AMET UNIVERSITY

(Deemed to be University Under Section 3 of UGC Act 1956)

Student Internship

A Sample Internship Report of the Programme, B.E-Electrical and Computer Engineering is given below

NLC INDIA LIMITED

("NAVRATNA" – A GOVERNMENT OF INDIA ENTERPRISE)

NEYVELI – 607 801, TAMIL NADU

INTERNSHIP REPORT ON

A STUDY OF TRANSMISSION AND DISTRIBUTION OF POWER FROM 230/400 KV SWITCH YARD.

SUBMITTED BY

MARIA ROSHAN M

B.E., ELECTRICAL AND COMPUTER ENGINEERING

ACADEMY OF MARITIME EDUCATION AND TRAINING

CHENNAI-603112

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
ACADEMY OF MARITIME EDUCATION AND TRAINING (AMET)

(Declare as Deemed to be University u/s 3 of UGC Act 1956)

135, EAST COAST ROAD, KANATHUR, CHENNAI - 603 112. TAMILNADU, INDIA

CERTIFICATE

This is to certify that the "**Internship report**" submitted by **Maria Roshan Regd. No.: AEC22038** is work done by her and submitted during 2017 – 2018 academic year, in partial fulfillment of the requirements for the award of the degree of **BACHELOR OF TECHNOLOGY inELECTRICAL AND COMPUTER ENGINEERING,** at **NLC India Ltd, Neyveli.**

Department Internship Coordinator
R.Karthick Manoj ME.,(PhD)
Assistant professor, EEE

Dr.V.Sridevi ME., PhD
Professor and Head,
Department of Electrical & Electronics Engineering,
AMET Deemed to be University.

NLC INDIA

CREATINGWEALTH FORWELLBEING

NLC INDIA LIMITED

("NAVRATNA" – A GOVERNMENT OF INDIA ENTERPRISE)
NEYVELI – 607 801, TAMIL NADU

BONAFIDE CERTIFICATE

Certified that the Internship Training report titled **"A STUDY OF TRANSMISSION AND DISTRIBUTION OF POWER FROM 230/400 KV SWITCH YARD."** is the bonafide work of,

MARIA ROSHAN M (AEC22038)

Studying B.E., Electrical and Computer Engineering at ACADEMY OF MARITIME EDUCATION AND TRAINING, Chennai, done during the period from 06-09-2023 to 19-09-2023 at Learning and Development Centre, NLC INDIA ,

His performance, conduct and attendance during the period was Excellent.

SHRI .VELU A
EXECUTIVE ENGINEER/ELECTRICAL
THERMAL POWER STATION
NLC INDIA LIMITED

DATE: 19.09.2023
PLACE: NEYVELI

Permitted to submit the internship report to college / university authorities

19/09/2023

CHIEF MANAGER
LEARNING AND DEVELOPMENT CENTRE
NLC INDIA LIMITED

DATE:19.09.2023
PLACE: NEYVELI

Chief Manager
Learning & Development Centre
NLC India Limited, Neyveli-3.

DECLARATION

I hereby declare that the Internship training report titled **"A STUDY OF TRANSMISSION AND DISTRIBUTION OF POWER FROM 230/400 KV SWITCH YARD"** is the original work done by me under the guidance of **SHRI. VELU.A EXECUTIVE ENGINEER/ELECTRICAL THERMAL POWER STATION II,** NLC India Limited, Neyveli.

This internship report is for reference only and no part of the report will be published copied anywhere without the written permission from officials of NLCIL, Neyveli.

DATE: 19.09.2023

PLACE: NEYVELI

Signature of the student

MARIA ROSHAN M

ACKNOWLEDGEMENT

I express my sincere thanks to **NLC INDIA LIMITED** for providing me the opportunity to carry out the Internship Training.

I also express my sincere thanks to **Shri. SARAVANABHAVAN A KR, DGM/L&DC** and the staff of Learning & Development Center for providing me the opportunity to carry out the Internship Training in NLC India Limited, Neyveli.

I sincerely thank **SHRI. A. VELU EE/E,TPS II NLCIL,** for providing guidance during the internship training program from 06-09-2023 to 19-09-2023.

I express my gratitude to the Unit Head, **SHRI.P. NAKKERAN, EXECUTIVE DIRECTOR, & SHRI.A. MANIMARAN, DEPUTY CHIEF GENERAL MANAGER, TPS II** for granting me permission to undergo internship training in the Unit.

I sincerely thank **Dr.T.SASILATHA, DEAN INTERNATIONAL RELATIONS** and **Dr.S.PRIYA, DEAN ACADEMICS/ AMET UNIVERSITY** for providing me support and guidance for internship.

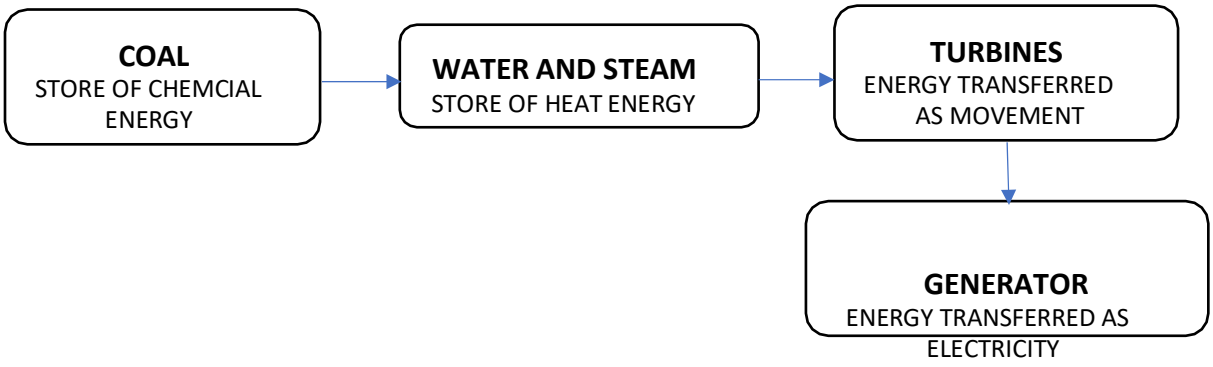
I sincerely thank **Dr.V.SRIDEVI/HOD/EEE.DEPT/AMET UNIVERSITY** for encouraging me to successfully complete the internship training.

INDEX

CHAPTER -1

INTRODUCTION

Electricity is the only form of energy that can be easy to produce, easy to transport, easy to use and easy to control. So, it is mostly the terminal form of energy for transmission and distribution. The thermal power plants are the major power generating source in India. Almost 70% of the total generated electrical power comes from thermal power plants. Any thermal power plant converts the chemical energy of coal or other fuel into electrical energy. The process involved in this is based upon the modified ranking cycle. Any thermal power plant has three apparatus: Boiler, Turbine, and generator.



Its operation involves the production of super-heated steam in the boiler which rotates the turbine where the mechanical energy gets converted into electrical energy. The basic raw materials are coal and water.

NEYVELI LIGNITE CORPORATION INDIA LIMITED

NLC India Limited (NLCIL) (formerly Neyveli Lignite Corporation Limited) is a 'Navaratna' government of India company in the fossil fuel mining sector in India

and thermal power generation. In NLC India Limited, heat energy released by burning lignite is converted to the mechanical form through a thermal cycle and then converting mechanical energy through generators to the electrical form. The chemical energy stored in lignite is transferred into electric energy in thermal power plants. The heat released by the combustion of lignite produces steam which gives off some of its internal energy as mechanical energy. The axial-flow type of turbine is normally used with several cylinders on the same shaft. The steam turbine acts as a prime mover and drives the electric generators. These generators and the distribution network should be synchronised to obtain a reliable power supply to consumers.

ABOUT NLCIL

HISTORY OF LIGNITE IN NEYVELI

Lignite deposit was found by chance when some 'brown substance' gushed out with water in Rao Bahadur Mudaliar's 620-acre own farm artesian well during 1934. He acted swiftly and contacted the then British Raj, which sent geologists to Neyveli. It was later identified as 'Lignite'. He generously extended a substantial portion of the sprawling land-bank for soil exploration. Through his effort and donated his 620 acres land to the Madras Government.

NLC has been a forerunner in the country in the energy sector for 62 years, contributing a lion's share in lignite production and significant share in thermal power generation. It was inaugurated by the first Prime Minister Jawaharlal Nehru in 1956. It annually produces about 30 million tons of Lignite from opencast mines at Neyveli in the state of Tamil Nadu in southern India and at Barsingsar in Bikaner district of Rajasthan state. The lignite is used at pithead thermal power stations of 3640 MW installed capacity to produce electricity. Its

joint venture has a 1000 MW thermal power station using coal. Lately, it has diversified into renewable energy production and installed 1404 MW solar power plant to produce electricity from photovoltaic (PV) cells and 51 MW electricity from windmills. The company is also setting up 1209 MW Solar Power Projects at Tirunelveli, Virudhunagar and Ramanathapuram districts of Tamil Nadu, of which, 300 MW have been commissioned. NLC is aiming to achieve a total renewable energy capacity of 4251 MW. NLCIL has a target of becoming a 20,000+ MW company by 2025. Works are under progress for the lignite based Neyveli New Thermal Power Plant (1000 MW), Bithnok TPS and Barsingsar TPS Expansion (each 250 MW). Further, NLC, jointly with the Uttar Pradesh Rajya Vidyut Utpadan Nigam Limited (UPRVUNL), is setting up a 3x660 MW coal based thermal power plant at Ghatampur in Uttar Pradesh, through its subsidiary company Neyveli Uttar Pradesh Power Limited (NUPPL) (equity participation in the ratio of 51:49). Apart from the above, the addition of thermal capacity to the tune of 6040 MW by way of installation of new plants and acquisition of power assets to the tune of 3000 MW is in the pipeline.

THERMAL POWER PLANTS

Thermal power plants use heat energy to produce electrical energy. Neyveli Thermal Power Station is a set of power plants situated near lignite mines in Neyveli. It consists of three distinct units (Neyveli Thermal Power Station I Expansion, Neyveli Thermal Power Station II and Neyveli New Thermal Power Station) capable of producing 420 MW, 1470 MW and 1000 MW respectively including their expansion units. It is operated by NLC.

POWER PLANTS	CAPACITY (MW)	CAPACITY (MW)
TPS I EXPANSION	2*210	420
TPS II	7*210	1470
TPS II EXPANSION	2*250	500
NNTPS	2*500	1000
BARSINGSAR TPS	2*125	250
TUTICORIN POWER PLANT(NTPL)	2*500	1000
WIND POWER PLANT	51	51
SOLAR POWER PLANT	1370.6	1370.6
	TOTAL	6,061.6

Neyveli Thermal Power Station II

The power station has a configuration of 1470MW (7x210MW units). Lignite is the raw material used here to produce the required heat energy. Lignite is taken from Mine II in Neyveli and taken to the power station through conveyor belts. Thermal power station II has totally 7 units where Stage 1 (unit 1,2,&3)produces 230KV whereas Stage 2 (units 4,5,6&7) produces 400KV. Boilers were supplied by Ganz-Danubius and generators were supplied by Franco Tosi. At the second stage from March 1991 to June 1993 four units with the same capacity, supplied by Bharat Heavy Electricals Limited, were added.Under Stage II expansion, two units of 250 MW each were installed by BHEL. These units use circulating fluidised bed combustion (CFBC) boilers

OVERALL THERMAL PROCESS

- Fuel Ash Cycle:

Heavy Furnace Oil (HFO) used for ignition, and Light Diesel Oil (LDO) burnt to increase temperature. Lignite crushed into 80 mm particles in the crusher house, with hot air from the boiler removing moisture. Crushed lignite sent to the boiler through the mill for combustion.

Two types of ashes collected: Bottom ash (20%) disposed of via slag conveyor, and Fly ash sent to Electrostatic Precipitator for separation and collection.

- Water Steam Cycle:

Water from the lake clarified and treated in the DM plant before going to the condenser is sent to Low-Pressure (LP) heater via Condensate Extraction Pump (CEP).Water passed through Deaerator to remove dissolved oxygen, then sent to boiler via Boiler Feed Pump (BFP) and High-Pressure (HP) heater for steam generation. Steam passed to HP turbine through the superheater, returning

steam passed through Reheater. Steam then sent to Intermediate Pressure Turbine (IPT) and Low-Pressure (LP) turbine, connected to the same shaft as the generator and it produces 21 KV, stepped up to 400 KV using a transformer for transmission.

- Air-Fuel Gas Cycle:

Atmospheric air enters the boiler through Regenerative Air Preheater (RAPH) using Forced Draft (FD) fan. RAPH removes moisture from the air before entering the boiler. Fuel gas sent to the atmosphere via chimney using Induced Draft (ID) fan.

- Cooled Water Circulation:

Steam from LP turbine sent to the condenser, where condensation occurs with the help of cold water from the lake. Cold water absorbs heat from the condenser pipe and moves to the cooling tower. After condensation in the cooling tower, the cooled water is sent back to the condenser for recirculation.

CONSTITUENTS OF THERMAL POWER STATION

A thermal power station, also known as a thermal power plant, is a facility that converts heat energy into electrical energy. It involves several key components and systems that work together to produce electricity. Let's explain the constituents you listed:

1. Lignite Handling System:

Lignite is a type of coal with low carbon content and high moisture content. The lignite handling system in a thermal power station is responsible for receiving, storing, and transporting lignite from the mines to the power plant. The process

typically includes lignite crushing, conveying, and stockpiling to ensure a continuous supply of fuel to the power plant.

Two conveyors transport lignite from mines to the Bunker.Lignite is filled into the Bunker through a Reversible Shuttle Conveyor (RSC).From the RCC Bunker, two Conveyors and Universal Shuttle Conveyor (USC) carry lignite to the crusher house .Paddle feeder ensures equal extraction of lignite from the RCC Bunker slots.In the Crusher House, lignite particles greater than 80mm are crushed using the eccentric screening technique and double rolled eccentric crushing method.Lignite is taken to the boiler bunker through two Conveyors, Reverse Conveyor, and RSC.

2. Boiler:

The boiler is a critical component of a thermal power station where the heat generated from burning the fuel (lignite in this case) is used to produce high-pressure steam. The combustion of lignite releases energy in the form of heat, which is transferred to water in the boiler to produce steam at high temperatures and pressures. . The type of boiler used here is "RADIANT TYPE". The boiler produces 640tones of steam/hour to produce a power of 21 KW /hr. At a pressure and temperature of 180kg/cm and 540 C. Boiler is 121m in height. The boiler drum is located at the top of boiler. The walls of the boiler are surrounded by water tubes.

3. Turbine:

The high-pressure steam generated in the boiler is directed to a steam turbine. The turbine consists of blades attached to a shaft. As the high-velocity steam passes over the turbine blades, it causes the turbine to rotate. This rotation converts the kinetic energy of steam into mechanical energy. The multistage turbine consists of three stages namely:

➢ HP turbine

HP Turbine (high-pressure turbine) is usually a double-flow turbine element with an impulse control stage followed by reaction blading at each end of the element. It produces about 30-40% of the gross power output of the power plant unit. Steam is supplied to this turbine from the super heaters. The pressure of steam is about 180KSC.

➢ IP turbine

The IP turbine casing has to provide openings large enough to pass the exhaust steam on to the LP turbine at moderate velocities. IP turbines are usually coupled with the LP turbines. Here, the pressure of steam reduces to about

40K.SC.

➢ LP turbine

This is the last and the most efficient part of the multistage turbine producing 60%-70% of the total mechanical power generated. As the highpressure steam comes out of the high-pressure turbine losing its pressure to rotate the blades, its specific volume increases (Pressure decreases).So,in order to handle fluid with high specific volume, low pressure turbine is made bigger in size. The pressure of steam reduces to about 18 KSC.

All these turbines are coupled together on a common shaft

4. Generator:

The rotating shaft of the turbine is connected to the rotor of a generator. The generator is a device that converts mechanical energy into electrical energy

through the principles of electromagnetic induction. As the turbine shaft rotates, it spins the generator rotor, generating electricity in the stator windings.

As high-pressure steam or hot gases expand through the turbine, they impart rotational motion to the turbine blades. The turbine spins at high speeds due to the force of the steam or gas, converting thermal energy into mechanical energy.

This causes the rotor to rotate, the rotor is the rotating part of the generator. It consists of a shaft and an electromagnet called the field winding. The field winding is typically supplied with direct current (DC) through an excitation system .

The stator is the stationary part of the generator and surrounds the rotor. It consists of a hollow core with a set of insulated copper coils called the stator winding. The stator winding is connected in a specific configuration to form three-phase windings.

As the rotor's magnetic field rotates, it induces a varying magnetic flux in the stator windings. According to Faraday's law of electromagnetic induction, this changing magnetic field induces an electromotive force (EMF) in the stator windings. The induced EMF generates alternating current (AC) in the stator windings.

The AC output from the stator windings is collected through conductors and taken out through the generator's output terminals. It is typically three-phase

AC power.

5. DM Water Plant (Demineralized Water Plant):

In thermal power plants, demineralized water is required for various purposes, such as feedwater for the boiler and cooling water for certain systems. The DM

water plant is responsible for purifying the water, removing mineral salts and impurities, thus producing high-quality demineralized water.

6. Switchgears:

Switchgears are electrical devices used to control, protect, and isolate electrical equipment in the power station. They play a crucial role in managing the flow of electricity, ensuring safety, and preventing damage to the equipment during abnormal conditions such as short circuits.

7. Switchyard:

The switchyard is a part of the power station where the generated electrical power is stepped up using transformers to high voltages suitable for long-distance transmission. It also contains various circuit breakers and switches to control the flow of electricity and distribute it to the grid or different consumers.

8. Ash Handling System:

During the combustion process in the boiler, ash and other solid by-products are produced. The ash handling system is responsible for collecting, conveying, and disposing of these ash residues. This is done to ensure proper disposal of ash and to prevent its release into the atmosphere, reducing environmental impacts. Ash handling system collects bottom ash (20%) and fly ash (80%).Bottom ash is disposed of through a slag conveyor. Fly ash is sent to an Electrostatic Precipitator for separation and collection.

These are some of the primary constituents of a thermal power station, each playing a crucial role in the process of converting heat energy from burning lignite into electrical energy for distribution and consumption. The efficient and reliable

operation of these components is essential to maintain a stable and continuous supply of electricity.

CHAPTER -II

SWITCH YARD

INTRODUCTION:

A switchyard is a switching station which is the main link between the generating plant and the transmission system. It can be considered as the heart of the power plant; the generated power will only be worthy if it can be transmitted and received by the consumers. Switchyard is a junction which carries the generated power to the destination, it plays a major part in the security of the system, it can control the reactive power devices which plays a major role in power quality. It is mostly an assemblage of switches, power circuits, breakers, and the auxiliary equipment which is used to collect power from the generators at the power plant and then it will be distributed to the transmission lines at a load point.

A switchyard is a grouping of electrical apparatus used to switch high voltage energy utilizing a variety of parts. One of the crucial components in a substation where power is converted from one voltage to another from transmission and distribution are electrical switchyards. The interface between a producing station and the grid might be thought of as the switchyard. The switchyard is used to transport the power produced by the producing station to the grid. The grid receives secure electricity from Switchyard. A switchyard or substation is a collection of equipment that changes the properties of electrical energy from one location to another while regulating the flow of electricity. Electricity exchange is regulated by switchyard. Each transmission line's electrical properties, including voltage, current, power, and frequency are monitored. The voltage that is generated in Stage 1 is 15KV and Stage

2 is 15.75KV. This can't be distributed because of heat loss and the large area of the distributing conductor. This voltage is Stepped up using Generator Transformer to 230KV (Stage 1) and 400KV (Stage 2).

BASIC TERMS IN SWITCH YARD

Major terms that come under switchyard are

- Grid
- Feeder Distribution
- Bus system

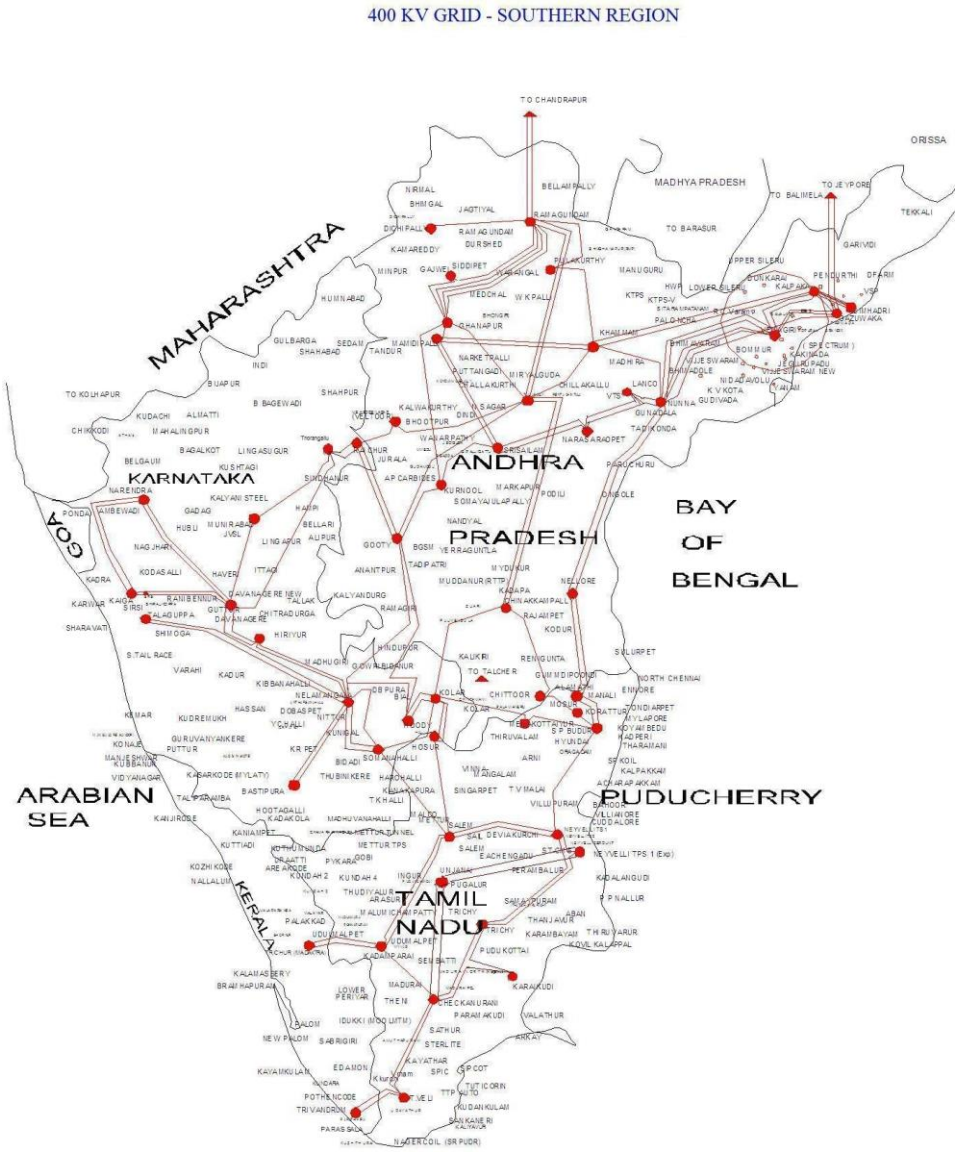
GRID

A network of synchronized power producers and consumers, connected by transmission and distribution lines, and managed by one or more control centers makes up an electric grid.

There are 5 sub–Power Grids in India

1. Northern grid
2. Eastern Grid
3. Western Grid
4. Southern Grid
5. North-Eastern Grid.

In Sothern Grid the Transmission is controlled by SRLDC.



FEEDER DISTRIBUTION

The most common electrical power distribution systems include:

1. Radial Power Distribution Systems

Substations or producing plants positioned in the center of the customer's property employ a radial power distribution system. The distributors are placed at one end of this system, while the feeders push power to them from the other end. Only one way is possible for the energy to flow.

2. Ring Power Distribution Systems

Every distribution transformer in ring distribution systems is intended to connect to two feeders through two distinct pathways. These feeders create a loop that leaves from the bus bars of the substation, travels across the load area where distribution transformers are being fed, and then returns to the bus bars of the substation.

Bus system:

A bus is a node where a line or several lines are connected and may also include several components such as loads and generators in a power system. Each bus or node is correlated with one of three quantities: (1), magnitude of voltage, (2) phase angle of voltage, (3) frequency of the feeder.

Types of bus:

- UAT bus
- Station bus

- Main bus
- Transfer bus
- Emergency bus

UAT bus (6.6 KV):

The unit auxiliary transformer bus is the name of this system. It is utilized to provide power for auxiliary devices like the mill motor, CWP (Circulating Water Pump), and BFP (Boiler Feed Pump), among others. It is the voltage that the generator steps down from the generated voltage.

Station bus (6.6 KV):

It is utilized to deliver power to the equipment shared by the two units. These include AHS, LHS conveyor, etc. When the unit journeys, the bus' primary purpose is served. The station supply enters the picture in this situation.

Main bus (400 KV):

It consists of 2 buses namely Main bus 1 and Main bus 2. Power produced from unit 1 goes in Main bus 1 to thermal power station 2. Bus coupler is placed between the 2 main bus. If any of the main bus trips the bus coupler comes to picture by sharing the load to another bus and not overload one bus.

Transfer bus (400 KV):

In case of any fault in any Main bus, the outgoing circuit may be transferred to the transfer bus. It is easy to connect to outgoing feeder from anyone main bus transfer bus.

Emergency bus (0.4 KV):

The emergency bus is used when UPS also fails. DG set (Diesel Generator) will be connected to this bus to prevent sudden trip in machines. The sudden trip may cause damage to the machines in power system.

COMPONENTS:

ISOLATOR:

An isolator/disconnector is a device that separates a piece of a circuit from the remaining portion. Due to the lack of an arc quenching mechanism, it is an offload device. For maintenance purposes, it is utilized to divide a circuit's good and unhealthy portions. In the switch yard, a total of 6 isolators are in service. The different types of isolators are as follows:

1. **Single Break / Centre Break**: Only I break point is available. One arm contains the male contact and the other contains the female contact N%en actuated both arms rotate in opposite directions hence making contact at one point. And the isolator is closed.

2. **Double break**: A central insulator of three insulator mounted on a post has the rotating male part and the other are mounted with 2 female contacts. When actuated, the male part rotates and makes contacts, hence closing the isolator. Since there are 2 break point, this is called as a double break isolator.

3. **Pantograph**: A pantograph mechanism is employed to make, break contacts

A pantograph mechanism is a linkage connected is a manner based on parallelograms.

The 230kV yard uses gang operated double break isolator and the 400kV uses pantograph and Centre break isolator.

CIRCUIT BREAKER:

It's an on-load device, where it can be turned ON or OFF even when the current flows through it. If any fault occurs, Breaker trips automatically. The tripping mechanism is of different types: Spring, pneumatic and hydraulic operator. When

the tripping occurs, an arc is generated between the two contacts separated abruptly which is quenched by SF_6 gas.

SF_6 gas is an insulator and inert gas when an arc is identified, SF_6 being highly electro negative accepts the free electrons and becomes SF_6^- which is a very good dielectric which surrounds, cools and quenches the arc.

TYPES OF CIRCUIT BREAKERS

- Air circuit breakers
- SF6 circuit breakers
- Vacuum circuit breakers
- Oil circuit breakers

In our Power station SF6 breaker is mostly used. It is a Sulphur hexafluoride circuit breaker in which Sulphur hexafluoride is used as the arc extinguishing medium. The Sulphur hexafluoride gas attracts free electrons. As the circuit contacts are opened, the gas flows through the chamber striking the arc. The free electrons are then absorbed by the SF6 resulting in immobile negative ions. For the arc to extinguish completely, the Insulating strength of the medium should be increased. Both the contacts fixed and moving contacts are placed in the arc chamber along with the gas.

OPERATING MECHANISM:

The operating mechanisms is a mechanical setup (or the current itself) forces contacts to separate apart. This movement is coupled with SF_6 reservoir which forces into the passage where arc is produced. This happens simultaneously without delay.

TYPES:

Spring operated

- Hydraulic

- Pneumatic
- Magnetic coil

Also based on interrupters present the circuit breaker can be differentiated as:

Single interrupted:

Double interrupted:

Advantages of SF6 circuit breaker

• The arc extinguishing property is excellent

• SF6 gas is three times greater than air, making the interruption of the current large.

• It's environment-friendly as there is no exhaust released.

• Low maintenance.

• Suitable for harsh conditions such as in coal mines.

Disadvantages of SF6 Circuit Breaker

• SF6 gas is expensive.

• SF6 needs to be reconditioned after every use

CURRENT TRANSFORMER:

A current transformer steps down current. Practically aluminum bar of hair pin like shape is taken to be primary and five coils are wounded on bar as secondaries. There are five coils for metering and protection purposes. The above side are placed inside a cavity formed by porcelain filled with oil plus N_2 gas, or SF_6 gas. This is used for cooling and insulation purposes. This setup is in turn mounted on a steel tank and then is terminated with a top chamber which serves as a block to prevent expansion of oil.

PRINCIPLE:

When current flows through the primary, an alternating flux isgenerated and this flux induces a current in the secondary.

TYPES:

(A) Based on type of primary winding

1. Bar type-consists of a bar type primary
2. Wound type- has more than one primary turn.
3. Window type- No primary winding present, secondary wound over primary.

(B) Functions:

Measuring current transformer- used along with measuring devices and protective current transformer- used along protective devices like trip coils relays etc…

CAPACITIVE VOLTAGE TRANSFORMER:

A capacitive voltage transformer steps down voltages. A potential or voltage divider arrangement is employed using capacitors. The capacitance directly connected to the ground is of low value compared to other ones used. Hence the voltage across this particular capacitor is less. Since the usage of capacitor introduces an phase angle, an inductor is used to nullify it. Finally an auxiliary transformer is used to step the voltage down and is used for metering purpose.

LIGHTNING ARRESTER:

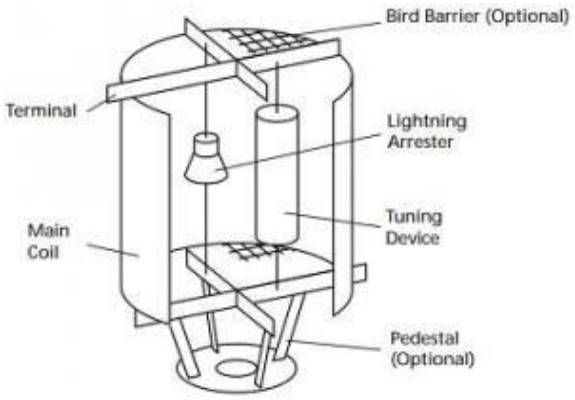
Device used for protection of equipment at substation against travelling waves is called lightning arrester. It is connected between line and earth. It provides a very low resistive path between the line and the ground only when a travelling wave reaches the lightning arrester . Other times it behaves as an insulator with a high resistance so that the usual current following through the line is non-grounded. Further, the insulation of the equipment can be protected against lightning, if the shape of the voltage and the current at the diverter terminal is similar to as shown below.

RELAYS

Relays are a dedicated component of electrical substation equipment for the protection of system against abnormal situations e.g. faults. Relays are basically sensing gadgets which are devoted for sensing faults and are determining its location as well as sending interruption message of tripped command to the specific point of the circuit.

WAVE TRAPPER:

The wave trapper is one of the substation components which is placed on the incoming lines for trapping of high-frequency waves. The high-frequency waves which are coming from nearby substations or other localities are disturbing the current and voltages, hence its trapping is of great importance



EARTHING

The fundamental role of any substation earthing is to dissipate the short circuit current into the earth without drying out the area and to limit the potential gradient throughout the substation to maintain the step and touch voltages within safe values. There are two features considered during the design of earthing for a substation which are:

- Providing a low impedance path for the fault currents occurred during normal conditions and fault conditions
- Avoiding fatal electric shocks to the person working in the vicinity of the grounded facilities
- **Bus reactor:** A device which nullifies the hike in voltage available in the Bus.

- **Bus coupler:** A device helps which couples or makes the two buses in parallel.
- **Bus transfer:** A device which switches from Bus I or Bus II to an alternative Bus called the transfer bus .

SYNCHRONOSCOPE

While connecting a load in the bus bar the synchronoscope is used to check the lead or lag .It is the instrument that displays the exact instant where the two alternating current generators are in exact phase relation to be in parallel connection. It also shows whether the incoming generator has more operating speed when compared with that of an on-line generator.

It has two phases wounded stator and a rotor. The alternators supply a two-phase kind of supply for the device. When there happens to match the phases, then the third phase will get automatically synchronized. The prevailing alternator in the device provides power supply for the stator, whereas incoming alternator provides supply for the rotor.

The phase difference that exists between these two supplies implies the frequency and phase variation of the alternators that are in parallel connection. The device also defines the operating speed (quick or slow) with that of the incoming alternator.

The device will start to function when the alternators of various frequencies have a connection with each other. When both rotor and stator frequency levels are similar, then the rotor will stop to rotate or stays as a constant which means that the dial also stays as static. And when the frequency of the stator and rotor supply varies, then the rotor initiates to rotate which means that the dial starts to deflect. The rotor speed is based on the variation of the supply frequency level. When the variation is more, then rotor deflects at greater speed and when the variation is minimal then rotor deflects at less speed.

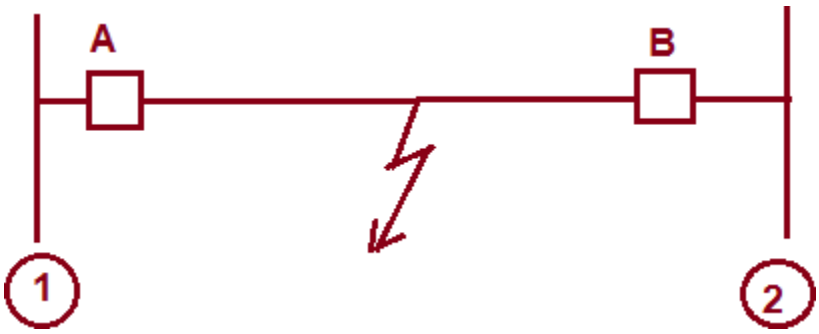
Condition for Synchronoscope

- The alternators should possess a similar level of magnitude voltages
- They should even possess similar frequency levels
- Also, the same phase series has to be maintained. The operation of this device is to signify any kind of variation that exists either in the frequency or phase levels. The phase series is calculated through a device named as "phase sequence gauge", and the voltage rating is measured using a voltmeter.

PLCC

Power-line carrier communication (PLCC) is mainly used for telecommunication, tele-protection and tele-monitoring between electrical substations. Power Line Carrier Communication is used for the Carrier Tripping and Direct Tripping in case of Distance Protection. For detail of how does Distance protection relay sends and receives carrier signal, read Distance Protection philosophy.

Whenever there is a fault in the line, it is very much important to isolate the fault. Merely tripping of breaker at one end of line cannot isolate the fault. Breaker at the other end of line should also open.



In case of fault, breaker A and B should open. Let us assume that, the fault is being sensed by relay at station 1. This relay should issue trip command to breaker A and send trip signal to the remote end. This trip signal to remote end is called Direct Trip(DT) signal.

BATTERY UNIT

A battery unit is used as a backup power source to provide electricity to critical equipment and systems in the event of a power outage or disruption. The battery unit typically consists of a bank of batteries that are connected in series or parallel to provide the required voltage and current. The battery unit is charged when the power supply is available and discharged when there is a power outage or disruption. The battery unit can provide backup power for a few minutes to several hours, depending on the size and capacity of the batteries and the load requirements. In a power plant, batteries can play a crucial role in several ways. While power plants primarily rely on large-scale generators and turbines to produce electricity, batteries can provide various benefits, including:

1. Energy Storage:

Batteries can store excess electricity generated during periods of low demand or high renewable energy production. This stored energy can be discharged when demand is high or during power outages, improving grid stability and reliability. Energy storage systems can also help integrate intermittent renewable energy sources like

solar and wind into the grid, as they can store energy when it's abundant and release it when needed.

2. Load Balancing:

Power plants aim to match electricity generation with consumer demand. Batteries can assist in load balancing by supplying additional power during peak demand periods or absorbing excess power during low-demand periods. This helps stabilize the grid, reduces strain on conventional power plants, and avoids the need for expensive infrastructure upgrades.

3. Frequency Regulation:

Batteries can respond quickly to fluctuations in power supply and demand, helping maintain a stable frequency in the electrical grid. By absorbing or injecting power as needed, batteries can provide frequency regulation services and support the grid's overall stability.

4. Backup Power:

In case of a power outage or unexpected generator failure, batteries can provide backup power to critical systems. They can ensure continuous electricity supply to essential services such as hospitals, data centers, and emergency facilities until the primary power source is restored.

FEEDERS CONNECTED

In the 230kV yard connected to the following.

- Karaikal
- TANTRANSCO 1&2(TNEB)

- Villiyanur
- Ulundurpet
- TAQA
- Kadalangudi
- Mines feeder 3&4
- Station transformer 1,2,3&4(for
- Inter connecting transformers 1&2
- 230kV bus coupler
- Generator transformer 1,2&3
- 230kV bus transfer
- NNTP Tie Line 1&2

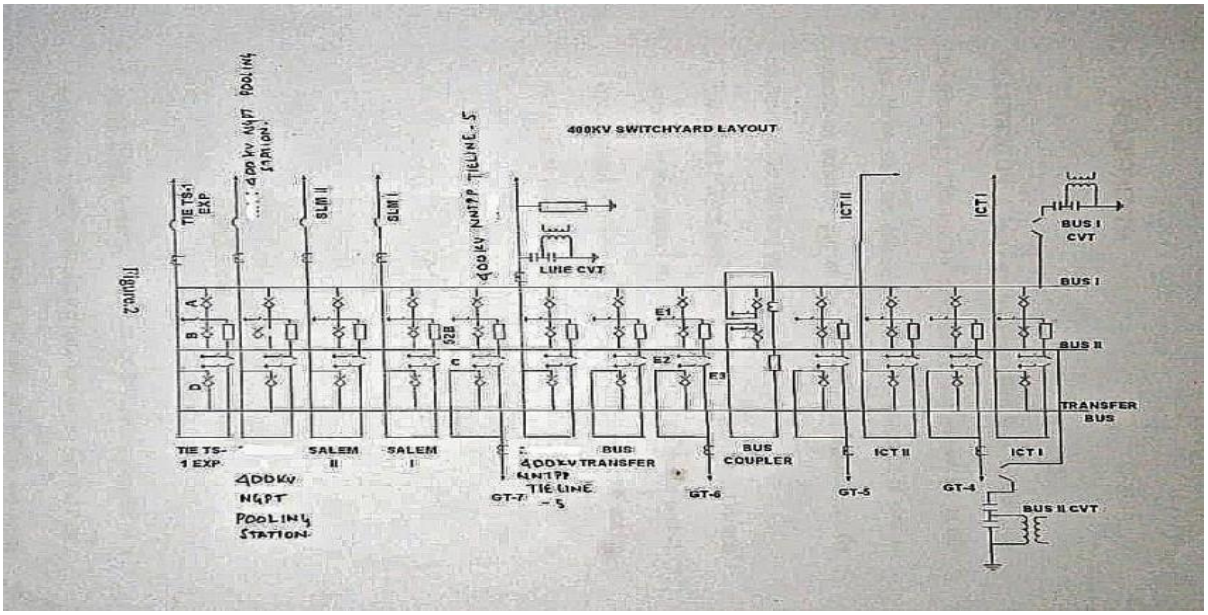
400kV yard is connected to the following:

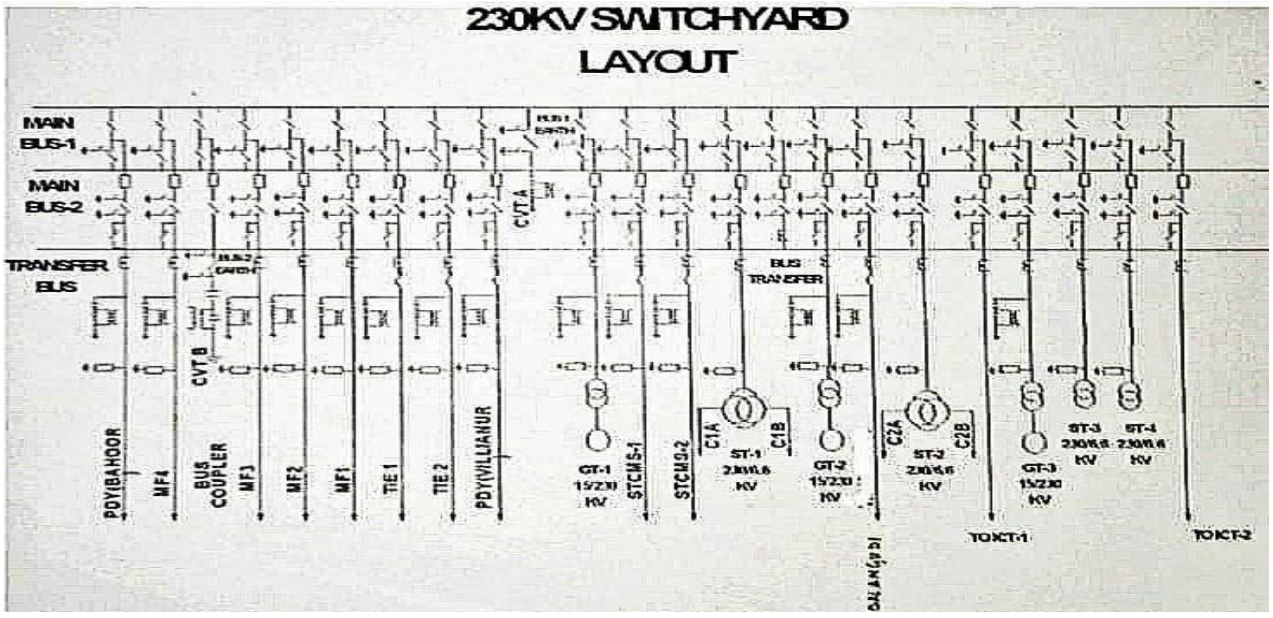
- Salem 1,2
- Nagapattinam pooling station
- Pugalur
- TS-I Expansion Tie Line-3
- NNTPP Tie Line-5
- Inter connecting transformer-1&2
- Reactors 1&2
- Generator transformer 4,5,6&7
- 400kV Bus transfer
- 400kV Bus coupler

- TS-II Expansion Tie Line 4

Apart from the above mentioned, the requirements of other intra-plant are satisfied.

The Inter Connecting Transformers is the transformer that reduces 400KV to 230KV according to the demand in the load. The Mines Feeder is the radial type of feeder which is only one way of energy transferred, while others are round feeders. Tie line feeders are the input received from local substation.





According to the SCADA the standard units are

- 1st bus isolator - 89A
- 2nd bus isolator -89B
- Line isolator -89C
- Transfer bus isolator -89D
- Circuit breaker -52 series
- Current transformer
- Capacitive voltage transformer
- Lightning arrester
- Breaker earth bus side -89E1
- Breaker earth line side -89E2
- Earth switch -89E3

AVAILABILITY BASED TRAIFF SYSTEM

ABT is there formation on the Indian power tariff mechanism to motivate the generators for their enhancement of power during low frequency and penalize them for their reduction of generation during high frequency.

Time of Use (TOU) Tariffs: TOU tariffs charge different rates for electricity consumption based on the time of day or season. Generally, there are peak, off-peak, and shoulder periods. Peak hours (usually during the day) have higher rates due to higher demand on the power grid, while off-peak hours (usually at night) have lower rates. Shoulder periods fall between peak and off-peak times and have intermediate rates.

Demand Charges: Some energy tariff structures include demand charges, which are

based on the maximum amount of electricity a customer uses during a specific period (often measured in kilowatts). These charges aim to account for the stress placed on the power grid during peak demand.

Fixed Charges: Fixed charges are flat fees that customers pay regardless of their actual energy consumption. These charges cover the costs of maintaining the utility infrastructure and providing service.

Renewable Energy Tariffs: Some regions or utilities offer special tariffs for customers who want to support renewable energy sources. These tariffs may be tied to renewable energy certificates or provide access to a specific portion of renewable energy generation.

This primarily focuses on these things

- Commitment (declaration)
- Demand (schedule)
- Deviation between actual and demand.

How this is done

- A Fixed charge payable a every month buy each beneficiary to the generator for making capacity available for use. The Fixed Charge will also vary with the level of availability achieved by generator .
- In Case of thermal station like those of NLCIL, Where the fixed charge as not already been defined separately by GOI notification .
- An energy charge per KWh of energy supplied as per a pre committed Schedule of supply drawn upon a daily basis.

A charge for unscheduled interchange for the supply and consumption of energy in variation from the pre committed daily schedule. This charge varies inversely with the system frequency prevailing at the time of supply or consumption. Hence it reflects the marginal value of energy at the time of supply.

UNSCHEDULE INTERCHANGE (UI):

- UI is the difference between actual export and scheduled export for a given period of time.
- **C = ACTUAL ENERGY – SCHEDULE ENERGY**
- If UI is positive --- incentive.
- If UI is negative --- penal

CHAPTER-3

CONCLUSION

Our internship experience has been both enriching and rewarding, providing us with valuable insights into the real-world application of the knowledge and skills acquired during our academicjourney. The internship offered us a unique opportunity to bridge the gap between theory and practice, and we are grateful for the chance tobe part of such a dynamic and innovative team. This experience has confirmed our passion for the industry and has solidified our career aspirations. we now feel more confident in our chosen career path andeager to explore further opportunities in this electrical domain.

We would like to express our gratitude to **Mr. VELU A EXECUTIVE ENGINEER/ELECTRICAL THERMAL POWER STATION II**, and all the individuals who supported us during our internship. Their guidance, feedback, and encouragement were instrumental in our growth and development. In conclusion, our internship has been a transformative and unforgettable journey. We are excited about the prospect of applying the knowledge and experience gained here to our future academic and professional pursuits. We are truly grateful for the opportunity and look forward to contributing to the industry's growth and innovation in the years to come.

REFERENCES

1. https://www.nlcindia.com
2. https://energyeducation.ca/encyclopedia/Electrical_substation
3. https://www.electricalpowerenergy.com/2017/01/high-voltage-circuit-breaker
4. https://www.electrical4u.com/electrical-isolator-or-electrical-isolation-switch

FEEDBACK

The internship training was very useful as well as it brought a good exposureto the industrial types of machines and huge production and lots of employees and employers who is kindly guiding us towards the peaceful training sessions, and we thank the guides and mentors who guided us during the training sessions

NLC INDIA

CREATINGWEALTH
FORWELLBEING

NLC INDIA LIMITED

("NAVRATNA" – A GOVERNMENT OF INDIA ENTERPRISE)
NEYVELI – 607 801, TAMIL NADU

CERTIFICATE

This is to certify that

MARIA ROSHAN M

Studying BACHELOR IN ENGINEERING at

ELECTRICAL AND ELECTRONICS ENGINEERING

AMET UNIVERSITY, CHENNAI

has undergone Internship Training on

"A STUDY OF TRANSMISSION AND DISTRIBUTION OF POWER

FROM 230/400 KV SWITCHYARD"

during the period from 06-09-2023 to 19-09-2023 at

THERMAL POWER STATION - II

NLC INDIA LIMITED, NEYVELI.

20/09/2023

Date: 20-09-2023
Place: NEYVELI

for LEARNING AND DEVELOPMENT CENTRE
NLC INDIA LIMITED
Chief Manager
Learning & Development Centre
NLC India Limited, Neyveli-3.

Training adding Value to life