover procedures description.
6. Cutover evaluation criteria.
7. Cross reference between the specification and the test plan and subsequent procedures.
8. Required Contractor's and estimated Client's personnel.

The final cutover plan and procedures/steps shall be based on functional and performance requirements and any subsequent agreed modifications.

9.14.8 Software Support Manual

This manual will be used by the Client for software maintenance of the system. Such information can be used also as a general training document.

The manual shall include as a minimum the following:

- a) general description of the system hardware and its characteristics,
- b) overall system objectives and system function definition,
- c) list of pertinent references and documents,
- d) system generation and start-up,
- e) description of available debugging tools and general procedure used in trouble shooting,
- f) guidelines for system on-line modification and future system expansion/upgrade,
- g) detailed procedures for data base generation and editing,
- h) detailed procedures for using the display generation capability,
- i) detailed procedures for applications expansion/upgrade (implementing spares in tables, files and algorithms).

9.14.9 Maintenance Manuals

Separate sets of manuals must be provided for each major component of the upgraded system. Each manual shall list any special precaution or testing instructions to be observed when servicing the equipment. The manuals shall address at least the following topics:

- a) Preventive Maintenance.
- b) Troubleshooting: Instructions for troubleshooting using the Contractor-supplied test tools.
- c) Instructions - Instructions detailing equipment operations shall be given.
- d) Diagnostics.

9.14.10 Manuals for operation and use

These Manual must provide a complete introduction to the equipment and shall describe in detail, with examples, all operator interfaces and man-machine procedures – showing differences with existing system.

Operator's manuals will be in Slovenian language.

9.14.11 Other Documentation

Also, other documentation such as certificates, licenses and statements must be submitted by the Contractor for respective part of equipment or system as a whole. In accordance with Slovenian legislation following is requested (not limited to):

- a) Software licenses as requested and
- b) Certificates.

10 ITEMS SPECIFICATON TO BE IMPLEMENTED

Items specification is based on Technical Specifications requirements that are defined in previous Sections. In case some requirement is not listed in these Items specification, it must be nevertheless delivered in order to fulfill the requirements. For all specific software items, that the Contractor has to implement, also all respective services and licenses are to be included.

10.1 CV GEN/SEL

No.	Item - description
1.	SYSTEM SOFTWARE UPGRADE: 1. Supporting all functionalities 2. Supporting fault tolerance 3. Supporting complete configuration 4. Supporting data engineering 5. PSE 6. QA
2.	COMMUNICATIONS: 1. IEC 104 or IEC101 – 32 connections; 16 each system side) 2. ICCP, Secure ICCP – 4 partners per system (GEN and SEL) 3. IEC 61850 4. OPC UA
3.	SCADA: 1. Functionality upgrade 2. Customization
4.	AGC: 1. Functionality upgrade 2. Hierarchical AGC organization 3. Per unit implementation 4. Renewables, BESS system 5. Control area (12 areas)
5.	PRODUCTION SCHEDULES: 1. Functionality upgrade 2. Customization
6.	VVC: 1. Functionality upgrade 2. Customization to power plant data
7.	APPLICATIONS: 1. External applications (metering data, ARSO, event lists, etc.)
8.	CYBER SECURITY: 1. Compliance with ISO/IEC 27001 2. Modelling of threats

No.	Item - description
	3. Support for Security Information and Event Management (SIEM)
9.	DATA BASES and DATA STORAGE AND RETRIEVAL: 1. Functionality upgrade (Avanti, Engineering) 2. Data bases for other applications 3. Data engineering Data Bases synchronization and retrieval
10.	HUMAN MACHINE INTERFACE: 1. Functionality upgrade 2. Modification of HMI (GUI-Harmonized UI PSE for SCADA and GMS), 3. HMI - 27 system licenses
11.	TESTING: 1. Software Security Checking 2. HW test 3. Installation and start-up 4. Preselected point to point test 5. Functionality & operational test online including QA system, failover,etc 6. Acceptance tests (FAT/SAT) 7. Communication test
12.	MAINTENANCE and SUPPORT AFTER WARRANTY INCLUDED IN EXTENDED/RENEWAL S&M CONTRACT 1. Customer Support 2. System Maintenance 3. 1 st line support
13.	SUPPORT DURING WARRANTY INCLUDED 1. 1 st line
14.	PERMANENT LICENSES (valid for the whole life cycle): 1. NM 2. DBMS 3. Communications: a. IEC 104 (IEC 101) b. ICCP & Secure ICCP c. IEC 61850 4. Workstations 5. Data Engineering DB 6. 3 rd party licenses for system operation-support, parameterization and administration
15.	TRAINING: 1. Data Engineering 2. Software Training 3. Troubleshooting & Diagnostics 4. Operator Training 5. Workshops
16.	DOCUMENTATION