



O. T. OTIS ENGINEERING

MANAGING SMART GRID COMMUNICATION NETWORKS

Introduction

O. T. Otis Engineering with her partner (LI), is the joint Project Consultant to the Nigeria Delta Power Holding Company of Nigeria (NDPHC) for the provision and expansion of smart grid communication network of the national grid as part of the National Integrated Power Projects (NIPP). The objective of this project is to achieve /upgrade teleprotection, voice and data communication, and other smart grid applications in high voltage facilities. Smart grid refers to an electricity grid whose applications are managed by advanced information technology over an integrated reliable and secured communication network.



SELTA Synchronous Digital Hierarchy (SDH) Equipment

Scope

The communication network interconnects high voltage facilities nationwide using fiber in the form of Optical Ground Wire (OPGW) and Power Line Carrier (PLC) media, integrates and provides traditional smart grid applications namely teleprotection, enterprise voice/ data services and broadband access for the operation of the high voltage facilities.

OTIS was tasked with providing an integrated consultancy encompassing pre-qualification and evaluation services; verification and approval of design and equipment ; factory acceptance tests of equipment; monitoring and supervising works; technical support to contractors, provision of progress reports; pre-commissioning and commissioning.



Wavetraps at a Transmission Substation

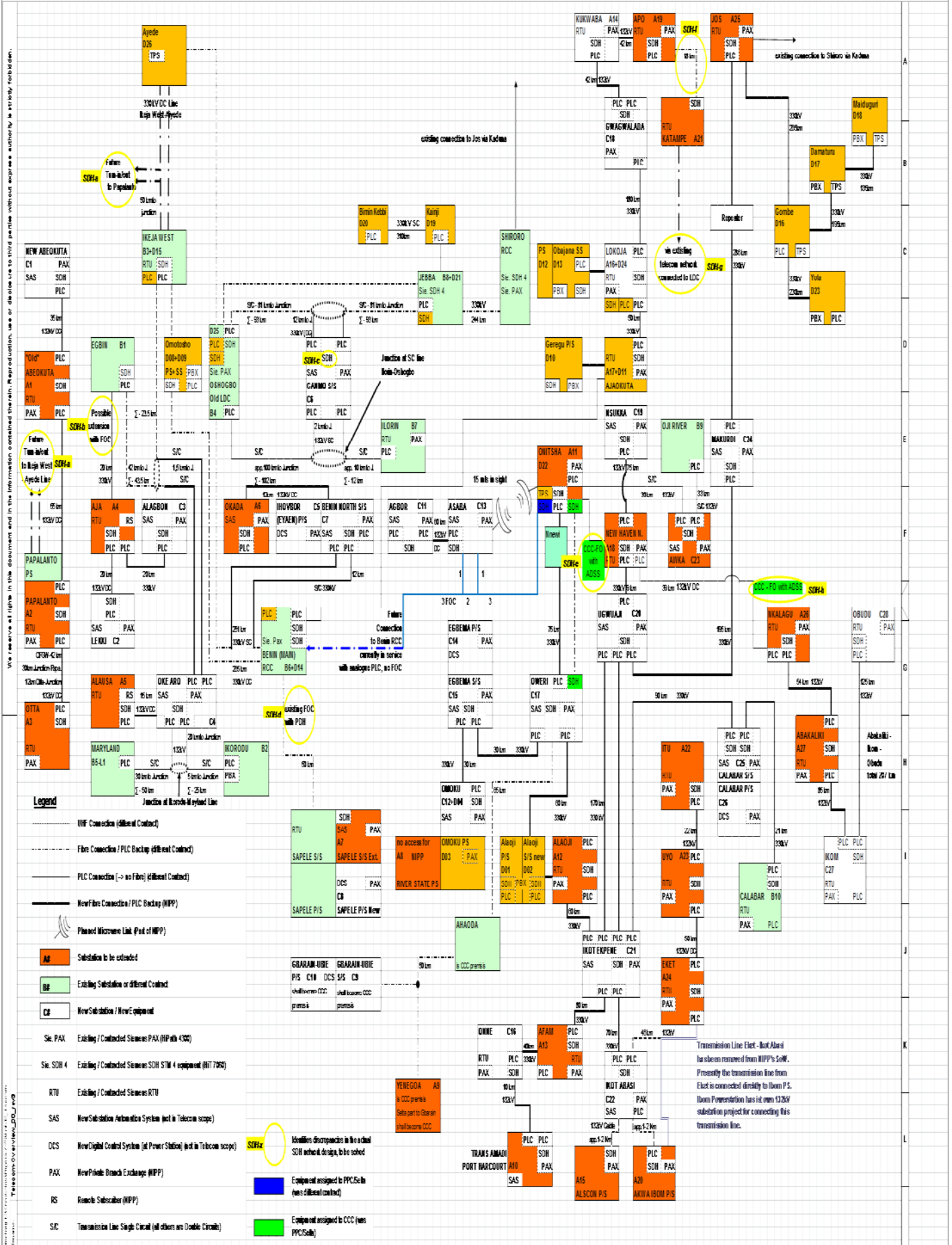
Services Rendered by O.T. Otis

- Support in preparing Project Schedules, work programmes and review and analysis of same.
- Co-ordination of activities between the Telecommunications/Teleprotection contractor and the PCs/EPCCs of Transmission Lots and Power Station Lots, especially on points of interfaces.
- Direct supervision of installation of Telecommunications/Teleprotection equipment.
- Preparation of proposals or measures to overcome situation of unsatisfactory progress of works
- Supervision and continuous monitoring of the EPC Contractor's work programme and progress, quality of work, site safety, equipment/materials order and deliveries, environmental issues etc, in order to ensure compliance with the approved design and contract documents, as well as recognised standards and regulations
- Management of issues of variation orders and change orders, regarding the quantities of the work and the period of completion of the works after obtaining the approval of the Employer
- Preparation of a Quality Assurance Manual for the particular sub project, including the control and inspection plans and procedure.
- Enforcement of contractual provisions, especially those related to guarantees, performance bond, insurance and claims.
- Continuous monitoring of project cash-flow in relation to the planned activities
- Review and recommend approval of interim and final payments to the EPC Contractor; including the final account
- Maintenance and updating of financial records of payments and costs.
- Preparation and realisation of design meetings with the Contractor to supervise the progress and the results of the design;
- Inspection of works requirements, specifications and the EPC contractor's approved drawings;
- Monitoring of the status of all design submissions against the Programme under the form of compliance with the Specifications and with the National legislation and standards;
- Timely review and approval/disapproval of Design Documentation under the form of Design and Documentation Reports;



SELTA Teleprotection Equipment

Network Architecture



| | | | | | | | | | | | | | | | | | |
|---------------------|--|--|--|---|--|---|--|-------------------------|--|-----------------------------------|--|-----------------------------------|--|----------------------------------|--|---------------------|--|
| A Scope and Address | | | | E | | I | | Prepared: 16.10.2011 JS | | NATIONAL INTEGRATED POWER PROJECT | | NIGER DELTA POWER HOLDING COMPANY | | Telecommunication Infrastructure | | Formal: R2 | |
| B Scope and Address | | | | F | | J | | Checked: 16.10.2011 JS | | NIPP | | NIGER DELTA POWER HOLDING COMPANY | | General Overview | | Drawing No: | |
| C Scope and Address | | | | G | | K | | Released: 16.10.2011 JS | | MPP | | NIGER DELTA POWER HOLDING COMPANY | | MPP LOT-42 | | Telecom-Overview_M1 | |
| D Scope and Address | | | | H | | L | | | | Project No: ZIC04 | | NIGER DELTA POWER HOLDING COMPANY | | MPP LOT-42 | | Sheet 1 of 1 | |

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Description of Station Services

O.T. Otis manages the implementation of the NIPP transmission network means for three logic sub-networks:

Data Tele-control network: the final elements of the tele-control network are RTU and SAS. They are the "Slave" elements that must be reached by the Master interrogation and must answer to the Master.

Tele -protection network: each Tele-protection device controls its own Power Line and it has connection to another Tele-protection in the other side of the Power Line.

Speech network: the final elements are the subscribers and digital phones that must be connected to the entire phone network.

The primary transmission way comprises fibre optic backbone, while power line carrier links constitute point to point back-up line thereby providing complete redundancy which guarantees protection of the services.

Main Architectural Elements of the NIPP Transmission Network:

Transport SDH: METROPOLIS;

Access SDH: SAFN-S;

Power Line Carrier: STE-D;

Tele-protection Equipment: TPS-NU;

Telephone Exchange (PBX): [S@EIPX](#) with digital and analogue phones (alternatively PBX type SAM 4000E.

Repeater for optical signal regeneration along transmission paths.

Microwave link

VSAT

Others are broadband fibre media as OPGW and power line (electric conductors).

Every station realizes many "Virtual Service Path": "interrogation/answer" paths between Slave and Master. They allow the communication in speech network (e.g. the connection of the phone to the telephone network), in the tele-protection network (e.g. the transmission of the command under reliability and security), in the tele-control network, (e.g. between the SCADA and RTU Slave).

The following Acceptance Tests are carried in order to ascertain the compliance of the equipment with specifications:

Speech test

Data test

Teleprotection test

Transport SDH test

Transport and Access SDH synchronization test

Stations Being Jointly Supervised by O.T. Otis for Communications/Teleprotection Links

| | |
|--------------------------------------|-------------------------|
| 1 Afam SS | 50 Lekki S/S |
| 2 Akwa-Ibom PS | 51 Erukan S/S |
| 3 Alaoji SS | 52 Abakiliki SS |
| 4 Alscon PS | 53 Agbo SS |
| 5 Calabar PHCN SS | 54 Asaba SS |
| 6 Calabar SS | 55 Awka SS |
| 7 Calabar PS | 56 Benin Main |
| 8 Eket S/S | 57 Benin North SS |
| 9 Egbema SS | 58 Ihovbor PS |
| 10 Egbema PS | 59 Nkalagu S/S |
| 11 Ikom S/S | 60 Nsukka S/S |
| 12 Ikot Abasi SS | 61 Oji River SS |
| 13 Ikot Ekpene S/S | 62 Okada SS |
| 14 Itu S/S | 63 Onitsha SS |
| 15 Gbarain SS | 64 Sapele SS |
| 16 Gbarain PS | 65 Sapele PS |
| 17 New Haven North S/S | 66 Obajana P/S |
| 18 Obudu S/S | 67 Obajana S/S |
| 19 Omoku PS (Rivers State) | 68 Gombe S/S |
| 20 Omoku SS | 69 Damaturu S/S |
| 21 Onne SS | 70 Maiduguri S/S |
| 22 Owerri SS | 71 Kainji S/S |
| 23 Trans-Amadi SS | 72 Birnin Kebbi S/S |
| 24 Ugwuaji S/S | 73 Yola S/S |
| 25 Uyo S/S | 74 Ayede S/S |
| 26 Yenegoa S/S | 75 Geregu PS |
| 27 Ajaokuta SS | 76 Alaoji PS |
| 28 Apo S/S | 77 Olorunsogo PS |
| 29 Ganmo S/S | 78 Olorunsogo 330Kv S/S |
| 30 Gwagwalada S/S | 79 Olorunsogo 132Kv S/S |
| 31 Ilorin SS | 80 Omotosho PS |
| 32 Jebba SS | 81 Omotosho S/S |
| 34 Jos S/S | 82 Alaoji S/S |
| 34 Katampe S/S | |
| 36 Lokoja S/S | |
| 37 Makurdi S/S T/L | |
| 38 Oshogbo S/S 1 BENIN - SAPELE OPGW | |
| 39 Egbin S/S | |
| 40 Otta S/S | |
| 41 Papalanto S/S | |
| 42 Old Abeokuta S/S | |
| 43 New Abeokuta S/S | |
| 44 Alausa S/S | |
| 45 Ikorodu S/S | |
| 46 Ikeja West S/S | |
| 47 Mary Land S/S | |

SUMMARY

13 NO POWER STATIONS
69 NO SUBSTATIONS
1 NO T/L (OPGW)

Equipment Deployed:

- ❖SDH (Fibre Optic Terminal Unit) - 66No
- ❖Teleprotection Signalling Equipment - 221 No
- ❖Power Line Carrier Equipment - 369 No
- ❖Line Matching Units - 391 No
- ❖Private Automated Branch Exchange - 62 No

Joint Consultant: Lahmeyer International (LI)



O. T. OTIS ENGINEERING

HEADQUARTERS OF O.T. OTIS ENGINEERING



O.T. OTIS Engineering is an indigenous Nigerian company with its Head Office at NO 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.