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## MANAGING POWER GENERATION EQUIPMENT PROCUREMENT

### Introduction:

Generation Projects in NIPP are divided into EPC (Engineering, Procurement and Construction) contracts and OEM (Original Equipment Manufacture) contracts. The major equipment of a gas turbine power plant include the Gas Turbine, Generators and other auxiliary equipments. The original equipment manufacturer supplies the power generation equipment and provides technical services in support of installation and maintenance of such equipment. During Stage 1 of NIPP, the client procured these critical generation equipment directly from the OEM. This was done to ensure uniformity in brands, enforcement of standards, and savings from economy of scale. These OEM equipments were free - issued to the EPC contractors for erection at the respective Power Stations. OTIS is the Joint Project Consultant that engineered and managed the procurement of these generation equipment from the OEM contractors. We managed the processes ranging from design to manufacture, shipment, inland transportation and eventual deployment to various power generation project sites



Mark 6 Turbine Control Compartment

### Services Rendered by Otis Engineering

OTIS carries out specialized services as the Joint Project Consultant for the supervision of OEM (Original Equipment Manufacture) contracts. The services are geared towards ensuring that the imported gas turbines and associated equipment are erected, installed, commissioned and fired to meet quality requirements. The Equipment Manufacturer is General Electric of the United States of America.

Some of the services for the implementation of the OEM contract for the Gas Turbines, Generators and Generator Transformers include:

- Support and assist in the implementation of the gas turbine maintenance Long Term Service Agreement (LTSA)
- Support in the technical advisory services of the OEM to the client.
- Defining of the interfaces and the co-ordination of the respective limits of supply between the OEM and EPC Contracts.
- Designations of Responsibilities (DOR) between OEM, EPC and Project Consultant
- Monitoring, assessing and reporting of the overall work progress of all Sites and extended scope of work to the Client.



Air Processing Unit (APU) System

- Negotiating and supervising of both the LTSA and the In-Country Maintenance facility, which will be installed by the Gas Turbine OEM Contractor.
- Monitoring of interfaces during design audit and erection/commissioning phases.
- Monitoring defect liability periods for each installed equipment by the OEM contractor.
- Monitoring Assessments carried out by the OEM contractor for the installed equipment.
- Organise project meetings
- Support in identification and monitoring of failed parts at the site.
- Supervise the procurement of failed parts during commissioning and grid supply operations at the sites to meet quality, time and standard.
- Supervise the procurement process to meet client standard.
- Supervise the TDI (Technical Direction and Installation) of the OEM contractor.
- Monitor the Assessments carried out on the installed equipment before commercial operation.
- Supervise and Monitor performance tests carried out on installed equipment by the original equipment manufacturer.

## How The Gas Turbine Works

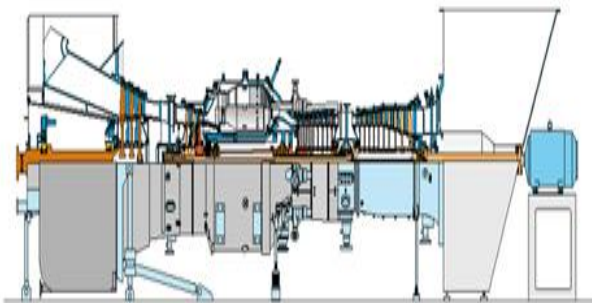
A turbine is a wheel that absorbs kinetic energy from a fluid stream. Water, steam, air are some types of the fluids.

Gas turbine engines are, theoretically, quite simple. GTs have 3 parts:

- ❖ A compressor to compress the incoming air to high pressure.
- ❖ A combustion area to burn the fuel and produce high pressure, high velocity gas.
- ❖ A turbine to extract the energy from the high pressure, high velocity gas flowing from the combustion chamber.

Additionally the gas turbine will have these parts:

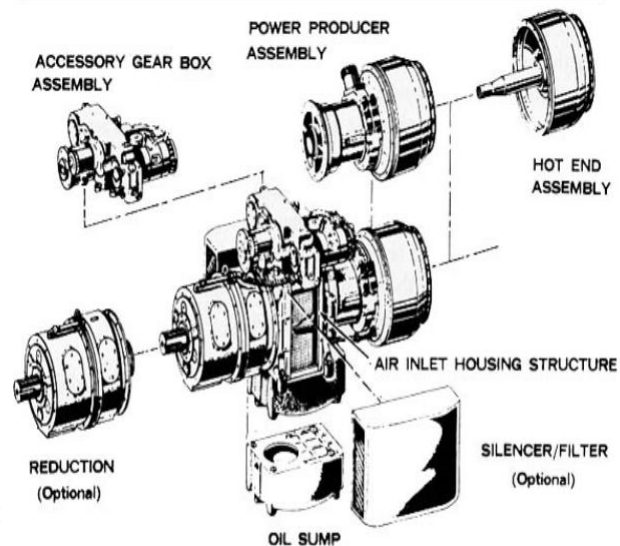
- An accessory drive gear box, to drive various pumps for fuel, water and oil.
- A reduction gear box, to reduce the high revolutions of the turbine to a more efficient speed for the propeller.



A Gas Turbine



Generator Step Up Transformer (GSUT) at Egbema



The Parts of a Gas Turbine

## Technical Advisory Services

OTIS acts as an independent consultant in all technical aspects related to the project pools as well as to assist and advise on general technical, managerial and financial matters. This involves recommending on and/or analysing of and/or evaluating of all technical issues according to new utilities and further maintenance of the equipment.

These duties can be summarised as follows:

- a) Assist and advise the client in all technical aspects of the procurement project;
- b) Support the client in the technical interfaces with third parties.
- c) Prepare engineer's cost estimates for variation orders,
- d) Support and assist in the implementation of the GT maintenance contracts (LTSA);
- e) Support and assist in workshop inspections, factory acceptance tests and performance tests;
- f) Monitor the conformity with general specifications, design fundamentals and local regulations;
- g) Assist in the assessment of current overall project status.



Inspection of LTSA Parts at Egbema PS



### **Long Term Service Agreements (LTSA)**

OTIS is the joint Consultant on the Long Term Service Agreement contract which covers 18 gas turbines across 5 Power Stations. The agreement becomes effective at the Commercial Operation date of any of the 18 gas turbines and terminates on the date upon which the unit has reached its performance end date. In managing the LTSA agreement, we ensure:

- That the planned maintenance is done in accordance with the contract
- That the contractor provides parts and services necessary for the planned maintenance of the covered unit.
- That the contractor performs necessary conversions, modifications and upgrades
- That combustion inspection and major inspection are done at the contracted fired hours of the unit.



**Inspection of Turbine Compartment**



**Rust on Spray Pipe - Discovered during boroscope Inspection**



**Inspection of Turbine Casing in Progress**

### **Condition assessment of the Gas Turbines**

As a result of long storage of the gas turbines and ancillary equipment, it was necessary to ascertain their condition before installation. The extent of compliance with prescribed mode of preservation of the equipment was determined. Thereafter, we prescribed the methodology for a condition assessment of the equipment, which include:  
Physical Inspection  
Boroscope Inspection

#### **Physical Inspection**

A through physical inspection of the Gas Turbines was carried out according to the OTIS Procedure 2-9749, (Procedures for Inspection of Mechanical Parts). The physical condition of the equipment was determined by visual inspection. Evidence of paint damage, corrosion, accumulation of debris, and ingress of water were checked. The condition of externally visible cables was determined.

The physical inspection was meant to determine the condition of external parts of the equipment. In order to ascertain the condition of enclosed parts, boroscope inspection was carried out



**Major Inspection at Ihovbor Power Station**

#### **Boroscope Inspection**

The boroscope inspection is a methodology that utilizes a video probe to check the internal conditions of an encased equipment. OTIS and her JV partner (LI) supervised the boroscope inspection on 18 Gas turbines. A 6mX6.1mm flexible videoscope was utilised for the examination. Color images were captured and the conditions of internal areas were highlighted.

The inspection ascertained the condition of each unit with respect to

- Presence of deposits
- Foreign Object Damage(FOD) .

OTIS supervised the corrective measures that were taken following the result of the boroscope inspection

**Associated Consultant: Lahmeyer International (LI)**



Corporate Headquarters of O.T. otis Engineering



**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 industrial, energy 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.