

**Implementation of SCADA/EMS/RTU/ICS for National Dispatch Centre (NDC)**

**SCADA/EMS/RTU SCOPE of works**

**July 12, 2025**

**NATIONAL ELECTRIC GRID of UZBEKISTAN - NEGU**

Section VII, Volume A

Final Version

Acronyms used in the Technical Requirements

|  |  |
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| **Abbreviations** | **Meanings** |
| AB | Administrative Building |
| AC / DC | Alternative / Direct Current |
| AGC | Automatic Generation Control |
| AVR | Automatic Voltage Regulation |
| BCR | Benefit-Cost Ratio |
| BCU | Bay Control Unit |
| BNDC | Backup National Dispatch Centre |
| CAPS | Central Asian Power System |
| CB | Circuit Breaker |
| CCGT | Combined Cycle Gas Turbine |
| CDC “Energiya” | Coordinating Dispatch Centre “Energiya” |
| CHP | Combined Heat and Power |
| CIM | Common Information Model |
| CT | Current Transformer |
| DC | Dispatch Centre |
| DCS | Distributed Control System |
| DMZ | Demilitarized Zone |
| DTS | Dispatcher Training Simulator |
| E&S | Environmental and Social |
| ECAP | Environmental Commitment and Action Plan |
| EHS | Environment, Health, and Safety |
| EIRR | Economic Internal Rate of Return |
| EMS | Energy Management System |
| EnR | Energie Renewables / Renewables |
| EPC | Engineering, Procurement, and Construction |
| ERP | Emergency Response Plan |
| ERP / BI | Enterprise Resource Planning / Business Intelligence |
| ESA | Environmental Site Assessment |
| ESA | Environmental and Social Assessment (this scoping report) |
| ESMF | Environmental And Social Management Framework |
| ESMP | Environmental and Social Management Plan |
| ESMP | Environmental and Social Management Plan |
| ESMS | Environmental and Social Management System |
| ESS | Environmental and Social Standards |
| FOC | Fibre Optic Cable |
| FXS | Foreign Exchange Subscriber |
| Gbps | Gigabytes per second |
| GDP | Gross Domestic Product |
| GHG | Greenhouse Gas |
| GIIP | Good International Industry Practice |
| GOU | Government Of Uzbekistan |
| GSM | Global System for Mobiles |
| H&S | Health And Safety |
| HMI | Human Machine Interface |
| HPP | Hydro Power Plant |
| HSMP | Health And Safety Management Plan |
| HSMS | Health And Safety Management System |
| ICCP | Inter control Centre Communication Protocol |
| IED | Intelligent Electronic Device |
| ILO | International Labour Organization |
| IP | Internet Protocol |
| IT | Information Technology |
| JSC | Joint Stock Company |
| KEGOC | Kazakhstan Electricity Grid Operating Company |
| LAN | Local Area Network |
| LCGP | Low-Carbon Growth Planning |
| LRF | Livelihood Restoration Framework |
| LVAC | Low Voltage Alternate Current |
| MES | Main Electrical System/Network |
| MPLS | Multi-Protocol Label Switching |
| MW | MegaWatts |
| NDC | National Dispatch Centre |
| NEGU | JSC “National Electric Grid of Uzbekistan” |
| NEGU | National Electric Grid of Uzbekistan |
| NMS | Network Management System |
| NPV | Net Present Value |
| OHTL | Over Head Transmission Line |
| OHTL | Over Head Transmission Line |
| OIC | Operative Information Complex |
| OPGW | Optical fiber Ground Wire |
| ICS | Integrated Control System |
| PABX | Private Automatic Branch Exchange |
| PCBs | Polychlorinated Biphenyls |
| PIU | Project Implementation Unit |
| PLC | Power Line Carrier |
| PMU | Phasor Measurement Unit |
| PPE | personal protective equipment |
| PS | Power System |
| RDC | Regional Dispatch Centre |
| REN | Regional Electrical Network |
| RTU | Remote Control Unit |
| RTU’s | Remote Terminal Units |
| S/S | Substation |
| SCADA | Supervisory Control and Data Acquisition |
| SCEEP | State Committee of The Republic of Uzbekistan on Ecology and Environmental Protection |
| SCMS | Substation Control and Monitoring System |
| SDH / PDH | Synchronous Digital Hierarchy / Plesiochronous Digital Hierarchy |
| SFTP | Secure File Transfer Protocol |
| SS | Substation |
| SGR | Switchgear on Power Plant |
| TI | TeleInformation |
| TM | Telemeasurement |
| TOC | Table Of Contents |
| TPP | Thermal Power Plant |
| TS | Tele Signalisation |
| TSO | Transmission System Operator |
| UPS | Uninterruptible Power Supply |
| UPS (of a Country) | Unified Power System |
| USSR | Union of Soviet Socialist Republics |
| VT | Voltage Transformer |
| WAMS | Wide Area Monitoring System |
| WBG | World Bank Group |

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Scope of Works

# Introduction

## Background

Uzbekistan is undertaking a comprehensive transformation of its energy sector with a strategic goal of expanding renewable energy capacity by 2030. This initiative is driven by the need to enhance energy security, reduce greenhouse gas emissions, and meet the increasing energy demand. The country's commitment to renewable energy, particularly in solar and wind power, is expected to reshape its power industry, introducing new opportunities while addressing existing challenges.

To facilitate this transition, the Ministry of Energy has set ambitious targets for renewable energy integration and grid modernization. A critical component of this initiative is the digitalization and intelligent transformation of the national dispatch system. This modernization effort is essential for accommodating the growing share of variable and decentralized renewable energy sources while ensuring grid stability and operational efficiency.

## Need for Dispatch System Upgrade

The existing dispatch system relies on outdated methods, such as mail and telephone, for balancing power supply and demand. These legacy processes lack the speed, precision, and agility required to manage an increasingly complex grid that integrates renewable energy sources. To address these shortcomings, Uzbekistan has implemented several new thermal power units and energy storage systems to help balance the load. However, the current dispatch system is incapable of fully leveraging these advancements, posing a significant challenge to power reliability and efficiency.

To overcome these limitations, Uzbekistan plans to implement a modern, state-of-the-art Supervisory Control and Data Acquisition (SCADA) and Energy Management System (EMS). These systems will enable real-time monitoring, control, and data analysis, which are crucial for managing a diverse and modern power grid effectively. The upgrade will be executed in two phases:

**Phase 1 – Core SCADA/EMS Implementation**

The first phase shall focus on the design, deployment, and commissioning of the main SCADA/EMS system at the newly established National Dispatch Center (NDC). Key objectives include:

* Establishing the central SCADA system at the NDC, providing real-time monitoring and control of the power grid.
* Integrating critical substations and power plants to enable improved grid stability and operational efficiency.
* Implementing Automatic Generation Control (AGC) and Load Frequency Control (LFC) to facilitate automated power balancing and frequency regulation.
* Deploying essential Energy Management System (EMS) functionalities, supporting real-time dispatch and optimization of power generation and interchange operations.

**Phase 2 – System Expansion and Full Deployment**

The second phase shall focus on completing the full SCADA/EMS infrastructure, including:

* Integration of the remaining substations and power plants into the SCADA/EMS system.
* Establishment of the Backup National Dispatch Center (BNDC) and Regional Dispatch Centers (RDCs) to enhance system resilience and operational redundancy.
* Implementation of a Wide Area Monitoring System (WAMS) for real-time grid situational awareness and advanced analytics.
* Completion of the full SCADA/EMS system, ensuring comprehensive grid monitoring, automation, and energy management capabilities across the Uzbekistan power network.

## Power Sector Structure and Project Beneficiary

Previously, Uzbekistan’s power generation, transmission, and distribution were managed by a single state-owned entity, JSC Uzbekenergo. In March 2019, the sector was unbundled into four separate entities:

* Thermal Power Plants JSC – Manages thermal generation assets.
* Uzbekhydroenergo JSC – Oversees hydroelectric power plants.
* Regional Electric Grid JSC – Handles regional power distribution.
* National Electric Grid of Uzbekistan (NEGU) JSC – Responsible for transmission infrastructure.

This project is specifically designed for the National Electric Grid of Uzbekistan (NEGU), which manages the country’s transmission system and operates its power control framework.

## Dispatch System Hierarchy

**NEGU has organized its power control system into two levels:**

**National Dispatch Centre (NDC):**

* Located in Tashkent, the NDC is responsible for monitoring and controlling high-voltage transmission networks (500 kV, 220 kV, 110 kV, 35 kV, 10 kV, and 6kV), managing generation across the country, and overseeing power exchanges with neighboring nations.

**Backup National Dispatch Center (BNDC).**

* The BNDC will contain equivalent hardware and software as in the NDC. The location of the BNDC shall be designated based on the selected site of the NDC. Specifically, if the NDC is established in Tashkent, the BNDC shall be located in the New Tashkent area. Conversely, if the NDC is situated in the New Tashkent area, the BNDC shall be located in Tashkent.

**Regional Dispatch Centers (RDCs):**

* Operating under the NDC, RDCs manage power transmission at lower voltage levels (110 kV and some 35 kV), oversee parts of the 220 kV network not covered by the NDC, and supervise smaller generating units.
* Uzbekistan has five RDCs, located in Tashkent, Samarkand, Ferghana, Takhiatash, and Termez.

**Territorial dispatching departments (TDD):**

* Operating within the framework of the RDC, TDDs manage the transmission of electricity at lower voltage levels (110 kV not covered by RDC, 35 kV, 10 kV, and 6 kV.
* There are the following fourteen TDDs in Uzbekistan, the locations of which are listed below:

1. Dispatch department of the city of Tashkent - Tashkent city
2. Tashkent territorial dispatch department (TashTDD) in Tashkent region;
3. Jizzakh territorial dispatch department (JTDD) - in the city of Jizzakh;
4. Syrdarya territorial dispatch department (SyrDaryaTDD) - in the city of Gulistan;
5. Samarkand territorial dispatch department (SamTDD) in Samarkand;
6. Bukhara territorial dispatch department (BukhTDD) - in the city of Bukhara;
7. Kashkadarya territorial dispatch department (KashTDD) - in Karshi;
8. Navoi territorial dispatch department (NavTDD); in the city of Navoi;
9. Fergana territorial dispatch department (FerTDD) – in Fergana;
10. Andijan territorial dispatch department (Andijan) - in Andijan;
11. Namangan territorial dispatch department (NamTDD ) – in Namangan;
12. Karakalpak territorial dispatch department (KarakalpakTDD ) - in Nukus;
13. Khorezm territorial dispatch department (KhorTDD) - in Urgench;
14. Surkhandarya territorial dispatch department (SurkhanTDD) – in the city of Termez.

## Purpose of this Contract

The NEGU Project seeks to implement a state-of-the-art SCAD/RTU/EMS system to enhance the monitoring, management, and control of the electrical network with high reliability and safety. The system will facilitate real-time supervision of energy exchanges across zone interconnections, operating under the authorization of the National Control Centre (NDC). The project also includes the deployment of Remote Terminal Units (RTUs) and necessary adaptations at designated substations.

This initiative aims to establish a New National Dispatch Centre (NDC) that will significantly improve operational efficiency and grid management by achieving the following key benefits:

* Rapid Fault Detection and Restoration: Swift identification of tripping and fault locations to expedite service restoration.
* Minimized Outage Duration: Reducing power disruption periods to mitigate revenue loss.
* Enhanced Power Supply Continuity: Lowering non-supplied energy costs through improved system reliability.
* Optimized Equipment Utilization: Enabling better asset management and deferral of network reinforcement investments.
* Loss Reduction: Providing capabilities to monitor and minimize transmission and distribution losses.
* Accurate Load Calculation: Enabling precise real-time and historical analysis of system loads and peak power demands on daily, weekly, monthly, and yearly bases.

## Key Objectives

NEGU invites experienced contractors specializing in SCADA, energy management systems (EMS), remote terminal units (RTUs) and adaptation work to submit proposals aimed at solving the following tasks:

* Implementation of a new national dispatch center (NDC), a backup national dispatch center (Backup NDC), regional dispatch offices (RDU) and territorial dispatch departments (TDO) that meet the functional and technical requirements of the NEGU.
* Training of NEGU and NDC personnel to ensure efficient operation, maintenance and support of the deployed system and equipment.
* Comprehensive Project Execution, including but not limited to:
* Data collection, engineering design, and system architecture.
* Manufacturing, procurement, and logistics of all necessary components.
* Installation, testing, and commissioning of SCADA/EMS (hardware & software), RTUs, adaptation works, and 48V DC power systems.

## Project Outcome

The implementation of the new SCADA and EMS systems is designed to achieve the following outcome:

* Real-Time Grid Monitoring & Control: Enhancing situational awareness to improve decision-making and response times.
* Real-Time Geographical System Visualization: Develop an interactive 2D geographic display of Uzbekistan’s entire energy system, showing the geographical locations of all grid assets (TPPs, HPPs, substations, etc.) and dynamically updating key system parameters (voltage levels, voltage angles, power flow corridors, and system frequency) to enhance operational situational awareness and support informed decision-making.
* Renewable Energy Integration: Ensuring seamless coordination between thermal, hydro, and renewable power sources as well as BESS to optimize grid stability.
* Advanced Grid Performance Optimization: Utilizing data analytics, load forecasting, and automated dispatching to improve overall efficiency.
* Resilient and Stable Power System: Replacing outdated dispatch mechanisms with modern digital solutions for improved reliability.
* Implementing Automatic Generation Control (AGC) and Load Frequency Control (LFC) to facilitate automated power balancing and frequency regulation.
* Medium-term and short-term (3-5 min) forecasting of renewable energy generation in the power system and, through the AGC system, the formation of control signals (reserve accumulation, loading, unloading) for other generation sources connected to the AGC system.
* Strengthening Uzbekistan’s Energy Infrastructure: Supporting future expansion and increasing reliance on clean energy to align with national sustainability goals.

This project represents a critical step in modernizing Uzbekistan’s power system, ensuring its ability to meet evolving energy demands while fostering the transition to a more sustainable and resilient energy landscape.

## Existing Situation

* + 1. Power Sector Reform and Structure

Until 2019, Uzbekistan’s power sector was vertically integrated and monopolized under JSC Uzbekenergo, a state-owned entity. However, a significant shift occurred with Presidential Decree #4249 (March 2019), initiating the unbundling of the power sector. As a result, the sector is now operated by four independent companies:

* Thermal Power Plants (TPP) JSC – Responsible for thermal power generation.
* Uzbekhydroenergo JSC – Manages hydropower generation.
* Regional Electric Grid (REG) JSC – Handles electricity distribution across the regions.
* National Electric Grid of Uzbekistan (NEGU) JSC – Oversees transmission and national grid operations.
* According to the Resolution of the Cabinet of Ministers RU No. 126 dated March 24, 2022 established the State Unitary Enterprise "NDC" under the Ministry of Energy of the Republic of Uzbekistan, which is entrusted with the functions of operational management of the energy system in real time and national, regional and territorial electrical networks, etc.
* Package 1: Control Centers and SCADA/EMS System
* This package represents the primary scope of the present tender and encompasses the establishment of new National and Backup Dispatch Centers, including all associated infrastructure and systems. The scope includes the design, supply, installation, configuration, testing, and commissioning of a modern SCADA/EMS platform, Automatic Generation Control (AGC), Wide Area Monitoring System (WAMS) applications, Remote Terminal Units (RTUs), and 48V DC power systems. In addition, necessary adaptation and integration works shall be performed to ensure full interoperability with existing and future network elements. This package forms the core of the national grid modernization effort and shall be executed in close coordination with the Telecommunication and OPGW packages to ensure seamless system integration.
* Package 2: Telecommunication Subsystem (to be tendered separately)
* This package encompasses the complete scope of the Telecommunication Infrastructure required for the project. It includes the design, supply, installation, configuration, testing, and commissioning of all communication systems necessary to support SCADA/EMS operations and RTU integration across the National Dispatch Center (NDC), Backup National Dispatch Center (BNDC), and associated substations.
* The telecommunication system shall be based on an IP/MPLS network architecture. Until the new network is fully deployed and operational, the SCADA system shall make use of the existing telecommunication infrastructure to the extent feasible.
* Close coordination and interface will be required between this package and other related packages, including those covering the SCADA/EMS, Automatic Generation Control (AGC), and RTU systems, to ensure seamless integration and system functionality.
* Package 3: OPGW Deployment (tendered separately)
* This package comprises the deployment of Optical Ground Wire (OPGW) infrastructure across approximately 3,000 kilometers of the transmission network, subdivided into eight (8) implementation lots. The scope of this package includes all necessary works for the installation, integration, and commissioning of OPGW to establish the physical backbone required for the telecommunication network supporting the SCADA/EMS and RTU systems. This package is intended to be tendered to qualified local Uzbek companies. The successful implementation of this package will provide the essential infrastructure foundation for the IP/MPLS-based telecommunication network referenced in Package 2.
  + 1. National Electric Grid of Uzbekistan (NEGU)

NEGU was formed from the former Uzelektroset and Energosotish entities and is tasked with:

* Operation, maintenance, and expansion of Uzbekistan’s transmission network.
* Electric energy transportation, including inter-regional and cross-border transits.
  + 1. NEGU Infrastructure and Capacity

NEGU operates:

* 14 regional transmission companies (MES).

The transmission system includes:

* 95 substations (220-500 kV, some 110 kV).
* Over 9,700 km of overhead power transmission lines (220-500 kV).
* 4,713 personnel managing and maintaining operations.
  + 1. Power Generation and Fuel Mix

Uzbekistan’s generation capacity exceeds 23,500 MW, composed of:

* 2245 MW from hydropower plants (HPP).
* More than 17,350 MW from thermal power plants (TPP).
* 2400 MW solar power plants
* 1500 MW wind farmsA combination of reservoir-based and run-of-river hydropower units.

Some thermal plants, such as Tashkent CHP and Mubarek CHP, generate both electricity and heat. The primary fuel sources include:

* National natural gas (predominantly used in TPPs).
* Locally produced and imported coal, primarily for Novo-Angren and Angren TPP.
* Mazut (heavy oil) as a reserve fuel for winter shortages.

Many gas-fired Steam Turbine (ST) power plants suffer from inefficiency and aging infrastructure. To modernize the sector, Uzbekistan is investing in Combined Cycle Gas Turbine (CCGT) units and encouraging private sector participation. Currently, operational CCGT plants include:

* Navoi TPP – 478 + 450 MW.
* Talimarjan TPP – 2 × 450 MW.
* Tashkent TPP – 370 MW.
* Turakurgan TPP – 2 × 450 MW.
* Takhiatash TPP – 2 × 280 MW.
* Acwa Power Syrdarya – 1500 MW
* Cengiz Tashkent TPP – 262 MW
* Aksa Tashkent TPP – 240 MW and 230 MW

Planned CCGT projects include:

* Navoi TPP 3 and 4 CCGT – 2 x 550 MW
* Talimarjan TPP 4 and 5 CCGT – 2 x 550 MW.
* EDF Syrdarya - 2 – 1,500 MW .
* Stone City TPP – 1500 MW
* Chengiz Jizzakh TPP – 550 MW
  + 1. Renewable Energy Ambitions

Uzbekistan possesses significant untapped solar and wind energy potential and has set a target of:

* 7.1 GW of solar energy.
* 11.3 GW of wind energy by 2030.

The World Bank’s IFC group and Asian Development Bank (ADB) are actively supporting renewable energy tenders. The National Master Plan (LGP), expected to be approved soon, will outline targets for commissioning new plants and phasing out older thermal capacity.

* + 1. Transmission System Challenges and Development

Uzbekistan’s bulk transmission network was primarily developed during the Soviet Union era, forming part of an interconnected electrical system. Today, aging infrastructure presents challenges, including:

* Unreliable supply and higher transmission losses.
* Difficulty integrating intermittent renewable energy sources.

To address these issues, the World Bank has been supporting modernization efforts since 2015, focusing on reconstructing and upgrading transmission substations.

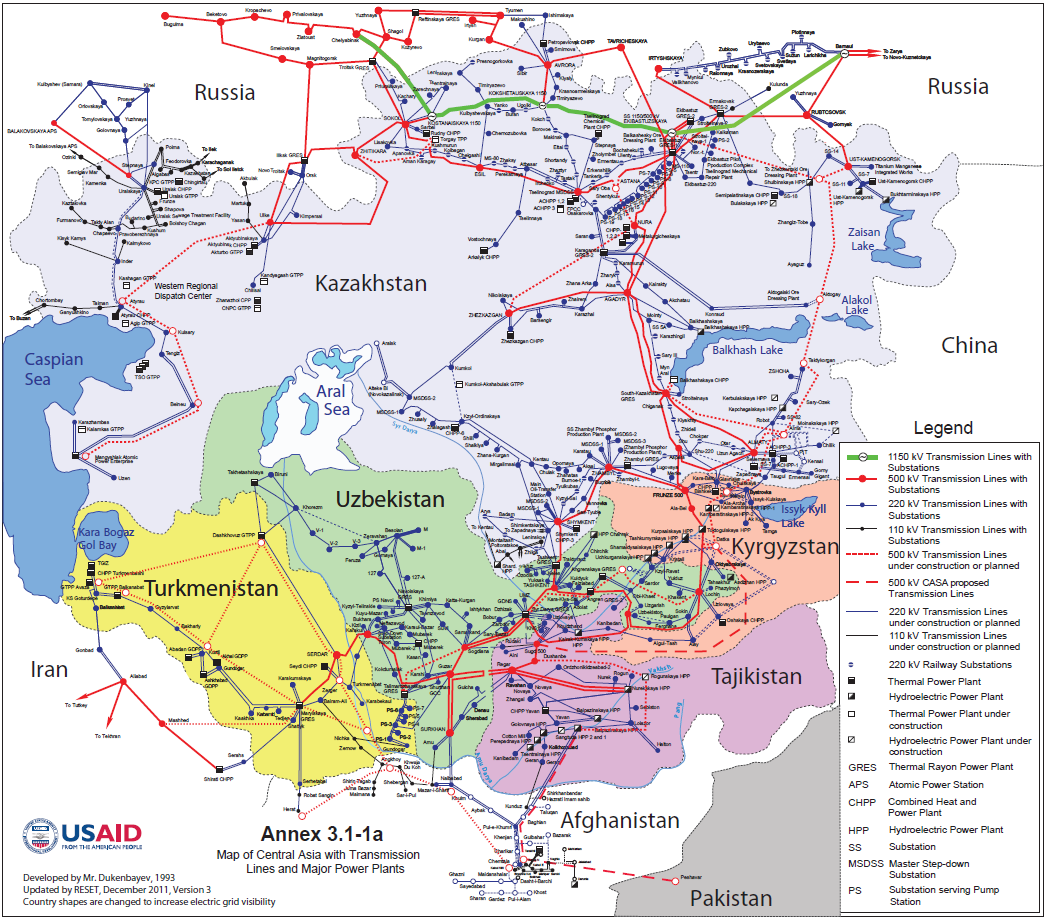
* + 1. Uzbekistan’s Role in the Central Asian Power System (CAPS)

Uzbekistan is interconnected with Kazakhstan (South), the Kyrgyz Republic, and Tajikistan as part of CAPS. Seasonal electricity trading within and outside CAPS is common, as:

* Kyrgyzstan and Tajikistan rely on hydro generation, producing surplus energy in summer due to snowmelt.
* Uzbekistan engages in regional energy exchanges, including the supply of electricity to Afghanistan.

Uzbekistan also imports electricity from designated parts of Turkmenistan. A major ongoing transmission project is the 500 kV Surkhan – Puli –Khumri transmission line, which aims to increase Uzbekistan’s electricity export capacity to Afghanistan.

Uzbekistan’s energy sector is undergoing a significant transformation, shifting from a centralized monopoly to a more diversified, competitive, and investment-friendly market. With ongoing modernization efforts, a focus on renewable energy expansion, and strengthened regional energy cooperation, the country is well-positioned to enhance energy security and sustainability in the coming decades.



# Scope of Works and Supply

## REQUIREMENTS APPLICABLE TO ALL ITEMS

* The Contract for the “Implementation of National Dispatch Centre in Uzbekistan (NDC)” is on a Turn-Key basis.
* The Contractor must provide perpetual licences for all system elements, software, hardware including but not limited to SCADA, WAMS, EMS, PMU, RTU, ICS, AGC, etc.
* The Contractor shall be responsible for supply, installation, and commissioning of all supplied equipment and systems.
* The Contractor shall survey, investigate, collect data, design, manufacture, supply, procure, transport, install, test, and commission all necessary works for the turnkey implementation of the “Implementation of National Dispatch Centre (NDC) and Backup National Dispatch Centre (BNDC) in Uzbekistan” Project, the integrated System includes the following Subsystems
  1. SCADA & EMS Subsystem
  2. RTU/ICS/SCMS, Adaptation Works, and 48 VDC Subsystem
* The OPGW, Telecom and Civil works related to this contract are covered under the separate contracts.
* It is understood that the work includes everything requisite or necessary to finish the entire work properly, and the equipment installed has to be complete and operational in every respect, even though every item may not be specifically mentioned.
* The Contractor shall ship and transport all equipment and materials to their respective sites.
* The Contractor shall provide all project related documentation such as the Statement of Work, manuals, user guides, testing procedures and plans, “As-Built” documents for all executed works as described in Volumes B and C of these Technical Requirements.
* The Employer reserves the right to choose the supply and execution of works for any optional items, from the Optional Scope.
* All optional items listed in these Technical Requirements shall be offered and priced in Proposal.
* The items listed in the Price Schedule (refer to Section VIII) may include indicative quantities for certain components; however, such quantities are estimates only and shall not be considered binding or as final measurements of the scope of work to be executed. Due to the lump-sum nature of the pricing, and given that the project is on a turn-key basis, the Contractor shall be deemed to have accounted for all necessary requirements, including but not limited to any plant, materials, and related services, to complete the scope of work in full without incurring additional charges to meet the project’s requirements and objectives.
* The contractor shall elaborate the schedule of Prices with all necessary ancillary equipment and services required to deliver a complete and functional system, meeting the requirements of the specifications.
* At the request of Purchaser, the Proposer has to submit atomic break down price of any element(s) in the price schedule.
* The Contractor shall provide all project-related documentation such as the Statement of Work, manuals, user guides, testing procedures and plans, and “As-Built” documents for all executed works described in the Tender specifications.
* The Contractor must consider the technical specifications as a whole, as there are strong interactions between the different volumes and chapters composing this Request for Proposal.
* If the Contractor discovers errors or omissions in these Specifications or in the other Documents, or if he is uncertain as to their meaning, he must contact the Employer promptly for interpretation, clarification, or correction before submitting his Proposal within the deadline for clarification requests to avoid delays in this tender.
* The Technical Specification provides functional and qualitative requirements that will serve as a foundation for the comprehensive design included in the Scope of Work. Given that this is a functional specification, the Proposer may always propose a solution of greater or similar quality to that described in the specifications.
* If the Specifications and/or Drawings do not contain particulars of materials or works necessary for the proper and safe completion, operation, and maintenance of the equipment in enquiry, all such materials and works shall be deemed to be included in the supply.
* This document defines the Works, as well as their qualitative and quantitative specifications, but leaves the Works' particular to the Proposer, who is responsible for carrying out all required works and supplies. Unless otherwise stated in this document, the proposal should adhere to the Employer's standards and specifications.
* Any additional quantities of equipment and material not included in the price schedules which are required to deliver a Turn-key System compliant to the specifications and performance requirements shall be delivered without any additional costs.
* The Contractor is not allowed to start manufacturing of the contracting equipment before The Employer approves the design documents.
* The Contractor shall provide support and maintenance for all equipment and systems during the Warranty Period (Defects Liability Period (DLP)).
* In case there is any discrepancy in the RFP chapters or clauses, the Employer shall interpret the document to its favor so long as the Proposer does not request clarification for such discrepancy before Proposal submission deadline.
* The Contractor has to submit table of compliance including all items and sub-items.
* The Contractor will have the opportunity to visit sample of sites at their own expense to inspect the existing equipment, and to determine if adequate space exists for expanding the existing equipment and installing the new equipment.
* The Contractor shall implement an on-line/web-based electronic documents management system that shall be designed for collaboratively creating, managing, storing and retrieval and sharing documents and Web services of the Contractor’s Documents and correspondences.
* Whenever deemed necessary, the Contractor is requested to provide-upon specific request from The Employer-an electronic copy of any international standard that may be necessary to justify the acceptability of a proposed technical solution.
* In case of contradiction, the hierarchy of the technical documents of the contract is as follows

1. The Scope of work.
2. The Technical Specifications.
3. The unit price schedules and the detailed quantity estimates.

* The Proposer shall be responsible for effective liaison and coordination with other contracting parties and project components that may geographically or functionally impact the execution of the works. Such coordination shall be carried out under the direction and facilitation of the Employer, who will identify the relevant parties and, where necessary, assist in arranging coordination meetings or data exchanges. The Proposer shall cooperate fully to ensure seamless integration of interfaces with civil, telecom, and/or system-level contracts, as applicable.
* The Supplier shall submit, for Employer approval, a Functional Base Design (FBD) that includes all documents and drawings required to set up that the Proposer's proposed work meets the Specification requirement, in consideration of the survey's findings, prior to the commencement of procurement.
* According to the approved FBD, the Supplier shall Develop and submit a Detailed Design (DD) for the entire system, including all system interfaces. This submission must be submitted for approval prior to installation commencing. The Detailed Design must include the system's overall architecture and a detailed description of all equipment and systems provided under this contract, including any drawings, schematics, descriptions, functional and electrical diagrams, and data needed for manufacturing, testing, installation, and commissioning.
* The scope of work/supply shall be used for elaborating the Price Schedule. However, the Supplier shall elaborate these Price Schedules with all necessary ancillary equipment and services required for a complete and functional system towards achieving all RTU/Gateway equipment exchanging data with both datacentres. The Proposer shall conduct any ancillary works that are implied or required to fulfil the capabilities described in this Technical Documentation .
* All such ancillary equipment and services shall be included as a lot per station; each lot shall be detailed and described by the Proposer.
* Supply and installation of the procured equipment shall be performed in full. All the components necessary for enabling regular operation of the concerned equipment shall be included in the scope of supply and installation.
* The Proposer shall guarantee the proper functioning of the complete system compliant with the Design, Specifications, and the Scope of Services.
* All systems and equipment shall be supplied with spare parts to be estimated by the Contractor, which shall be sufficient for the regular operation of the system, except for consumable spares, such as printer toner, data backup media, etc., and standard computer material such as workstations, monitors, printers, etc., which shall be supplied sufficient for two years of availability and performance to be met. The Bid shall include a quotation for the recommended level of spares and the recommended list of all test equipment required to maintain, fault find, and repair the supplied equipment.
* The Contractor shall perform the formal tests (Type Test, Routine Test, Factory Acceptance Test (FAT), Reliability Test, Point to Point Test P2P, Site Acceptance Test (SAT), Availability Test for the overall delivered Systems as specified in “Section VII. Volume C” document.
* The Contractor shall provide training for all delivered systems for NEGU personnel as specified in each paragraph referring to Training in each “Section VII. Volume C” document.
* The Contractor shall be responsible for supplying Spare Parts & Tools for all delivered Systems as described in each “Section VII. Volume C” document.
* The Proposer shall complete in section **4.2 “Form 2 – Equipment Country of Origin”** by providing detailed information for each major item of equipment, hardware, and components to be supplied under the Contract. The form must be filled in accurately and comprehensively as follows:
* **Item**: Reference number or designation as per the Technical Proposal or Bill of Quantities.
* **Description**: A brief description of the equipment or material (e.g., RTU, server, communication router, workstation, etc.).
* **Code**: Internal code or part number used by the bidder (if applicable).
* **Country of Origin**: The country where the equipment or component is manufactured or assembled.
* **Manufacturer**: The name of the original manufacturer or supplier.
* **Type of Equipment**: The category or classification of the item (e.g., SCADA server, router, GPS module, etc.).
* **FAT Country**: The country where the Factory Acceptance Test (FAT) will be conducted for the respective item.
* **Note:** All entries must correspond to the proposed equipment in the technical submission. Any changes to the manufacturer, country of origin, or FAT location after contract award shall require prior written approval by the Employer.

## Implementation Schedule

* The Contractor must submit a detailed Contract implementation work plan in a form of Gannt Chart with critical path analysis (refer to Section VII. Volume D, Implementation Schedule) for the entire Scope of Works/Supply described hereafter. This Work Plan shall identify all key activities and milestones, e.g., design stage, manufacturing, shipment, site installation, and commissioning.
* The Supplier shall set out a detailed Program and Schedule for mobilization and construction of the Works to be performed, including estimated starting and finishing dates for individual components and identification of major milestones and critical path. The proposed Program and Schedule shall be developed according to Works Requirements and shall address the following:
* Details of the proposed schedule for obtaining permits that may be necessary in order to commence the Works, including the preparation of required studies, supporting information, and applications.
* Details of the proposed timeline for carrying out the Works within the Time for Completion, in the form of a bar chart showing notably the critical path and the dependencies between the different subsystems/components.
* Details of the proposed timeline for the testing, commissioning and handing over of the completed Works.
* Mobilization Schedule.
* This Implementation Schedule (refer to Section VII. Volume D, Implementation Schedule) presents the two Bid packages to account for and consider their interdependence. NEGU or its consultant manages the cohesion to optimize its completion time.
* The Time Schedule from the Contractor shall include the following vital durations from the Contract Commencement Date:
* Completion of first Phase– 12 Months
* Completion of the second phase – 18 Months
* Completion of Project, including warranty period – 42 Months

The expected milestones are:

* Access to dust-free Critical Rooms (Computer & Communication Room + UPS Room) - 7 Months
* Completion of all SAT for SCADA, Hardware, Software, RTU, and Point-to-Point tests for Phase 1 Substations -11 Months
* Availability Tests Completion and Go Live - 12 Months

## Warranty & Support

* The SCADA/EMS, ICS, RTU 48 DC and Adaptation work including all components, software and accessories shall be fully guaranteed against all defects arising from faults in design, manufacture, and workmanship for a period of **24** months from the takeover date.
* All defects and faults notified to the Tenderer within this time shall be remedied without charge.
* Should any design fault become apparent to the Employer or the Contractor during the warranty maintenance period, the Contractor shall deliver all components necessary to correct the fault, together with all necessary instructions and specialist assistance, free of charge.
* More details about **Warranty & Support** can be found in **Section VII. Volume C.**

## Cybersecurity Certification

* SCADA/EMS, ICS software package should be certified by the State Unitary Enterprise Center "Center of Cybersecurity of Uzbekistan" as a commercially available product.
* The certificate confirms the compliance of certified products with the requirements of normative documents of the Republic of Uzbekistan in terms of functionality, reliability, security, efficiency and other declared consumer properties of the software product.
* Certification is made for compliance with the requirements of regulatory documents:
* O'z DSt 3065:2016 Telecommunication Networks. Automated user billing systems. Telecommunication services. General technical requirements and control methods
* O'z DSt 2814:2014 Information technology. Automated systems. Classification according to the level of protection against unauthorized access to information.
* O'z DSt 2815:2014 Information technology. Firewalls. Classification according to the level of protection against unauthorized access to information.
* O'z DSt 2816:2014 Information technology. Classification of information security software by level of control of absence of undeclared capabilities.
* O'z DSt 2817:2014 Information technology. Computing hardware. Classification according to the level of protection against unauthorized access to information.
* O'z DSt 2298:2011 Information technology. Electronic document management Typical requirements
* O'z DSt 1135:2007 Information Technology. Requirements for databases and information exchange between public administration and local public authorities
* More information at https://www.csec.uz/.
* For taking certification, each Tenderer must apply individually to the Cyber Security Institute by giving any software and program part of technologies in the Offer regarding to the SCADA. The Cyber Security Institute will check individually and give its comments.
* More details about **Cybersecurity Certification** can be found in **Section VII. Volume C.**

## Post-Warranty Maintenance Services

The Contractor shall propose an optional Maintenance Framework service contract for one or two year after completing the warranty period.

Post-Warranty Maintenance Period’ means the 1-year (possibly extended to second year on the same unit price) period after the Warranty during which the Contractor provides support services under the SLA.

* The primary purpose of the required maintenance services is to maintain the required functions and performance levels of the SCADA & EMS, AGC, WAMS, and ICS/RTU system.

The Contractor shall provide comprehensive maintenance and technical support for the entire SCADA/EMS/AGC/WAMS system and all supplied RTUs, communications (ICS), and 48V DC power systems for a period of one, (may be extended upon request of Purchaser, the same price for year 1 will be preserved for year 2 as well) year after the end of the Warranty Period. This Service Level Agreement (SLA) shall include, at minimum: preventive maintenance visits, 24/7 technical support and troubleshooting, timely repair or replacement of any defective components, supply of necessary spare parts and consumables, and software patches/upgrades to keep the system up-to-date and secure.

The costs of the Post-Warranty Services are included in the Proposal’s evaluated price and shall be fixed through the Contractor’s rates in the Price Schedule.

The Contractor shall meet all service levels and performance indicators during the post-warranty period as outlined in Section 13 (Post-Warranty Maintenance Services) of the SCADA Technical Requirements. This includes guaranteed response and resolution times for different priority incidents, regular reporting, and adherence to key performance indicators (KPIs) for system uptime and support quality.

The Contractor’s maintenance responsibility during this period is all-inclusive – it covers all labor, expertise, replacement parts or modules, software support, and any other resources needed to keep the system running optimally. The Employer will not bear any additional costs for routine maintenance activities apart from those covered by the SLA.

The Contractor shall submit an annual performance and maintenance report summarizing all support activities carried out, issues encountered, system health, and recommended improvements.

The Contractor shall ensure during the SLA period that up-to-date documentation is handed over as systems evolve.

The Costs for the one (1) year following the end of the Warranty Period shall form part of the total evaluated bid price and shall be quoted by the Contractor in the Price Schedule (Schedule 11) on a fixed, all-inclusive, in year base.

The Employer reserves the right to enter into a separate Maintenance Services Agreement (SLA) with the Contractor for the post-warranty period. This agreement may be signed:

* + concurrently with the main contract,
  + at any time during the implementation of the project, or
  + prior to the expiry of the Warranty Period.

The Employer may choose to contract the SLA in for a year base, with renewals at its sole discretion, up to the full 2-year period. In all cases, the applicable service prices shall be those quoted in the Contractor’s Cost Price Schedule, without escalation, renegotiation, or adjustment.

The Contractor shall remain bound by these prices and service terms throughout the duration of the post-warranty period, irrespective of the timing or phasing of the SLA signing.

The Employer shall notify the Contractor in writing at least **[90 days]** prior to the end of the Warranty Period (or ongoing SLA period) whether it intends to activate or renew the SLA services for the next period. If the Employer opts not to continue, the Contractor’s obligations for post-warranty service will cease at the end of the current paid period.

The Contractor shall establish a maintenance office or team in Uzbekistan with sufficient spare parts and personnel such that on-site response can be achieved within the SLA timelines.

The Contractor shall upgrade or replace system components as necessary to meet the performance requirements throughout the 3-year period, at no additional cost. This includes updating hardware that no longer meets capacity or is no longer supported by the manufacturer, and migrating software to newer versions or platforms as needed to maintain supportability.

The scope of SLA services shall include, but is not limited to, the following components:

* SCADA Core System: Real-time control and monitoring of substations, remote equipment, and operational data.
* Energy Management System (EMS): Software modules for network modeling, load flow, contingency analysis, state estimation, and optimal dispatch.
* Automatic Generation Control (AGC): Real-time balancing of generation and frequency control via dispatch center-set points.
* Wide Area Monitoring System (WAMS): PMU data acquisition, analysis, and visualization tools.
* RTUs and Data Acquisition Interfaces: Including communication protocols, IED integration, and protocol converters.
* Inter-Control Center Communication Protocol (ICCP/TASE.2): Real-time data exchange between the National Control Center and interconnected regional or external control centers.
* SCADA Data Center Hardware: Servers, workstations, firewalls, routers, switches, storage, virtualization infrastructure, and backup systems.
* Human-Machine Interface (HMI) & Display Systems: Operator workstations, video wall components, and user interface software.
* SCADA Communication Network: Including WAN/LAN equipment used to interface with substations, PMUs, regional centers, and backup sites.
* Cybersecurity Systems: Security patches, access controls, antivirus, logging, and compliance with SCADA cybersecurity requirements.
* UPS, 48V DC power/back-up systems: Maintenance of Uninterruptible Power Supply units that support critical SCADA infrastructure.

All SLA prices shall be inclusive of all costs, including but not limited to: labor, travel, tools, software licenses (SCADA, EMS, AGC, WAMS, HMI, OS, DB, security tools), spare parts, consumables, communication equipment maintenance, and any third-party renewals required for system continuity.

The Contractor shall provide all necessary software updates, upgrades, and patches for the SCADA/EMS application, including AGC and WAMS modules, throughout the 1 (possibly extended second year) year SLA period. Any software license required for ongoing operation (whether system software or third-party databases, OS, etc.) must be maintained and renewed by the Contractor as needed, such that the Employer faces no lapse in software support.

## Technical Responsiveness Checklist

In demonstrating the responsiveness of its proposal, the Contractor is strongly urged to use the Technical Responsiveness Checklist. Failure to do so will significantly increase the risk that the Contractor's technical proposal will be declared technically non-responsive. Among other things, the checklist should contain explicit cross-references to the relevant pages in the Contractor's technical proposal.

The following Checklist is provided to help the Contractor organize and consistently present its Technical Bid. For each of the following Technical Requirements, the Contractor must describe how its Technical Bid responds to the requirements. In addition, the Contractor must provide cross references to the relevant supporting information, if any, included in the bid. The cross reference should identify the relevant document(s) and page number(s). The cross reference should be indicated in the column " Bidding Doc. Cross Ref". The Technical Responsiveness Checklist does not supersede the rest of the Technical Requirements (or any other part of the Bidding Documents). If a requirement is not mentioned in the Checklist that does not relieve the Contractor from the responsibility of including supporting evidence of compliance with that other requirement in its Technical Bid. One- or two-word responses (e.g. "Yes," "No,", "Will comply," etc.) are normally not sufficient to confirm technical responsiveness with Technical Requirements

**Table 1: Technical Responsiveness Checklist**

|  |  |  |  |
| --- | --- | --- | --- |
| **№** | **Technical Requirement:** | Bidding Doc.  Cross Ref | Status |
| 1 | All pages of the TENDER DOCUMENTS, submittals bear initials and are officially stamped |  | ***Mandatory*** |
| 2 | Copy of Valid ISO Certificates |  | ***Mandatory*** |
| 3 | Subcontractors Qualification & Letters of Commitment |  | ***Mandatory*** |
| 4 | Subcontractors Equipment, type, age, number, location and condition |  | ***Mandatory*** |
| 5 | Departure from Specifications if any |  | ***Mandatory*** |
| 6 | Vendor List for proposed materials & services |  | ***Mandatory*** |
| 7 | All sheets of Technical Schedules are filled, signed and stamped. |  | ***Mandatory*** |
| 8 | Catalogues and descriptive information of all major equipment quoted by the Tenderer |  | ***Mandatory*** |
| 9 | Project Organization Chart, including CVs of Key Personnel |  | ***Mandatory*** |
| 10 | Detailed Time Plan (Work Program) |  | ***Mandatory*** |
| 11 | Scope of Supply (or unpriced Price Schedules) detailing the offered equipment, training, spare parts, test & tools, etc.. |  | ***Mandatory*** |
| 12 | Soft copy (3 copies on CD) of complete Technical Offer, this shall include editable formats of completed Technical and Price Schedules. |  | ***Mandatory*** |
| 13 | Experiences and Reference Lists for previous projects. |  | ***Mandatory*** |
| 14 | Warranty for a period of at least 2 years with provision  for planned preventive maintenance and repairs. |  | ***Mandatory*** |

For each SPECIFICATION, Contractors are requested to provide a clear and concise explanation in the DETAILED DESCRIPTION section or provide a cross-reference to where that explanation or supporting information can be found in other part of the technical proposal.

## Site Survey Requirement

The Contractor shall perform a comprehensive site survey for all sites included in the project scope. The site survey shall cover all necessary technical, structural, electrical, and communication aspects relevant to the successful engineering and implementation of the project.

The Contractor shall prepare and submit a detailed Site Survey Report for each site to the Client. The report shall include, but not be limited to, the following:

* Existing equipment and infrastructure conditions.
* Available space, power supply, grounding, and cable routing assessments.
* Environmental and accessibility conditions.
* Identification of any constraints, risks, or site-specific challenges.
* Updated site drawings, measurements, and photographs as applicable.

The findings and results of the site surveys shall be used as a formal input for the engineering, design, and subsequent implementation stages of the project. No final engineering work shall commence without incorporating the approved site survey results.

The Site Survey Reports must be submitted for Client review and approval prior to the finalization of detailed design documentation.

## Scope of Works for SCADA & EMS System

* The Contractor shall investigate, collect data, design, manufacture, supply, procure, transport, install, test, and commission all system engineering, software design, development, integration, and implementation work at NDC, BNDC, and five (5) RDCs related to Supervisory Control and Data Acquisition (SCADA) & Energy Management System Applications (EMS), as described in “Section VII. Volume C: Section 3.”
* The Contractor shall provide training to NDC personnel, tailored to the varying levels of responsibility associated with SCADA/EMS operations, ensuring appropriate depth and intensity based on each role.
  + 1. Hardware and Software
* The Contractor shall provide the design, supply, installation, commissioning, and testing of the Software and Hardware, including Servers, Consoles, Network Equipment, Printers, Cyber Security Equipment, and all related support material for NDC, BNDC, and RDC. As described in “Section VII.C, SCADA Sections 3 and 4.”
* Provisioning Of Two Datacentres
* Two datacentres—NDC and BNDC—will be established to host servers and critical IT equipment under the scope of this contract. The location of each datacentre will be confirmed by NEGU at a later stage.
* The Proposer shall be responsible for investigating, collecting data, designing, manufacturing, supplying, procuring, transporting, installing, testing, and commissioning all systems, integration, and implementation activities related to the datacentre infrastructure and IT systems, as detailed in “Section VII.C, SCADA Sections 3 and 4.”
* Note: The physical construction and civil works related to the datacentres shall be managed separately and are not included in the Proposer’s scope.
  + 1. Performance Requirements
* The delivered system shall meet the sizing and performance requirements specified in “S.VII. Volume B SCADA Technical Specifications .”
  + 1. Cyber Security
* The Contractor shall provide the design, supply, installation, commissioning, and testing of advanced Cyber Security Systems for the entire system, as described in “S.VII.C SCADA Technical Specifications §4.2”
  + 1. Data Engineering
* The Contractor shall provide the design, supply, installation, commissioning, and testing of the complete System (all displays and database) at NDC and BNDC.
* Data engineering scope shall cover all works and activities: site survey, data collection, construction, data modeling, ICCP data entry, report creation, the building of displays and database, and tuning of the database for the proper working of SCADA and EMS applications
* The scope of data engineering covers the current and future substations to be monitored and controlled by NDC, summarized in “S.VII.C SCADA Technical Specifications §3.9”.
* The Contractor shall provide a method and software tool for NEGU’s personnel to automate the data engineering method, create Substation Single Line Diagrams (SLDs), and populate the SCADA / EMS database.
* The Contractor shall provide technical support and assistance to NEGU personnel for data engineering and integration activities throughout the warranty period.
  + 1. Communication Interfaces with external Systems
* The Contractor shall provide the necessary communication interfacing equipment to guarantee the exchange of information between NDC and the RTUs, ICS/SCMS, and other systems summarized in “S.VII.C SCADA Technical Specifications §3.11”
* The SCADA System shall support the communication protocols:
* IEC 60870-5-101, IEC 60870-5-104 for data exchange between NDC and RTUs/ICS/SCMS equipment in transmission and power stations,
* Inter-Control Centre Communications Protocol (ICCP or IEC 60870-6/TASE.2) for data exchange between NDC and other Control Centres, including:
  + CDC Energyia (Monitoring and Coordination Center),
* The data exchanged over the ICCP protocol shall be finalized during the detailed engineering design stage.
  + 1. Licenses
* The Contractor shall provide all licenses for the software. The unit prices of various equipment shall include the cost of all required licenses for the system and software.
* All software and firmware licenses provided under this contract shall be perpetual and royalty-free for the lifetime of the system unless explicitly stated otherwise and approved by the Employer. Licenses dependent on cloud infrastructure or requiring renewal during system operation shall not be accepted unless identified in advance and agreed to in writing.
* Proposers shall duly complete the table in **4.3** **Form 3 – Software License of this document** by listing all software and firmware components to be supplied under the Contract, including (but not limited to) SCADA/EMS software modules, database systems, middleware, system management tools, engineering/configuration tools, and substation automation software (e.g., RTU configuration tools, communication drivers, etc.).
* For each software item, the following information shall be clearly stated:
  + Software: The name and version of the software or firmware component.
  + License: A brief description of the licensing scope (e.g., per server, per core, site-wide, per seat, etc.).
  + Vendor: The software vendor or original manufacturer.
  + License Type: Indicate whether the license is Perpetual, Royalty-Free, or otherwise. If the license is subscription-based, cloud-based, or subject to renewal, this must be explicitly declared.
    1. Capability to manage Renewable Energy
* The Contractor shall provide and demonstrate the capability of managing Renewable Energy summarized in “S.VII. Volume C , SCADA Technical Specifications §3.12”
  + 1. Capability to manage a Wide Area Management System
* The Contractor shall provide and demonstrate the capability of managing a Wide Area Monitoring System summarized in “S.VII. Volume C , SCADA Technical Specifications §3.13”
  + 1. Testing
* The Contractor shall perform all necessary tests to ensure the full functionality of the system and the formal tests (Factory Acceptance Test (FAT), Point to Point Test P2P, Site Acceptance Test (SAT), Availability Test for the overall SCADA/EMS Systems as specified in “S.VII. Volume C , SCADA Technical Specifications.

With regards to the testing of features that were evaluated during technical stage based on the rated criteria, the contractor must be able to demonstrate that it achieved all requirements in line with stated in the technical proposal. Failure to deliver such features may result in applying penalties under provision of GCC 27.1

## Scope of Works for RTU, Adaptation Works, ICS/SCMS and 48V DC Subsystem

* The Contractor shall survey all the relevant sites to assess the prevailing provisions, collect data and propose a detailed engineering design. The necessary data collection for the appropriate facilities shall cover all station process details (needed drawings for existing switchgear control, protection, metering panels), existing RTUs, Room Layout for new equipment arrangement, Cable Routing, etc.
* The equipment supply and the works shall comply with the specification specified in “Section VII. Volume B – RTU, Adaptation Works, ICS/SCMS and 48V DC Subsystem.”
* The Typical Signal List is detailed in “Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem”
* The existing situation in each Substation, EHV Substation, and Power station is summarized in “Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - Annex 01a.”
* The number of bays (500kV/220kV/110kV/35Kv/10Kv/6kV bays) in each Substation are summarized in “RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - Annex 01a.”

**Main Scope of Works**

The Contractor’s scope shall include design, manufacture, supply, installation, test, and commissioning as below:

* 22 substations under Phase 2 Modernization Project will be ICS/SCMS based: detailed ICS/SCMS specification for these 22 SSs in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.3.4 and also separately specified for ICS/SCMS specifications RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem
* 12 RTU based Substations (with existing Old USSR RTU): New RTU & RTU Cabinet(s), Transducers & Transducer Cabinet(s), Marshalling Cabinet(s) and its related material, Adaptation Works including necessary material, cables, etc. as detailed in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.3.1
* 26 RTU based Substations (without Automation Equipment RTU/ICS/SCMS): detailed in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.3.1
* 10 RTU based Substations (Privately Owned Substations): detailed in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.3.1
* 3 ICS/SCMS based existing Substations (with Existing ICS/SCMS): detailed in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.3.3
* 6 ICS/SCMS based Under Construction/Planned Substations (Future ICS/SCMS): detailed in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.3.3
* 68 modules of 48V DC System: detailed in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.3.4
* 22 modules of 220V AC / 48V DC Converters (redundant): detailed in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.3.4
* 9 RTU based Switchgear on Power Plants (with existing Old USSR RTU): detailed in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.4.1
* 9 RTU based Switchgear on Power Plants (without Automation Equipment RTU/ICS/SCMS): detailed in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.4.1
* 2 RTU based Switchgear on Power Plants (with existing suitable RTUs): detailed in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.4.2
* 2 Existing ICS/SCMS/SCS Based Switchgear on Power Plants: detailed in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.4.3
* 4 ICS/SCMS (Under Construction/Future) based Substations: detailed in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.4.3
* 64 RTU/SCMS (Integration of RTU/SCMS in Power Plant Switchgear (New & Future Installations – Privately-Owned Stations): detailed in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.4.5
* 18 modules of 48V DC System in Power Plants: detailed in Section VII. Volume B - RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §4.5
* Scope of works for 48 V DC Systems

o The Tenderer shall propose an appropriate 48V DC System at relevant Substations, as detailed in “S.VII. Volume B RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem.”

o the scope also includes the connection of new Telecom equipment to the existing 48 V DC System at ICS/SCMS Substations and Power Stations

o the equipment supply and the works shall comply with the specifications specified in “S.VII. Volume B RTU, & Adaptation Works, ICS/SCMS and 48V DC Subsystem - §10. 48V DC System Requirements”.

* Scope of Works for Substation Equipment Installation
* The Contractor shall survey and propose suitable locations for installing new equipment in each Substation. The scope shall exclude all civil construction and room adaptation works.
* The Contractor shall coordinate with the Employer for the provision of suitable, ready-to-use spaces for equipment installation.
* The client is responsible for ensuring that a suitable location is available for the new equipment before installation begins. If modifications to the substation building are required (such as creating a new room by partition or building an external enclosure), the client will handle these modifications outside of the Proposer’s contract. The Proposer will then proceed with equipment installation once the area is ready and handed over.
* The Contractor’s responsibility shall be limited to:
* Supply, delivery, configuration, and installation of new equipment (e.g., RTU, ICS/SCMS, 48V DC systems) in designated spaces prepared by others.
* Interfacing and cable termination within the allocated rooms or shelters.
* Functional testing, commissioning, and integration of the installed systems.
* Provide and install cable routing channels or cable trays for running power and communication cables from the new equipment to the nearest existing cable ducts or trays. All cable containment will be neatly integrated with the substation’s existing cable management systems.
* Mount and install the equipment panels on the existing raised floor. If no raised floor is present, panels will be installed on a suitable base frame support provided by the Proposer.

o The equipment supply and the works shall comply with the specification specified in “S.VII. Volume B RTU Technical Specs - §9”.

# DOCUMENTATION REQUIREMENTS

## GENERAL

* This chapter describes the documents to be provided for all equipment, functions and works delivered by the Proposer. The documentation shall describe all delivered systems and shall cover all necessary drawings, design specifications, design details, operation and maintenance manuals and other required information.
* The documentation shall include the complete functional specifications of all functions, systems, hardware, and software. It shall also include the complete set of maintenance and user manuals.
* All the standard reference manuals to cover the systems and equipment to be supplied in this Contract by the Supplier.
* All the factory and site test procedures and their result record sheets shall be supplied by the Proposer as a part of the documentation.
* All documents required for the Employer's approval shall be submitted by the Supplier.

## DOCUMENT REVIEW AND APPROVAL

* All documents provided under this contract shall be subject to formal approval except for the standard manuals.
* The Supplier shall ensure that documentations are submitted two (2) weeks prior to the date required for approval to permit amendments to be made and then re-submitted for approval.
* The Supplier shall not be allowed to do any work without approval of all related documents.
* The acceptance or approval of any documents shall not relieve the Proposer of the responsibility to meet all the requirements of the contract or of the responsibility for the correction of the documents.
* The Supplier shall have no claim for additional costs or extension of time on account of delays due to revisions of the documents that may be necessary for ensuring compliance with the contract.
* Any modification resulting from the factory or site testing shall be incorporated in the documentation.
* All previously submitted and approved documents shall be resubmitted for approval in case there are engineering changes, contract changes, or errors or omissions requiring the update of the related documents.
* All documents submitted for approval shall bear the following remark (stamped and signed): "This submission is declared to be strictly in accordance with the requirements of the Contract".
* The documents for reviewing or approval shall in general have adequate cross references to the Contract Specification Sections so that the Employer may easily review/approve the documents by comparing both the contractual requirements and the proposed solutions

## DELIVERABLES DOCUMENTATION

* The Proposer shall provide all necessary documentation for ALL DELIVERED Systems under the scope of this Tender, essentially:
  + SCADA/EMS/AGC/WAMS System,
  + Telecontrol System (RTU/ICS)
  + UPS systems
  + Spare parts, test Equipment and Tools
* The below list of documentation to be delivered by the Proposer is not exhaustive, the final list shall be elaborated during the initial stage of the project to cover all Proposer’s contractual obligation to deliver the scope and necessary works for the project.
* The Employer has the right to request for additional documents during the execution of project works that might deem necessary.

|  |  |  |  |
| --- | --- | --- | --- |
| **Document** | | | **Delivery Date** |
| **Project Documents** | | | |
| Updated Overall Project Schedule | | | 2 weeks after commencement start date of contract |
| Detailed Implementation Time Schedule (Program of Performance) | | | 2 weeks after commencement start date of contract |
| Project Implementation Plan | | | 2 weeks after commencement start date of contract |
| Updated Proposer’s Organization | | | 2 weeks after commencement start date of contract |
| Updated Documentation Plan | | | 2 weeks after commencement start date of contract |
| Updated Test Plan | | | 2 months after commencement start date of Updated |
| Training Program | | | 2 months after commencement start date of Updated |
| Detailed project Specific Quality plans and associated procedures | | | 2 weeks after commencement start date of Updated |
| Detailed proposal of the Monthly Progress Report format | | | 2 weeks after commencement start date of Updated |
| Monthly progress reports | | | Within 5 working days from start of each calendar month |
| Technical Documents | | | |
| Site Survey Reports | | Design phase | |
| List of Deliverable Hardware | | Design phase | |
| Equipment Configuration Diagram | | Design phase | |
| Cable Schedule, Cable Routing Diagrams, and Termination Details / Wiring Diagrams | | Design phase | |
| Network Configuration Diagram | | Design phase | |
| RTU Panel GA Drawings (General Arrangement) | | Design phase | |
| Panel Wiring Diagrams and Panel Layout Drawings | | Design phase | |
| Interconnection List | | Design phase | |
| Site Installation drawings and procedures | | At least 3 months prior to the related site installation works | |
| Equipment Manuals | | Design phase | |
| List of Deliverable Software | | Design phase | |
| Software Functional Description | | Design phase | |
| Software Requirement Matrix | | Design phase | |
| Cyber Security | | Design phase | |
| Cybersecurity Risk Assessment Report, Firewall and Access Control Policies, Security Test Plan & Results | | Design phase | |
| Testing Procedures for FAT, Local Site Testing, Site Acceptance Testing, Point to Point Testing, etc. | | At least 3 months prior to the related scheduled formal Tests | |
| Training Materials / Presentations, and Competency Matrix / Attendance Sheet | | At least 1 month1 prior to the related scheduled formal Tests | |
| Design Documents for all delivered systems, for each site subject to the Employer’s approval | | Design phase | |
| Server rooms layout | | Design phase | |
| Control rooms layout | | Design phase | |
| Power Supply, Single Line Diagram, load calculation for UPS systems | | Design phase | |
| Test Records including Variance Recording and Resolution for FAT, Local Site Testing, Site Acceptance Testing, Point to Point Testing, End to End testing, etc. | | In due time in accordance with the approved schedule | |
| User Manuals | | Design phase | |
| Maintenance Manuals | | Design phase | |
| As-built Documents | | Before Take Over Acceptance Certificate | |
| Power consumption list for all the equipment for Control Centre and each site | | Design phase | |
| Detailed Spare Parts List | | Design phase | |
| Handover Checklist, Maintenance Schedules & Procedures, Spare Parts Replacement Procedures, and Failure Recovery Procedures | | Design phase | |
| Detailed Test Equipment and Tools List | Design phase | | |
| Other Documents to be defined during the initial stage of the project | | | |

## DOCUMENT FORMAT

* All the technical documents to be submitted shall be provided on standard ‘A’ size sheets and shall be presented in a durable binding which shall be suitable for stacking on shelves.
* The title of each document shall be clearly marked on the front cover and spine, adequate and standardized coversheets, reference numbers, titles, submission dates, revised dates, etc, shall be included. Each page of each document shall be uniquely identifiable.
* All documents shall be submitted in English and translated copy into Russian language.
* Parameters specified on the drawings and documents shall be in metric units.
* All documents shall be supplied each with two (2) hardcopies and one (1) softcopies.
* Electronic version of documents shall be provided via standard third-party editable format (PDF, Microsoft Word) and drawing software such as AutoCAD.
* Documents delivered on softcopy media shall be formatted for printing on A4 size paper, any other standard format (A0, A1, A2, A3) when more appropriate.
* All documents shall be made available for consultation and download on the required on-line/web-based electronic documents management system to be established by the Supplier and shall permit sharing documentation with the World Bank.

## As-built Documents

* The Proposer shall prepare the final As-built drawings and documents for all the executed works.
* All the documents submitted and approved or reviewed shall be finalized and submitted as “As-built” Documents before TOAC is issued.
* The Proposer shall, during the course of the execution and before Substantial Completion of the Facilities, prepare and keep up to date a complete set of "as-built" drawings, recording all Permanent Works on a hard copy which shall be corrected daily, if necessary, to show each and every change from the Contract Drawings or approved design drawings/shop drawings and the exact "as-built" locations, sizes and kinds of work etc.. This set of drawings shall be kept on the Site and shall be used only for record purposes. A programme for the issuance of As-built drawings shall be submitted and consented to by the Engineer.
* In addition, the Proposer shall, at his own expense, prepare and submit to the "Engineer" "as-built" drawings of the whole of the Facilities Permanent Works required under the Contract and such drawings shall show all Facilities Works as executed. Such drawings shall be prepared for the relevant portions of the works as they are completed and shall be submitted to the "Engineer" for his inspection and approval whenever requested.
* Where the provisions of "as-built" drawings are required by the Employer or Local Authority as a pre-condition to providing the service connections, approval, licenses etc. the "Proposer" shall be responsible for submitting these drawings at the correct time and any delays caused by the non-submittal of these drawings will be the responsibility of the Proposer.
* Prior to commencement of the Tests on Completion, The Proposer shall submit to the Employer in writing, or at such earlier times as may be named in the Specification, the Proposer shall supply to the Engineer provisional operation and maintenance manuals in sufficient details and drawings, as may be necessary to enable the Employer to operate, maintain, dismantle, reassemble, and adjust all parts of the Facilities and provide all necessary technical information, operating manuals etc… Manuals as provided for in the Contract shall be delivered together with the Plant, Equipment or appliance to which they relate in three copies one of which must be an original.
* The Proposer shall submit a digital copy on a USB drive. Furthermore, the Proposer shall provide three original reproducible mother prints of the "as-built" drawings.
* Prior to the preparation of "as-built" drawings, the "Proposer" shall obtain the approval of the Engineer as to size of drawings, quality of transparent sheets, method of drawing and any other such detail.
* Failure of the Proposer to prepare and submit the “as-built” and “Operation and Maintenance Manuals” files to the Engineer’s satisfaction, shall result in withholding any progress payment until such time as the Proposer rectifies and provides all requirements under this Sub-clause.

# SAMPLE FORMS

## Form 1 - Contractor’s Equipment

The Proposer shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key Contractor’s equipment listed in bidding document. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Proposer.

|  |  |  |
| --- | --- | --- |
| **Item of Equipment** | | |
| **Equipment Information** | Name of Manufacturer | Model and Power Rating |
| Capacity | Year of Manufacture |
| **Current Status** | Current Location | |
| Details of Current Commitments | |
| **Source** | Indicate source of the equipment:  ☐ Owned ☐ Rented ☐ Leased ☐ Specially Manufactured | |

Omit the following information for equipment owned by the Proposer.

|  |  |  |
| --- | --- | --- |
| **Owner** | Name of Owner | |
| Address of Owner | |
| Telephone | Contact Name and Title |
| Fax | Telex |
| Agreements | Details of rental / lease / manufacture agreements specific to the project | |

## Form 2 - Equipment Country of Origin

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Item** | **Description** | **Code** | **Country of Origin** | **Manufacturer** | **Type of**  **Equipment** | **FAT Country** |
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## Form 3 – Software license

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| --- | --- | --- | --- |
| **Software** | **License** | **Vendor** | **License Type** |
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## Form 4 – Bill Of Equipment and materials (to be included as part of the Technical Proposal)

1. **Equipment, and Material for SCADA/EMS/AGC/WAMS**

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **Description** | **Quantity** | **Unit** |
|  | **SCADA-EMS** |  |  |
| **A** | **Hardware (NDC)** |  |  |
| A.1 | Redundant Pair of Servers | 5 | No. |
| A.2 | Storage & Switch for Disk Array | 1 | No. |
| A.3 | Redundant Pair of Firewalls Type-1 (External) | 1 | No. |
| A.4 | Redundant Pair of Firewalls Type-2 (Internal) | 1 | No. |
| A.5 | Redundant Pair of Switches Type-1 (48 Ports) | 4 | No. |
| A.6 | Redundant Pair of Switches Type-2 (24 Ports) | 2 | No. |
| A.7 | Port Serial Server | 2 | No. |
| A.8 | Network Time & Frequency System, including redundant slave clocks and components | 1 | No. |
| A.9 | Necessary Cabinet with their accessories (Cables, Cable Tray System, Installation Consumables, patch panels, Cable Glands, Terminals, Tags, and Lugs, etc.) | 6 | No. |
| A.10 | Workstations (includes RPAs) | 19 | No. |
| A.11 | Monitors for Workstations | 46 | No. |
| A.12 | Printers | 2 | No. |
| A.13 | Redundant No-break Power Supply System (UPS) | 1 | No. |
| A.14 | Redundant AC Auxiliary Power Supply and Distribution System | 2 | No. |
| A.15 | Video Wall Display and Controller | 1 | No. |
| A.16 | Digital Display Units | 4 | No. |
| **B** | **Hardware (BNDC)** |  |  |
| B.1 | Servers | 4 | No. |
| B.2 | Storage & Switch for Disk Array | 1 | No. |
| B.3 | Redundant Pair of Firewalls Type-1 (External) | 1 | No. |
| B.4 | Redundant Pair of Firewalls Type-2 (Internal) | 1 | No. |
| B.5 | Redundant Pair of Switches Type-1 (48 Ports) | 4 | No. |
| B.6 | Redundant Pair of Switches Type-2 (24 Ports) | 2 | No. |
| B.7 | Port Serial Server | 2 | No. |
| B.8 | Network Time & Frequency System, including redundant slave clocks and components | 1 | No. |
| B.9 | Necessary Cabinet with their accessories (Cables, Cable Tray System, Installation Consumables, patch panels, Cable Glands, Terminals, Tags, and Lugs, etc.) | 6 | No. |
| B.10 | Workstations | 7 | No. |
| B.11 | Monitors for Workstations | 17 | No. |
| B.12 | Redundant No-break Power Supply System (UPS) | 1 | No. |
| B.13 | Redundant AC Auxiliary Power Supply and Distribution System | 2 | No. |
| B.14 | Video Wall Display and Controller | 1 | No. |
| B.15 | Digital Display Units | 4 | No. |
| **C** | **Hardware (5 RDCs & 14 TDDs)** |  |  |
| C.1 | Workstations (includes TDDs) | 38 | No. |
| C.2 | Monitors for Workstations | 86 | No. |
| C.3 | Printers | 5 | No. |
| C.4 | Large screen | 1 | No. |
| C.5 | Firewall | 5 | No. |
| C.6 | Switch | 5 | No. |
| C.7 | Necessary Cabinet with their accessories (Cables, Cable Tray System, Installation Consumables, Cable Glands, Terminals, Tags, and Lugs, etc.) | 5 | No. |
| **D** | **WAMS** |  |  |
| D.1 | Redundant WAMS Server System | 1 | No. |
| D.2 | Syrdarya TPP PMUs | 2 | No. |
| D.3 | Tashkent TPP PMUs | 2 | No. |
| D.4 | Guzar PMUs | 2 | No. |
| D.5 | Sogdiana PMUs | 2 | No. |
| D.6 | Lochin PMUs | 2 | No. |

**Note:** The quantities indicated in this Bill Of Equipment and materials represent the expected baseline scope. However, if the Proposer intends to offer different quantities based on their system design or implementation approach, they may do so. In such cases, the Proposer shall clearly state the revised quantities in the BOQ table and provide a detailed justification and technical rationale within the Technical Proposal. Any deviation must ensure full compliance with the functional and integration requirements of the project.

1. **Equipment, and Material for RTU/ICS, & Adaptation Works**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/N** | **Item Description** | **Unit** | **Quantity** | **Notes** |
| A1 | Remote Terminal Unit (RTU) main processor unit | Set |  | Includes CPU, power supply, and basic controller. |
| A2 | Digital Input (DI) Modules | No. |  | For status signal acquisition. Specify number of channels per module. |
| A3 | Digital Output (DO) Modules | No. |  | For remote commands/control outputs. |
| A4 | Analog Input (AI) Modules | No. |  | For measurement signal acquisition (e.g., current, voltage, temp, etc.). |
| A5 | Analog Output (AO) Modules | No. |  | Optional, for analog signal retransmission if applicable. |
| A6 | Communication Interface Modules (RS232/RS485/Ethernet, etc.) | No. |  | Protocol converters or serial interfaces as per system requirement. |
| A7 | RTU Cabinet(s) with internal wiring | No. |  | Housing for RTU modules and auxiliary equipment, complete with internal wiring. |
| A8 | Transducer Sets with Cabinets | Set |  | Complete transducer units with mounting cabinets. |
| A9 | Marshalling Cabinets | No. |  | Includes all internal terminal blocks, relays, etc. |
| A10 | Terminal Blocks | LS |  | For signal termination in marshalling cabinet. |
| A11 | Decoupling Relays | No. |  | For signal isolation and interposing. |
| A12 | Auxiliary Relays | No. |  | For control logic or interlocks. |
| A13 | Miniature Circuit Breakers (MCBs) | No. |  | For protection and isolation inside cabinets. |
| A14 | Internal Cabling (within cabinets) | LS |  | Power and signal wiring within RTU, transducer, and marshalling cabinets. |
| A15 | External Cabling and Wiring to Substation Equipment | LS | 1 | Includes all connections to switchyard equipment, telecom, power, etc. |
| A16 | Earthing System Materials and Integration | LS | 1 | Earthing for all supplied equipment and cabinets. |
| A17 | Adaptation Works and System Integration | LS | 1 | Includes testing, telecom interface setup, and SCADA integration. |

**Note:** This table shall be completed separately for each RTU supply or extension and each substation included in the Scope of Work and Price Schedule. The detailed breakdown of quantities shall be provided in the Technical Offer as quantities only, **without any pricing information.**

1. **Equipment, and Material for 48V DC System**
   1. **Redundant AC/DC Converter System**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/N** | **Item Description** | **Unit** | **Quantity** | **Notes** |
| A1 | 48V DC Converter Module (220V AC Input, Redundant) | No. |  | Individual hot-swappable modules for redundancy (e.g., 1+1 or 2+1). |
| A2 | Converter Rack / Enclosure | No. |  | Cabinet or chassis housing converter modules. |
| A3 | Input/Output Terminal Blocks | Set |  | Includes AC input, DC output terminals. |
| A4 | Cooling Fans or Heat Dissipation Components | Set |  | Fans, heat sinks, or thermal management. |
| A5 | Monitoring & Control Interface (e.g., front panel or remote alarm) | No. |  | Digital controller/display, SNMP or Modbus interface. |
| A6 | Internal Wiring and Interconnections | LS | 1 | Power and signal wiring inside the cabinet. |
| A7 | Cabling, Connectors, and Accessories (External) | LS | 1 | Includes AC/DC cabling, lugs, cable trays, etc. – Lump Sum. |

* 1. **48V DC Charger, Battery, and Distribution Panels**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/N** | **Item Description** | **Unit** | **Quantity** | **Notes** |
| B1 | Rectifier Modules for 48V DC Charger (N+1 Configuration) | No. |  | Modular rectifiers in parallel redundancy. |
| B2 | Rectifier Controller / Monitoring Unit | No. |  | Voltage/current control and alarms. |
| B3 | 48V Ni-Cd Battery Cells | No. |  | Number of cells (typically 1.2V each, 40 per 48V bank). |
| B4 | Battery Rack / Tray | Set |  | Mechanical support structure for battery cells. |
| B5 | Battery Monitoring System (BMS) | Set |  | Optional smart monitoring of battery health. |
| B6 | 48V DC Distribution Panel | No. |  | For DC load feeders; includes protective MCBs/fuses. |
| B7 | 380V AC Distribution Panel | No. |  | Main AC input panel to feed charger system. |
| B8 | AC/DC Surge Protection Devices | No. |  | Lightning or surge arrestors. |
| B9 | DC Breakers / Protection Modules (Feeder-Level) | No. |  | Mounted inside DC distribution panel. |
| B10 | Internal Wiring and Copper Busbars | LS | 1 | Includes busbar trunking and wiring. |
| B11 | All External Cabling and Accessories | LS | 1 | Includes AC/DC cabling, earthing, fasteners, trays – Lump Sum. |

* 1. **AC/DC Converters for New Telecom Equipment**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/N** | **Item Description** | **Unit** | **Quantity** | **Notes** |
| C1 | Redundant 48V DC Power Supply (AC/DC Converter for Telecom) | Set |  | Dedicated to new telecom racks. Includes dual AC/DC modules. |
| C2 | Output Distribution Panel (Telecom Loads) | No. |  | Includes fuses/MCBs for telecom equipment distribution. |
| C3 | Optional DC-DC Converter Modules (if needed for voltage matching) | No. |  | Used if telecom devices require different DC voltage. |
| C4 | Output Cabling to Telecom Equipment | LS | 1 | DC cabling from power supply to telecom racks – Lump Sum. |
| C5 | Labelling, Termination, and Integration Accessories | LS | 1 | Labels, lugs, glands, fasteners, and termination – Lump Sum. |

**Note:** This table shall be completed separately for each Site / Substation included in the Scope of Work and Price Schedule. **The detailed breakdown of quantities shall be provided in the Technical Offer as quantities only, without any pricing information.**

1. **Equipment, Material for ICS for Substations Under Phase 2 Modernization**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/N** | **Item Description** | **Unit** | **Quantity** | **Notes** |
| A1 | SCMS Control Panels and Cabinets (Fully Wired) | No. |  | Preassembled with internal wiring and terminal blocks. |
| A2 | HV/LV Interface Cabling and Earthing Materials | Lot | 1 | Includes cabling, lugs, trays, and bonding to substation ground. |
| A3 | Engineering Workstation with one Monitor | Set | 1 | For SCMS configuration and diagnostics. |
| A4 | Operator Workstation with Dual Monitors | Set | 1 | For SCMS control operations. |
| A5 | Redundant Industrial Gateways (NDCC & BNDC) | Set | 1 | Each gateway shall have 2 ports to NDCC and 2 ports to BNDC; redundancy required. |
| A6 | A4 Color Printer | No. | 1 | For control room reporting. |
| A7 | Network Switch (Managed, Industrial Grade) | No. |  | For SCMS local area network interconnection. |
| A8 | Redundant GPS Time Server (NTP & IRIG-B supported) | Set | 1 | Dual-redundant time servers supporting both NTP and IRIG-B for high-accuracy synchronization. |
| A9 | Bay Control Units (BCUs) | No. |  | Interfaces to protection relays and SCADA. |
| A10 | Transducers and Signal Converters | No. |  | For analog/digital signal conversion to SCMS. |
| A11 | Common Auxiliary Units (e.g., terminal blocks, relays) | LS | 1 | Includes small components for signal adaptation and interface wiring. |
| A12 | Control Room Furniture (1 table + 2 chairs) | Set | 1 | Operator desk and seating. |
| A13 | Dual Battery Banks (48VDC & 220VDC) – N+1 Design | Set |  | Nickel-Cadmium or equivalent; includes racks. |
| A14 | Redundant Modular Chargers (for both voltages) | No. |  | N+1 modular rectifiers. |
| A15 | Redundant Modular DC/DC Converters | No. |  | Converts between 48VDC and 220VDC. |
| A16 | Segregated DC Distribution Cabinets | No. |  | With fuses/breakers for individual DC loads. |
| A17 | Redundant UPS (30-min autonomy) | Set | 2 | One for each critical path; should support SCMS in blackout. |
| A18 | Shielded LV DC Cabling & Terminations | LS | 1 | Includes shielded cables, trays, terminations – Lump Sum. |
| A19 | Dedicated ICS Grounding System | LS | 1 | Isolated clean earth with busbar and rods – Lump Sum. |
| A20 | Power Interface Cabling to RTUs/PLCs/Telecom | LS | 1 | Low voltage DC interfacing cabling – Lump Sum. |

**Note:** This table shall be completed separately for each ICS supply and each substation included in the Scope of Work and Price Schedule. The detailed breakdown of quantities shall be provided in the Technical Offer as quantities only, **without any pricing information**.

The scope of work related to the 22 ICS/SCMS-based substations under the Phase 2 Modernization Project shall be considered optional at this stage, and the Client reserves the right to confirm its inclusion or exclusion during the tender evaluation process. However, bidders are required to price this optional scope in the Price Schedule in full detail, as per the technical specifications. Any offer submitted without a quotation for this optional scope shall be considered non-compliant and subject to rejection.

1. **Mandatory Spare Parts**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/N** | **Item Description** | **Unit** | **Quantity** | **Notes** |
| **A** | **SCADA-EMS Spare Parts** |  |  |  |
| A1 | Servers | PC |  | Redundant SCADA/EMS backend servers. |
| A2 | Switches | PC |  | Core, aggregation, or access switches. |
| A3 | Workstations | PC |  | Operator or engineering workstations. |
| A4 | Monitors | PC |  | Dual or single screen displays. |
| A5 | Video Wall Display Panels | PC |  | LED/LCD panels for control room. |
| A6 | PMU (Phasor Measurement Units) | PC |  | For WAMS/EMS integration. |
| A7 | GPS Time Server Modules | PC |  | Redundant NTP / IRIG-B modules. |
| A8 | Patch Panels & SFP Modules | PC |  | For fiber/copper connectivity. |
| A9 | Additional Items (if any) | LS |  | Bidder to list and justify. |
| **B** | **RTU/ICS, 48 DC Spare Parts** |  |  |  |
| B1 | RTU Power Supply Module | PC |  | DC/DC or redundant RTU supplies. |
| B2 | Communication Interface Modules | PC |  | RS-485, Ethernet, serial converters. |
| B3 | CPU / Controller Module | PC |  | Main processing unit of RTU. |
| B4 | Analog Output (AO) Modules | PC |  | Output to actuators/process. |
| B5 | Analog Input (AI) Modules | PC |  | Signal acquisition (0-20mA, 0-10V, etc.). |
| B6 | Digital Output (DO) Modules | PC |  | Relay or transistor outputs. |
| B7 | Digital Input (DI) Modules | PC |  | Dry contact or TTL-level signal input. |
| B8 | 220V AC / 48V DC Converters | PC |  | Redundant conversion units. |
| B9 | 48V DC N+1 Modular Chargers | PC |  | Hot-swappable charger modules. |
| B10 | 48V Ni-Cd Battery Bank | PC |  | Cell/rack level spares or reserve bank. |
| B11 | 48V DC Distribution Panel | PC |  | Breaker or fuse-based DC panel. |
| B12 | 380V AC Distribution Panel | PC |  | For UPS/charger input supply. |
| B13 | Relay Modules (Auxiliary / Decoupling) | PC |  | Signal adaptation and isolation. |
| B14 | I/O Terminal Blocks (used in RTU/Marshalling Cabinets) | PC |  | DIN-rail mounted terminal sets. |
| B15 | Power Supply Fuses / Breakers (MCBs) | PC |  | Field-replaceable fuses or MCBs. |
| B16 | Cooling Fans for Converters / Chargers | PC |  | Forced air cooling modules. |
| B17 | Additional Items (if any) | LS |  | Bidder to list and justify. |

1. **Tools, Test Equipment, and Maintenance Kits**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item** | **Description** | **Unit** | **Quantity** | **Notes** |
| **A** | **SCADA-EMS** |  |  |  |
| A.1 | SCADA system diagnostic software/tools | Set |  | For configuration, diagnostics, and logs retrieval. |
| A.2 | Workstation/Server maintenance kit (ESD-safe tools) | Set |  | Screwdrivers, brushes, grounding strap, etc. |
| A.3 | Portable monitor/keyboard/mouse set | Set |  | For on-site diagnostics. |
| A.4 | Optical Fiber Tester (if SCADA LAN uses fiber) | Set |  | OTDR or equivalent tool if applicable. |
| A.5 | Additional items (if any) |  |  | Bidder to specify. |
| **B** | **RTU/ICS, 48V DC** |  |  |  |
| B.1 | RTU/PLC programming and diagnostics tool | Set |  | May include proprietary software/cable/licensing dongle. |
| B.2 | I/O testing tools (simulator box for DI/DO/AI/AO) | Set |  | For field verification and simulation. |
| B.3 | Digital multimeter or clamp meter | No. |  | For voltage/current testing. |
| B.4 | Battery bank tester (48V) | No. |  | Capacity or impedance tester. |
| B.5 | Spare cable crimping and termination tools | Set |  | Crimping tools, lug dies, etc. |
| B.6 | Labeling machine (for wiring identification) | No. |  | Portable printer recommended. |
| B.7 | Laptop with pre-installed tools | No. | 3 |  |
| B.8 | Additional items (if any) |  |  | Bidder to list clearly. |

## Form 5 – Post-Warranty Services Inventory

The following items are subject to post-warranty support and must be priced by the Proposer for a 1-year (possibly one more year of extension) period after expiry of the Warranty. These items are referenced in Schedule 11 of the Price Schedules and form part of the evaluated proposal price.

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| --- | --- | --- | --- |
| **Item No.** | **Description** | **Unit** | **Quantity** |
| 1 | SCADA/EMS/AGC/WAMS Hardware Maintenance | Year | 1  *(+1 extension possibly)* |
| 2 | SCADA/EMS/AGC/WAMS Software Maintenance | Year | 1  *(+1 extension possibly)* |
| 3 | SCADA/EMS/AGC/WAMS License Renewal | Year | 1  *(+1 extension possibly)* |
| 4 | Third-party Software Licenses (OS, DB, etc.) | Year | 1  *(+1 extension possibly)* |
| 5 | SCADA Hardware Spare Parts Provisioning | Year | 1  *(+1 extension possibly)* |
| 6 | RTU/ICS Hardware Maintenance & Support | Year | 1  *(+1 extension possibly)* |
| 7 | RTU/ICS Software Maintenance & Support | Year | 1  *(+1 extension possibly)* |
| 8 | RTU/ICS Spare Modules & Consumables | Year | 1  *(+1 extension possibly)* |
| 9 | RTU/ICS License Renewal | Year | 1  *(+1 extension possibly)* |
| 10 | RTU/ICS Third-party Software Licenses | Year | 1  *(+1 extension possibly)* |
| 11 | 48V DC System Hardware Maintenance | Year | 1  *(+1 extension possibly)* |
| 12 | 48V DC System Spare Modules & Battery Replacement | Year | 1  *(+1 extension possibly)* |