“CAESAREA” SUBSTATION
BATTERY ENERGY STORAGE SYSTEM

INSTRUMENTATION AND CONTROL EQUIPMENT

SPECIFICATION

ATTACHMENT TO ANNEXURE "B"

This document shall be revised in its entirety only.
All sheets of this document are the same revision.
INSTRUMENTATION AND CONTROL EQUIPMENT

1 General

1.1 Contractor shall furnish and install all instruments, gauges, switches and other control components required for proper operation in order to assure the technical requirements, safety and reliability.

1.2 The operation process shall be controlled and monitored by means of a PLC and a computer with HMI.

1.3 The control system shall have REMOTE/LOCAL modes of operation. The required mode is selected from the computer key board and shall provide the following:

- Remote control from IEC Dispatcher.
- Local control from the computer key board.

1.4 The complete operation of the equipment shall be fully monitored. An instrumentation system shall be supplied and shall be designed to function so that improper operation of the system will cause an alarm on the appropriate HMI display. The design shall shut-off the alarm circuits when the monitored equipment is not in service in order to eliminate false alarms.

Contractor shall provide interlocks to defeat the start and to stop the process when the parameters are not achieved as required by the Contractor process design. Contractor shall clearly state these conditions.

1.5 The safety interlocks and the supervision/alarm system shall operate in all modes of operation.

1.6 The control system shall include an application of data acquisition and data processing for all measurements.
1.7 Instruments will be connected to control system through junction boxes or directly with their discrete high/low contacts as well as with analog signals (4-20mA, 1-5VDC, T/C or RTD) whenever feasible.

1.8 All internal wiring and cable interconnection between all electrical and control parts of equipment in Scope shall be provided by the Contractor.

1.9 Free space shall be reserved in the control room of the Electrical Battery Energy Storage System (EBESS) container:
   - for IEC Registration System (IEC RS) electrical board 600*600*300mm (HxWxD)
   - for the table to place IEC RS computer on.

4 additional sockets 230VAC shall be mounted for IEC RS powering.

2 Control System

2.1 The control system shall be PLC-based. The PLC and related accessories shall be of proven design selected from the following recommended list:
   - Schneider Electric
   - General Electric
   - Siemens
   - ABB
   - Allen-Bradley

2.2 The PLC’s CPU and I/O cards shall be state-of-art products available on the market at the bid date.

2.3 The PLC’s CPU and I/O cards shall be industrial type for the installation in the cubicle according to the environment conditions with interrogating and operating voltage 24 VDC.

2.4 The PLC shall be provided with a minimum three-year battery for RAM user memory (an additional EEPROM flash memory is preferred). The access to replace the battery shall be from the front panel, without removing any system component and without interrupting the PLC operation.

2.5 Local HMI
The operation functions will be performed by means of one industrial PC with keyboard, mouse and display LCD 19". The hardware shall be based on the last version of required equipment available on the market and released for the System at the delivery date. One A3/A4 color laser printer shall be provided for system purposes.

2.6 Software platform.
All software packages shall be on Microsoft Windows platform (Windows 7 PRO at least) and supplied with all the necessary unlimited licenses with upward capabilities. The last proven version of the standard "off the shelf" software packages available on the market at the bid date shall be provided for Control, Operation and Supervisory of the PLC based system. The HMI software will be Vijeo Citect, Simatic WinCC, Cimplicity, RSview32, Industrial IT or similar pending on IEC's approval. PLC software shall be available for on-line and off-line programming on the local HMI (complied with IEC1131 standard). Contractor shall supply the System with Application Software (graphic displays, alarm lists, logs, trends, etc.) designed according to the controlled system's technological requirements and in the quantities defined mutually with IEC. In any case all controlled equipment shall have clear dynamic representation on the appropriate graphic displays. Contractor shall be responsible for developing, debugging and testing of all software programs in the Scope. The Contractor will provide a back-up of the software programs, licenses and the installed applications that should be stored independently of the PLC and PC (e.g.-on CD/DVD).

2.7 PLC external interfaces.
PLC-based Control System interfaces to "other systems" shall be either:
- via communication link
- hardwired

Hardwired signals may be analog signals of 4-20mA or digital signals - dry contacts.

2.7.1 Facilities (hardware and software) shall be provided to establish communication link to IEC Registration System (IEC RS) with one of the following protocols, listed in priority order:
- Modbus over TCP/IP
- Profinet
2.7.2 Additional communication link shall be provided as an option. It shall use OPC communication protocol with IEC RS as a client or/and provide access to SQL server for IEC RS.

2.7.3 The Contractor shall provide data signal exchange with existing IEC Substation Control System (IEC SCS) as follows:

2.7.3.1 Digital output signals (to IEC SCS) shall be carried out through NO dry contacts with contact rating 220VDC, 1.0A. The exact signal list will be defined mutually with IEC in the design stage of the project, but it shall include at least four mandatory signals:
- Power pack “ready”
- Power pack “not ready”
- Power pack switchgear “open”
- Power pack switchgear “close”

2.7.3.2 Digital input signals (from IEC SCS). The exact signal list will be defined mutually with IEC in the design stage of the project, but it shall include at least four mandatory signals:
- Substation switchgear “open”
- Substation switchgear “close”
- Substation switchgear “ready”
- Substation switchgear “trip”
IEC SCS will provide these signals in a form of NO dry contact.

2.7.4 The Contractor shall provide data signal exchange with existing IEC Dispatcher as follows:

2.7.4.1 Digital output signals (to IEC Dispatcher) shall be carried out through NO dry contacts with contact rating 60VDC, 100mA. The exact signal list will be defined mutually with IEC in the design
stage of the project, but it shall include at least the following mandatory signals:
- AUTO/MAN
- Power pack connected
- Power pack disconnected
- Predefined modes – SET1, SET2...
- Mode of operation – charge, discharge, frequency backing, inertia, reactive power
- Protection actuated (directly from protection relays, not as PLC output).
- Protection fault
- Equipment fault
- Fire protection actuated

2.7.4.2 Digital input signals (from IEC Dispatcher).
The exact signal list will be defined mutually with IEC in the design stage of the project, but it shall include at least the following mandatory signals:
- AUTO/MAN
- Command "connect" to IEC network
- Command "disconnect" from IEC network
- Predefined modes – SET1, SET2...
- Mode of operation – charge, discharge, frequency backing, inertia, reactive power

IEC will provide interposing relays with NO contact for this purpose.

2.7.4.3 Analog signals (to IEC Dispatcher) shall be carried out in a form of 4-20mA 4wire (active) signal. The exact signal list will be defined mutually with IEC in the design stage of the project, but it shall include at least the following mandatory signals:
- Frequency
- Active power
- Reactive power
- Current
- Voltage
- Available capacity
- Battery temperature
These measurements shall be transferred to IEC Dispatcher directly from measuring instruments and not as PLC outputs.

2.7.4.4 Analog input signals (from IEC Dispatcher) shall be carried out in a form of 4-20mA 4wire (active) signal. The exact signal list will be
defined mutually with IEC in the design stage of the project, but it shall include at least one mandatory signal:
- Setpoint

2.7.5 All other signals from the installed equipment needed for the System functions accomplishment will be defined mutually with IEC in the design stage of the project.

2.8 Special auxiliary equipment for assembling and maintenance of PLC hardware shall be provided if needed.

2.9 The control system shall be fully documented.

3 Additional requirements to the Control System

3.1 All specific alarms/trips that make up any general combined alarm should be in addition indicated separately.

3.2 Alarms and trips should be indicated by different colors.

3.3 Contractor will be requested to provide the User-Defined Dynamic Model of the Object in format of Matlab Simulink file. This will permit to Purchaser to link the model to ETAP transient stability program at run time when conducting Transient Stability Studies.

3.4 The Control System shall be able to work in parallel with control systems of other storage units optionally added to increase the total storage capacity. Additional redundant standard communication link shall be provided for this purpose.