



Power Transformation Projects (330/132/33 kV Substations)

Introduction

A Power System consists of Substations (power transformation stations comprising Power Transformers, Circuit Breakers, etc.) linked by transmission lines for wheeling power from power plants into the National Grid. The latter interconnects all the Power Stations, Substations and Transmission lines.

The highest grid voltage in Nigeria for now is 330kV. The generator terminal voltage at the power station is mostly 11kV or 16kV. This is fed into a step - up power transformer at the power station site, to give an output of 330kV which is then fed into substation bus bar nearest to the power station. From the bus bar, lines radiate at the same 330kV level to other distant substations of the grid after synchronization conditions are met. Voltage step down transformation then goes on at the distant substations (load centers). This is normally at 330/132/33kV transformation levels. Some long distance power transmission is done at 132kV level. The power transformation system under the NIPP consists of over 30Nos. 330/132kV substations, and about 31 Nos. 132/33kV substations including new constructions, and rehabilitations/expansions.

The Power Transformation Projects were conceived to aid the evacuation of the power generated at the power stations. O.T. Otis Engineering with LI, is the Design and Project Management consultant that carried out the Basic Engineering Design for the NIPP Power transformation Projects (330 kV and 132 kV substations), and has been managing the implementation of the projects.

Costing and Preparation of Estimates

Prior to the preparation of the cost estimates for the project, we carry out market surveys locally and internationally to determine cost, availability and quality of the materials intended for use on the project. Thereafter, the Engineer's estimate for the project is generated using the an earlier designed Single Line Diagram (SLD). The latter showing the required diameters (in coming/out going lines), transformers, reactor feeders, instrument transformers and the necessary switch gears. This is used as a guide for the selection of the intending EPC Contractors.



Transformation Substation under construction

Equipment Specification:

The specification of substation equipment is meticulously undertaken to conform with the IEC Standards. These technical specifications are published in the Request for Proposal (RfP) documents, to serve as a reference to the implementing contractors.

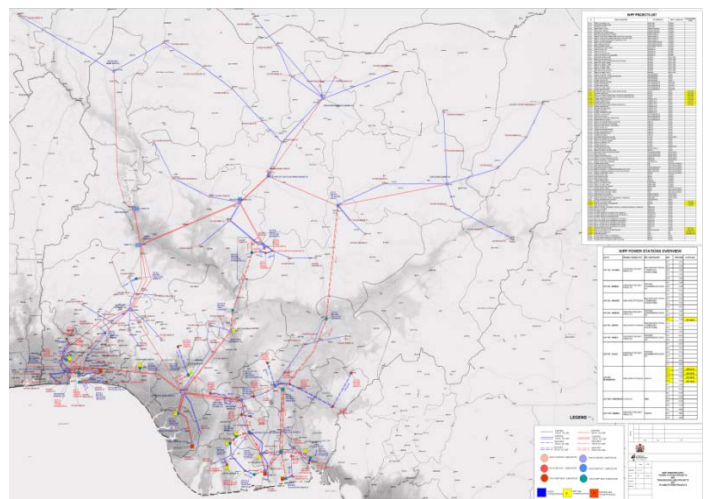


Abakaliki S S showing area for extension works for Ikom 132kV TL bays/equipment

Project Scoping:

After determining the power to be evacuated, we specify the capacities of the substations to match the power slated for evacuation. This includes the determination of the voltage levels, capacities of the power transformers, the associated switchgear and the configuration of the switch yard equipment.

Map of NIPP Transmission projects (Lines and Substations)





Management of Project Tendering:

O.T. Otis Engineering assists the Client to prepare the tender documents required for the bidding exercise which contain the relevant information for the bid, including standard letter of invitation, conditions of contract, terms of reference, standard forms of contract, technical specifications and requirements, bid submittals.

Tender Evaluation

We assist the client to evaluate received tenders. Our adjudication procedures are based on FIDIC guidelines, and Nigeria's Public Procurement Laws and regulations. The criteria for scoring are included in the Request for Proposals



60mva, 132/34.5kv power transformer for Obudu substation



Earthing transformer installation operation for Jos S/S

NIPP Power Transformation Projects Summary

1. Capacity 330/132kv	5,590MVA
2. Capacity 132/33kv	3,313MVA
3. Number of 330kv Substations	20
4. Number of 132kv Substations	9
5. Total Number of 330kv Ext	12
6. Total number of 132kv Ext	22

330/132kv Substation Projects Being Supervised by Otis

- Lot 1- 330/132/33KV Makurdi SS (New), 330/132KV Jos SS
- Lot 2 – 330/132KV S/S Ext. At New Haven (N)
- Lot 3 –330KV Ugwuaji (New Haven S.) S/S (NEW);
- Lot 4 –330KV Ikot Ekpene S/S;
- Lot 5 – 330/132/33KV IKOT ABASI S/S (new);
- Lot 6 – 330/132/33KV OMOKU S/S
- Lot 7 –132KV ALAUSA S/S (LINE BAY EXT.);
- Lot 8 – 132/33V AGBOR S/S (NEW),132/33KV ASABA S/S (NEW)132/33KV BENIN NORTH S/S (NEW) ;
- Lot 9 – 330/132/33KV GANMO S/S (NEW) 132/33KV GANMO TO S/S (NEW);
- Lot 10 – S/S Extension at Mando, Katampe, Kubotso & Abuja;
- Lot 11 – S/S Extensions at Ikeja West, Oworonsoki ,Agbara & Ojo;
- Lot 12 – Telecommunications for the whole projects;
- Lot 13 – New S/S & Extension at AJA, ALAGBON & LEKKI;
- Lot 14 – 132/33KV NEW ABEOKUTA S/S (NEW), 132/33KV OLD ABEOKUTA S/S (NEW);
- Lot 15 – 330/132/33KV GWAGWALADA S/S (NEW);
- Lot 16 – 330/132/33KV OKE ARO S/S (EXT.);
- Lot 17 – 330/132/33KV ONNE (PORT HARCOURT) S/S (NEW), 330KV Afam S/S (Ext);
- Lot 19 – 132/33KV OKADA S/S (NEW), 132KV BENIN NORTH S/S (LINE BAY EXT.);
- Lot 20 – 132/33KV IKOM S/S (NEW), 132KV ABAKALIKI S/S (EXT.),132KV NKALAGU S/S (EXT.);
- Lot 21 – 132/33KV NSUKKA S/S (NEW), 330/132/33KV NEW HAVEN NORTH S/S(EXT.);
- 23 – Ihiala 132 kv S/S
- Lot 25 Calabar 330KV S/S – Calabar 132 KV S/S
- Lot 27 - Rehabilitation/Extension of Sapele Switch - Yard



A Circuit Breaker at a Substation

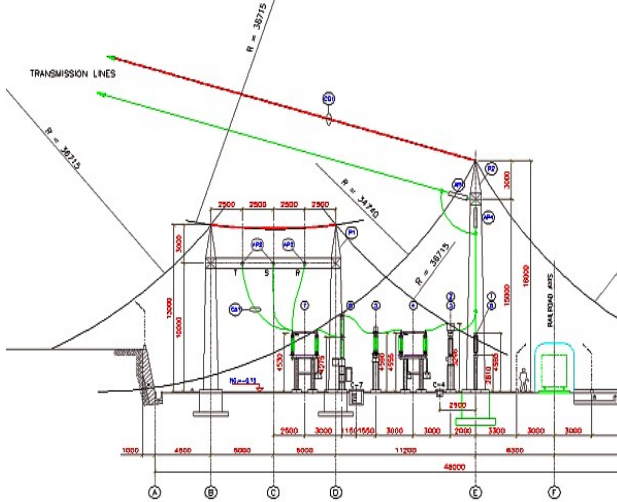
Power Transformation Substations

Three types of substations are being built all over the country: Air Insulated Switchgear (AIS), Gas Insulated Switchgear (GIS) and Mobile Substations. Majority of the substation are AIS except for 330/132kv Aja SS, 132/33kv Orlu and 132/33kv Abuja Central Area SS which are GIS .



Air Insulated Substation

Most 330kV and 132kV substations are outdoor Air Insulated substations (AIS) because of land availability and low cost of installation. In future the extension of the substation installation is easier.



Schematic Diagram for a 132/33kV SS



132/33kV Mando SS Commissioned

Supervision and Management of the Projects

O.T. Otis Engineering supervises the work of the Project Consultants as well as the Engineering, Procurement and Construction contractors. We monitor the project execution progress through periodic site visitations and the progress reports received from the field. This forms the basis for the vetting of invoices submitted by the EPC contractors and the Project Consultants. The supervision is also to ensure that the projects are delivered on time and in accordance with the technical specifications contained in the Request for Proposal.

We are committed to our Client by rendering technical advice and contract management services all through the faces of the project. Among the projects under our supervision about 50% are commissioned, 20% at the verge of commissioning others ongoing

Gas Insulated Substation (GIS)

In densely populated cities the major constraint for siting substation is land. We normally specify and recommend GIS to boost power supply in urban areas because of its compressed features

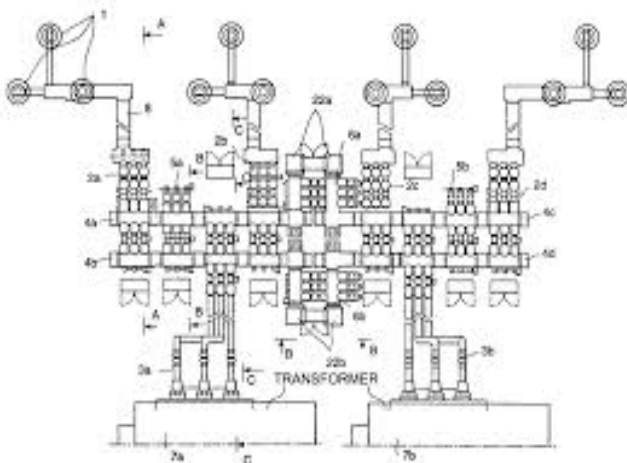


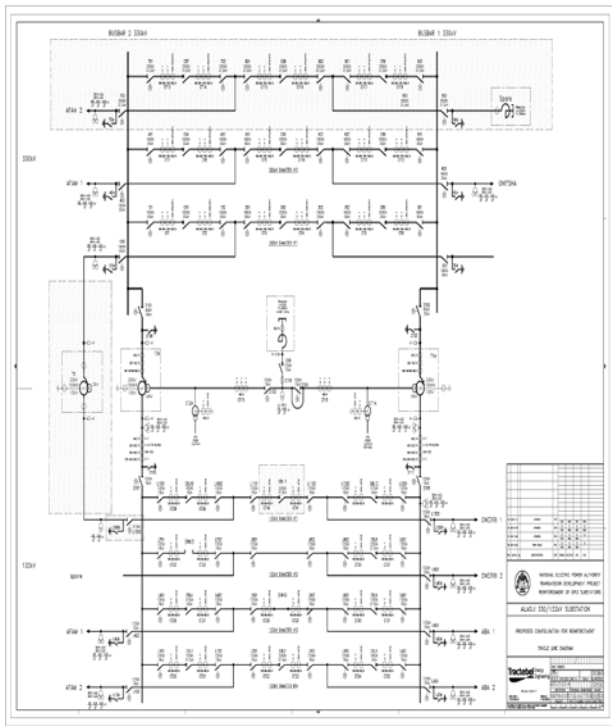
132/33 Kv GIS Extension at Central Area, Abuja – Completed and Commissioned.



Factory Acceptance Test for 150MAV at Crompton Greaves, India

Configuration of a 132/33kV GIS





Typical Power Transformation Single Line Diagram



132/33kV Control Panels



A 132/33kV SS Undergoing Pre-commissioning Test/Checks

Project Reporting

As part of reporting function, we arrange regular co-ordination and design meetings to facilitate:

- ❖ Information exchange between parties;
- ❖ Co-ordination of interfaces between the various lots;
- ❖ Overcoming difficulties pertaining to design;
- ❖ Exchanging information pertaining to design and construction;
- ❖ Co-ordination of the status of development with the overall time schedule;
- ❖ Initiation of further schedules if necessary;
- ❖ Monitoring of overall progress;
- ❖ Evaluation and control of all financial matters; and,



150 MVA 330/132/33 Kv Transformer reinforcement at Katampe, Abuja – Completed and Commissioned



A 300 MVA Transformer for NIPP Project

Joint Consultant: Lahmeyer International (LI)

About Us



O.T. OTIS Engineering is an indigenous Nigerian company with its Head Office at N0 30/23, Olu Agabi Close, Cadastral Zone CO2, Gwarinpa 1, Abuja, and branch offices in Warri, Benin, Calabar, Omoku, Yenogoa, and Katsina. It is a multi-disciplinary consultancy company primarily established to provide Engineering Services/Support in the energy, industrial and allied sectors of the Nigerian economy with particular emphasis on Consultancy Services and Project Management, Cost Engineering, Operation and Maintenance of Electro-Mechanical Equipment. **OTIS Engineering** has successfully completed projects in virtually all the facets of the Industrial sector in Nigeria from Machine Tools/Metal Working through Iron and Steel to Automotive Manufacture, Petroleum Refining and Petrochemicals, Electric Power to Pulp and Paper, in over 25 years of existence.

