Network & Substations

HV SUBSTATION PROJECT

Speaker: SIMON BATTANI & NICOLAS CHIDIAC
Company: MATELEC
- ENGINEERING & CONTRACTING DIVISION HISTORY.

- ACTIVITIES PROCESS:
  - MANAGEMENT & PROCUREMENT.
  - PRIMARY & SECONDARY ENGINEERING.
  - CONSTRUCTION & ERECTION.
  - TESTING & COMMISSIONING.

- CASE STUDY FOR 400kV CHEFFIA S/S IN ALGERIA.
HV SUBSTATION PROJECT

ENGINEERING & CONTRACTING

DIVISION HISTORY
Established in 1987 for the realization of complex HV, MV and LV projects.

The Division starts with 5 engineers in the Construction of the Congress Palace 60/20kV S/S in Syria and the Rehabilitation of Jamhour & Bsalim 150kV S/S in Lebanon.

Kept growing up and making new challenge in working for new markets and different standards.

Nowadays, the division count more than 100 Engineers, works in more than 10 countries and have build around 60 Substations.
HV SUBSTATION PROJECT

ACHIEVED PROJECTS

Algeria: Construction of (13) 400, 220 & 60kV GIS & AIS S/S.
  Extension of (9) 220 & 60kV AIS S/S.

Nigeria: Construction of (2) 330 & 132kV AIS S/S.
  Extension of (1) 330/132kV AIS S/S.

Senegal: Construction of (1) 67.5MW Power Plant with 90/15kV AIS S/S.

Egypt: Construction of (1) 66/11kV GIS S/S.

KSA: Construction of (1) 34.5/13.8kV Indoor S/S.

Lebanon: Construction & Extension of more than (15) 220 & 66kV GIS & AIS S/S.
  Rehabilitation of more than (60) 66/15-11kV AIS S/S.

Syria: Construction of (10) 230 & 66kV GIS & AIS S/S.
  Extension of (2) 220/66kV GIS S/S.
HV SUBSTATION PROJECT

LEBANON MAIN PROJECT

Beirut Central District 220/66/20kV GIS S/S:
(4) 220kV U/G Cable, (3) TR 220/20kV 80MVA.
(4) 66kV U/G Cable, (2) TR 66/20kV 40MVA.
(5) 20kV Incoming, (62) 20kV O/G, (5) 20kV Coupler.

Client: Solidere
Consultant: Dar El Handasah
ARAMOUN 220/150/20kV GIS S/S:

(8) 220kV O/G Feeder, (2) TR 220/20kV 70MVA.
(2) 150kV O/G Feeder, (1) TR 220/150kV 100MVA.
(2) 20kV Incoming, (22) 20kV O/G, (1) 20kV Coupler.

Client: EDL
Consultant: EDF
GANMO 330/132/33kV AIS Breaker and a Half S/S:
- (4) 330kV Line,
- (2) Auto TR 330/132kV 150MVA.
- (2) 132kV Line,
- (2) TR 132/330kV 60MVA.
- (2) 33kV Incoming,
- (6) 33kV O/G.

Client: Niger Delta Power Holding
Consultant: STUCKY
HV SUBSTATION PROJECT

SYRIA MAIN PROJECT

BANIAS 230/66kV GIS S/S:
(9) 230kV Line, (6) 230kV Inc. Generator, (3) TR 230/66kV 125MVA
(8) 66kV Line, (3) 66kV Incoming, (1) 66kV Inc.
(3) 66kV Starting Transformer, (3)

Client: PEEGT
MEKKERA 60/10kV GIS S/S:

(5) 60kV U/G Cable, (3) TR 60/10kV 30MVA.

(4) 10kV Incoming, (24) 10kV O/G, (2) 10kV Coupler.

Client: SONELGAZ
MANAGEMENT & PROCUREMENT

- ENGINEERING & CONTRACTING DIVISION HISTORY.
- ACTIVITIES PROCESS
  - MANAGEMENT & PROCUREMENT.
  - PRIMARY & SECONDARY ENGINEERING.
  - CONSTRUCTION & ERECTION.
  - TESTING & COMMISSIONING.
- CASE STUDY FOR 400kV CHEFFIA S/S IN ALGERIA.
Very Important Work to Accomplish The Essential Goal:
Respect The Deadlines of all the Project Activities.

All these Activities (Design, Approval, Procurements, Construction, Erection, Testing & Commissioning, etc.) are Mentioned in Primavera Tables with the Starting & Finishing Days to Facilitate their Follow Up.
A Critical Activity to Respect The Budget of Each Order And To Stay Within the Overall Project Budget.

All the Purchase Order are Done in ERP Software which Automatically Compare the Sum of Each Order to the Correspondent Item Budget in the Main Contract.
Once the Equipments are Defined & Approved, Procurements Responsible Put the Order Using ERP Software.

They Check the Budget and Follow up the Suppliers to Respect the Deadline, Send the Filled Routine Test and to Prepare the Factory Acceptance Test in Manufacturer House.
HV SUBSTATION PROJECT

ACTIVITIES PROCESS

PRIMARY & SECONDARY ENGINEERING

- ENGINEERING & CONTRACTING DIVISION HISTORY.

- ACTIVITIES PROCESS
  - MANAGEMENT & PROCUREMENT.
  - PRIMARY & SECONDARY ENGINEERING.
  - CONSTRUCTION & ERECTION.
  - TESTING & COMMISSIONING.

- CASE STUDY FOR 400kV CHEFFIA S/S IN ALGERIA.
The Engineers of Matelec are Skilled & Experienced in Executing all the Necessary Activities to Design in House:

- **Different Types of New GIS & AIS Substations** (Single BB, Double BB, Ul type BB, Breaker and a Half, ...).
- **Extensions of Existing S/S Choosing Feasible & Optimized Solution to have Minimum Cut-Out Period with Respect to the Existing Status**.

**Engineers Mains Scope of Works:**

- **Primary & Secondary Engineering** (SLD, General Layout & Sections, Scada Architecture, Functional DWG, Grounding System, Design Criteria, Calculation Note, Auxiliary Services, Civil Guide, Gantries & Metallic Structure, ...etc),
- **Definition & Checking the Supplier Primary & Secondary Engineering (HV, MV & LV Equipments).**
- **Coordination with the Client & the Responsible of the other Activities (Management, Procurement, Construction & Erection, Testing & Commissioning).**

All the Engineering Activities are Done According to the International Standards, Client Requirements and to the Following ISO Design Chart.
Client requirements stated in the contractual references

Required Standards (IEC or ANSI,...)

Climatic and environmental Condition

System characteristics
  Particular of System
  Insulation level
  Creepage distances
  Clearances in Air
SLD 66kV UI Type
CONSTRUCTION & ERECTION

- ENGINEERING & CONTRACTING DIVISION HISTORY.
- ACTIVITIES PROCESS
  - MANAGEMENT & PROCUREMENT.
  - PRIMARY & SECONDARY ENGINEERING.
  - CONSTRUCTION & ERECTION.
  - TESTING & COMMISSIONING.
- CASE STUDY FOR 400kV CHEFFIA S/S IN ALGERIA.
For our turnkey projects, our qualified subcontractors partners are handling the construction and erection works under Matelec team supervision.

Matelec site manager and supervisors are daily present to follow up the site work progress and to assure the best quality of work.

Matelec supervisors liaise with the client representatives by conducting regular meetings to discuss the work progress and solve arising problems.

Matelec specialists handle the site quality control as well as the safety rules and regulations.
Full coordination between the engineering Department and the Site

Upon drawings approval, a complete file including documents and drawings is prepared by the engineering department and sent to site for constructions and erection phase

The engineering department is always ready to find a solution for unexpected technical inconvenience and arising site problems

A regular progress report is prepared by the site supervision to follow up and update the site planning
**HV SUBSTATION PROJECT**

**ACTIVITIES PROCESS**

**TESTING & COMMISSIONING**

- Engineering & Contracting Division History
- Activities Process
  - Management & Procurement.
  - Primary & Secondary Engineering.
  - Construction & Erection.
  - Testing & Commissioning.
- Case Study for 400kV Cheffia S/S in Algeria.

---

28
For Every Substation, a Testing Engineer from Matelec is Dedicated to Manage the Testing & Commissioning Activities of the S/S. He Performs Several Tests (Functional Test, CT/VT Test, CB/DS/ES Test, .....etc) & Prepares the Filled Site Test Documents for the Client.

He is Supported by Matelec Specialists for the Testing of Certain Equipments (Protection Relays Setting, Scada System, Fault Recorder, Telecom, ....etc) and in some case Supplier Specialist Perform the Testing & Commissioning of their Equipments for example GIS Equipments.

All the Tests are Done According to Protocols Prepared in Matelec House with Respect to the Relevant International Standard, Manufacturer Recommendations & Client Requirement. They are Completely or Partially Witnessed by the Client.
LIST & EXAMPLE OF PROTOCOLS

- HV, MV & LV Equipments Test (Power & Aux. Transformer, CB, DS, ES, CT, VT, SA, LT, Charger, Battery, Diesel Group, ...).

- Functional Test (Line, Transf, Coupler, ..).

- Panels Test (AC, DC, Common, Busbar Prot., Fault & Event Recorder, Telecom, ...).

- System Test (Scada, Transformer Monitoring on Line, Metering, ...).

- HV, MV & LV Cables Test.

- Control, Prot. & Metering Relays Test.

- Details Procedure for Testing & Commissioning in Case of S/S Extension.
HV SUBSTATION PROJECT

Multi Function System for Current, Voltage & Power Transformers Tests.

Circuit Breaker Analyzer and Micro Ohmmeter.


TESTING EQUIPMENTS

T 3000 (ISA-Italy)

CPC 100 (Omicron)

CBA – 1000 (ISA-Italy)

CMC 256 (Omicron)

DRT-6 (ISA-Italy)
CASE STUDY
CHEFFIA S/S
400/220/31.5kV
- ALGERIA -

- ENGINEERING & CONTRACTING DIVISION HISTORY.
- ACTIVITIES PROCESS
  - MANAGEMENT & PROCUREMENT.
  - PRIMARY & SECONDARY ENGINEERING.
  - CONSTRUCTION & ERECTION.
  - TESTING & COMMISSIONING.

- CASE STUDY FOR 400kV CHEFFIA S/S IN ALGERIA.
HV SUBSTATION PROJECT

LOCATION & IMPORTANCE

400kV Network in Algeria

400kV Power Plant

400kV Substation

400kV Line

CENTRALE DE KOUDIET EDDRAOUCHE (3X400 MW)

VERS DJENDOUBA (TUNISIE)

400kV Power Plant

400kV Substation

400kV Line
400kV SLD

1 Double Bus Bar 5000A, 40kA
3 Incoming 400kV
2 Line 400kV
1 International Line 400kV
3 AutoTransf 400/220/31.5kV-300MVA
1 Coupler 400kV
HV SUBSTATION PROJECT

SUBSTATION COMPOSITION

220kV SLD

1 Double Bus Bar 4000A, 31.5kA
3 Incoming Auto TR 220kV
4 Line 220kV
1 Coupler 220kV

POWERING ENERGY
SUBSTATION GENERAL LAYOUT

- 400 meters
- 300 meters
- 400kV S/S
- 400kV ATR
- 400kV L.K.
- 220kV L.K.
- 220kV S/S
- Control Building
400kV LAYOUT & SECTIONS

150 m.

- L.K.
- ATR 400/220kV & 220kV SA
- SA, CT, ES, CB & ES of ATR
- Busbar 1 & 2 and BDS 1 & BDS 2
- ES, CB, ES, CT, DS/ES, LT, CVT, & SA of Line

ATR 400/220kV

Line 400kV

30 m.

21 m.

21 m.
2 Operators
Industrial PCs

1 Engineering PC

2 Central Units Redundant
Hot-Standby Configuration

Ethernet Switches
(61850)

GPS for Network Synchronizing

Fall Back Switch for Master Connection

To 220kV Loop
To 400kV Loop

Armoire unité centrale 1
Armoire unité centrale 2
From 400kV
SCADA Loop
Case of 400kV Int. Line - Jendouba

Control & Metering Relays (1 panel +S1):

Bay Unit REC670 (ABB)
- SynchroSwitch L183 (ABB)
- 2 Meters Cl 0.2 A1800 (Elster)

Protection Relays (2 panels +R1 & +R2):

Panel +R1:
- Main 1 Distance Prot. REL670 (ABB)
- Main 2 Distance Prot. D60 (GE)
- Breaker Failure 7VK611 (Siemens)
- Autorecloser REC670 (ABB)
- Directional E/F 7SJ621(Siemens)

Panel +R2:
- Directional Active Power F60 (GE)
- Frequency Relay F35 (GE)
- Decoupling Relay DRS-N1 (ICE)
HV SUBSTATION PROJECT

Case of 400/220/31.5kV AutoTransfo

Control & Metering Relays (1 panel +S1):

Bay Unit REC670 (ABB)
SynchroSwitch T183 (ABB)

Protection Relays (2 panels +R1 & +R2):

Panel +R1:

- Main 1 TR Differential RET670 (ABB)
- Main 2 TR Differential T60 (GE)
- Breaker Failure 7VK611 (Siemens)
- 400kV O/C Prot. REJ523 (ABB)

Panel +R2:

- 220 & 31.5kV O/C Prot. REJ523 (ABB)
- Overload Prot. REX521 (ABB)
- E/F Prot. REJ521 (ABB)
- Lockout Relay HAS (GE)
WHY MATELEC?
Working with MATELEC for HV Substation Turnkey Projects, means choosing the following Advantages & Benefits:

- Skilled & Experienced Teams in all the Activities.
- Respect & Adoption of Client Standards & Requests.
- Willpower not to Exceed the Deadlines and to Accomplish a High Quality Projects.
- An Effective & Quick After Sale Services.
- Partnership with the Client.
QUESTIONS SESSION