

## Automation Philosophy for 220kV Khoraj Sub-Station (220/66kV System)

### A) Technical Details of 220kV System

#### 1. Bus Bar Configuration

- 220kV System: - Two Bus (One Main and One Main Cum Transfer bus)  
66kV System: - Two Bus (Two Main Bus)
- Isolator system  
220kV System: - Four isolator configuration (Three Bus isolators and a Line/TRF isolator)  
66kV System: - Three isolator configuration (Two Bus isolator and a Line isolator for Feeder / Two Bus Isolator for X'mer (LV) side Bay)

#### 2. Control Voltage

- 220V DC

#### 3. Equipment's

<b>A</b>	<b>220kV System</b>	
<b>1</b>	220kV Circuit Breaker	Conventional SF6 Breaker
<b>2</b>	220kV Isolator	Motorized
<b>3</b>	220kV Control & Protection panel	Control & Protection panel (mounted in Yard Kiosk) with IEC 61850 <b><u>Edition 2 as well as cyber security</u></b> compatible BCU, Protective Relays
<b>4</b>	PLCC Panels	Conventional PLCC/FOTE panels (mounted in Control Room).
<b>5</b>	220kV Instrument Transformers	Conventional
<b>B</b>	<b>66kV System</b>	
<b>1</b>	66kV Circuit Breakers	Conventional SF6 Breaker
<b>2</b>	66kV Isolator	Motorized
<b>3</b>	66kV Control & Protection panel	Control & Protection panel (mounted in Yard Kiosk) with IEC 61850 <b><u>Edition 2 as well as cyber security</u></b> compatible BCPUs, Protective Relays
<b>4</b>	66kV Instrument Transformers	Conventional
<b>C</b>	<b>Auxiliary Equipments</b>	
<b>1</b>	Battery Charger	SCADA compatible
<b>2</b>	LT Panel Board	SCADA compatible
<b>3</b>	Transformer RTCC Panels	SCADA Compatible
<b>4</b>	Energy Meters	Conventional with Modbus Protocol

#### 4. Nos. of Bays

##### a) 220kV Switchyard

- Feeder Bay – **08** Nos.
- Transformer Bay 220/66kV HV – **03** Nos
- Bus Coupler Cum TBC Bay - **01** No.
- **Total bays for first phase – 12 Nos.**
- Future Bays – **00** No.
- **Total No. of Bays planned – 12 Nos.**
- **Bays to be connected to Bus Bar Protection in first phase - 12 Nos.**
- **Bus Bar Protection**
  - **Control Unit (Central Unit) - 24 Bays**
  - **Bay Units (Peripheral Unit) - 12 Nos. + 00 No (to be kept as spare)**

##### b) 66kV Switchyard

- Feeder Bay – **10** Nos + **01** Nos (Future Bay)
- Transformer Bay 220/66kV LV – **03** Nos
- Bus coupler Bay - **01** No.
- Station Transformer Bay – **01** No.
- Capacitor bank Bay – **00** No.
- **Total bays for first phase – 15 Nos.**
- Future Bays – **01** No.
- **Total No. of Bays planned – 16 Nos.**

##### c) 11kV Switchyard

- 66/11kV Station Transformer LV Bay – **01** No.

#### B) Main Substation (Master Control Centre)

- Main Substation (Master Control center) will be 220kV **Viramgam** Sub-Station located about @ 16 km away.
- **220kV Viramgam Substation** is conventional.

#### C) Automation

- 220kV System – Bay wise Bay Control Unit i.e. BCU and IEC61850 **Edition 2 as well as cyber security** compatible protective relays (IEDs) for protection as per protection philosophy.
- 66kV System – Bay wise IEC 61850 **Edition 2 as well as cyber security** compatible Bay Control & Protective relays (IEDs) i.e. BCPU for protection, control and monitoring as per protection philosophy.
- 11kV System – IEC 61850 **Edition 2 as well as cyber security** compatible Bay Control & Protective relays (IEDs) i.e. BCPU for protection, control and monitoring as per protection philosophy
- PLCC/FOTE BCU Panel for 220kV system. This panel will be connected to PLCC/FOTE panels through hardwiring whereas interface with respective Control & Protection panel through GOOSE.
- IEC61850 **Edition 2 as well as cyber security** compatible BCU / RTU having sufficient I/Os for station auxiliaries.
- IEC61850 **Edition 1 / Edition 2** compatible Transformer monitoring devices i.e. AVR, F.O. sensor for Hot spot temperature detection etc. (Integration of these devices with SCADA along with required accessories like LIU, FO cable, etc. are in bidder's scope.)
- Hard wiring of Instrument transformer's secondary to respective IEDs for Analogue inputs.
- Hard wiring of switchyard equipment's for Status and Command contacts to BCU for 220kV System and to BCPU for 66kV & 11kV System.
- Energy meters with Mod bus protocol shall be connected to F.O. network by using appropriate converter so as metering data shall be available to the dedicated computer (DAS metering PC).
- Metering data shall also be available to station HMI installed in SCADA room & in Master Control Centre (i.e. availability in Gateway), (SCADA compatible MFM or Transducers shall be provided for 66kV Bay if BCPU does not have sufficient analogue inputs to accommodate metering cores).

- Connection of all IEDs to Ethernet switches in star topology (Kiosk wise separate switch) whereas Gateway, DAS Computer, Station auxiliary BCU/RTU and other peripherals shall be connected to station level Ethernet switch.
- All switches shall be looped to form a ring via F.O. cable to have star-ring substation topology.
- Separate dedicated redundant F.O. network between Bus Bar Central unit and Peripheral unit.
- IEC 61850 **Edition 2 as well as cyber security** compatible intelligent Ethernet switches.
- Ethernet base 100Mbps LAN.
- All inter-bay interlocks through GOOSE messages by forming logics in IEDs.
- Provision of Remote Data transmission to Master Control Centre through GATEWAY which shall support IEC 61850 **Edition 2** and convert data to IEC60870-5-104 protocol for Remote control and monitoring.
- Remote data transmission to SLDC shall be through GATEWAY which shall support IEC 61850 **Edition 2** and convert data to IEC60870-5-104 protocol to match our existing RTU main system installed at SLDC Gotri. *(Integration of substation data to SLDC i.e. Database modification at SLDC will be done by GETCO, only coordination for data communication with SLDC is in bidder's scope).*
- Since Substation is to be controlled from Master Control Centre, Redundant HMI, DR work station and a laser jet printer at substation end as well as Redundant HMI for Control & Monitoring and one DR workstation along with Laser Jet printers for Master Control Centre shall be provided.
- Communication for remote control and monitoring shall be through OPGW.

#### D) Protection

Protection shall be as per Protection Philosophy given separately.

#### E) HMI Bay Views

- Voltage class wise SLDs.
- System architecture, NMS, Dynamic link failure monitoring.
- Bay wise dedicated HMI Bay views for each and every bay.
- Station auxiliaries, Bus bar scheme, Dedicated pop-up menus for LED, all troubles, etc.

**Note: - All the Relay/IEDs and Substations Automation System shall be;**

- ✓ **IEC 61850 Editions 2 compliant**
- ✓ **Cyber security (NERC CIP/ IEC 52351 / IEEE 1686 / IEC 62443) compliant.**