



Teknecik Power Plant

SUMMER INTERNSHIP REPORT

BARAN AKKANAT

KIBRIS TÜRK ELEKTRİK KURUMU

994000

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Teknecik Elektrik Santrali, Girne



CERTIFICATE

Certified that the internship report “**Electrical and Electronics in Power Plant**” is the bonafide work of Baran Akkanat, 3rd Year student of Electrical & Electronics Engineering Department, Ankara University, carried out under my supervision during 14th August to 25th September

25.09.2023

HARUN BEREKE

SUPERVISOR

<<Department/organization>>

<<Signature of the Supervisor>>



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ABSTRACT

This internship report provides a comprehensive analysis of the electrical energy generation methods employed at the Teknecik Power Plant in North Cyprus. As a candidate Electrical and Electronics Engineer, I embarked on an internship to gain practical insights into the diverse energy production techniques utilized in the facility. The power plant incorporates three primary methods for generating electricity: steam turbines, gas turbines, and diesel generators.

Furthermore, the report conducts a comparative assessment of these three methodologies, highlighting their respective strengths and weaknesses in terms of efficiency, reliability, and environmental sustainability. Special emphasis is placed on factors such as fuel consumption, emissions, and maintenance requirements, providing a comprehensive perspective on the overall performance of each technology.

ÖZET

Bu staj raporu, Kuzey Kıbrıs'taki Teknecik Enerji Santrali'nde kullanılan elektrik enerjisi üretim yöntemlerinin kapsamlı bir analizini sunmaktadır. Elektrik ve Elektronik Mühendisi adayı olarak tesiste kullanılan çeşitli enerji üretim teknikleri hakkında pratik bilgiler edinmek için staja başladım. Santral, elektrik üretmek için üç ana yöntem içermektedir: buhar türbinleri, gaz türbinleri ve dizel jeneratörler.

Ayrıca rapor, bu üç metodolojinin karşılaştırmalı bir değerlendirmesini yaparak verimlilik, güvenilirlik ve çevresel sürdürülebilirlik açısından güçlü ve zayıf yönlerini vurguluyor. Her teknolojinin genel performansı hakkında kapsamlı bir bakış açısı sağlayarak yakıt tüketimi, emisyonlar ve bakım gereksinimleri gibi faktörlere özel önem verilmektedir.



CHAPTER 1: INTRODUCTION

1.1 Background and Purpose:

Embarking on this internship at Teknecik Power Plant as a candidate in Electrical and Electronics Engineering marks a pivotal step in my academic and professional journey. The choice of a thermal power plant stems from a profound interest in understanding and contributing to the heart of electrical energy production.

With a robust academic foundation in Electrical and Electronics Engineering, I sought an internship that would not only complement my theoretical knowledge but also provide hands-on experience in the field. The intricate workings of a thermal power plant align seamlessly with my career aspirations, offering a unique opportunity to bridge the gap between theory and practice.

Recognizing the irreplaceable value of practical exposure, I was drawn to Teknecik Power Plant for its diverse methods of energy production: steam turbines, gas turbines, and diesel generators. This dynamic environment promised a multifaceted learning experience that would significantly enhance my understanding of power generation systems.

1.2 Thermal Power Plant Overview:

Teknecik Power Plant, located in North Cyprus, stands as a cornerstone in the regional energy landscape. Boasting a formidable capacity for power generation, it serves as a critical contributor to the electrical grid in the area.

The plant primarily harnesses the potential of natural resources, utilizing a combination of steam turbines, gas turbines, and diesel generators. This strategic approach enables Teknecik Power Plant to adapt to fluctuating energy demands and maintain a consistent supply of electricity to the grid.

At the core of this operation lies the judicious use of fuel resources. The choice of fuel, meticulously calibrated for efficiency and environmental impact, underlines the significance of responsible energy production in today's context. It is through this conscientious approach that Teknecik Power Plant plays a pivotal role in the regional energy industry.

1.3 Expectations and Structure:

Embarking on this internship, I harbored high expectations of honing practical skills, delving into diverse facets of electrical and electronic engineering, and gaining invaluable insights



into power generation systems. I anticipated a dynamic learning environment, where challenges would serve as opportunities for growth and innovation.

This internship aligns seamlessly with my academic pursuits and professional goals, offering a comprehensive understanding of electrical engineering principles in real-world applications. I envisaged emerging from this experience not only as a more adept engineer but also as a contributor to the sustainable evolution of energy systems.

In the forthcoming sections, this report will navigate through the intricacies of my tasks, the challenges encountered, the invaluable learning outcomes, and ultimately, the conclusions drawn from this enriching tenure at Teknecik Power Plant. This structured approach aims to provide a comprehensive overview of the internship experience and its profound impact on my academic and professional development.

CHAPTER 2: CONTENT OF THE POWER PLANT

2.1 General Information about the Power Plant:

The facility where I conducted my internship is the Teknecik Thermal Power Plant, located in North Cyprus. This plant plays a pivotal role in energy production and meets the energy demands of North Cyprus. The Teknecik Thermal Power Plant boasts a capacity of approximately 310 megawatts (stream turbines 60 x 2) (gas turbines 25mW x 2) (diesel generators 17.5 x 8) and generates electricity using Fuel Oil and Diesel as its primary fuel source. This plant stands as a cornerstone of North Cyprus' energy infrastructure.

2.1.1 LSFO

The LSFO (Low Sulphur Fuel Oil) ($s < 1\%$) is used in the power plant to cause less damage to the air and nature. As the sulfur content increases, the efficiency also increases, but since we are on a small island, this damage is very important for us. Low sulfur fuel oil plays a pivotal role in mitigating environmental impact and ensuring regulatory compliance in power generation. With significantly lower sulfur content, it leads to reduced emissions of sulfur dioxide and particulate matter when burned, thereby curbing air pollution and its associated health hazards. Adherence to stringent emission standards is facilitated, aligning power plants with environmental regulations. This transition to low sulfur fuel oil not only contributes to cleaner air quality but also underscores a commitment to sustainable and responsible energy production practices, benefiting both the environment and public health.



2.1.2 Cost of LSFO

It's essential to consider the cost-effectiveness of the fuel used in power generation. At Teknecik Power Plant, the economics of fuel oil play a significant role. To produce 1 kilowatt-hour of energy, we require approximately 270 grams of Low Sulfur Fuel Oil (LSFO). This translates to a cost of around 1.43 cents per kilowatt-hour solely for the fuel. In terms of procurement, one ton of LSFO amounts to 1,000 kilograms and comes at a cost of 530 dollars. This pricing structure is a critical factor in determining the overall operational expenses and subsequently influences strategic decisions related to fuel sourcing and consumption. Balancing the economic aspects with environmental considerations remains a key focus in ensuring sustainable and cost-effective energy production.

The management and maintenance of the plant's operations are overseen by a dedicated team of approximately 150 individuals. This team comprises engineers, technicians, and support staff with varying areas of expertise. Given the intricacies of thermal power generation, the collaboration of individuals from diverse fields of expertise is crucial for the efficient operation of the plant.

Notably, the Teknecik Thermal Power Plant not only serves the purpose of energy generation but also integrates various technological solutions to minimize its environmental impact and uphold sustainability principles. Beyond its contribution to energy production, the emphasis on environmentally friendly technologies adopted by the plant is worth highlighting.

Fuel transport pipes from tanks to the power plant:



Figure 1 Fuel transportation pipes



Figure 2 Fuel Tank 1/3

The Teknecik Thermal Power Plant goes beyond energy production; it provides an opportunity to understand the complexities and significance of thermal energy generation. This unique experience allowed me to observe energy production concepts in practice and established a solid foundation for my engineering career. In the following section, I will provide a detailed account of the projects and tasks involved in this internship experience.



2.2 Departments and Responsibilities

During my internship at the Tekneçik Thermal Power Plant, I had the privilege of working across various departments, each contributing to the plant's seamless operation and power generation processes. The plant is organized into several key departments, each with its distinct responsibilities:

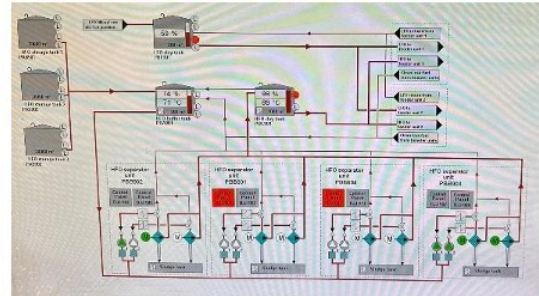


Figure 3 Control Room Fuel Separator Section

2.2.1 Operations Department:

In the Operations Department, I gained insights into the core functioning of the power plant. I observed the control room operations, where operators monitor and manage the power generation process in real-time. This department plays a critical role in ensuring the plant's stability, efficiency, and compliance with safety standards.

The control room serves as the operational nerve center, overseeing critical functions that ensure the reliable and efficient generation of electricity. Operators continuously monitor vital parameters such as voltage, current, frequency, and temperature, ensuring the system operates within safe limits. They manage the load demand, adjusting generator output to match the requirements of the electrical grid. The control room initiates startup and shutdown procedures, strictly adhering to safety protocols.

Additionally, it's responsible for fuel management, overseeing refueling schedules, and ensuring an adequate supply for uninterrupted operation. In emergency situations, the control room becomes the central hub for decision-making and coordinating response efforts, contributing to the plant's overall safety and stability.

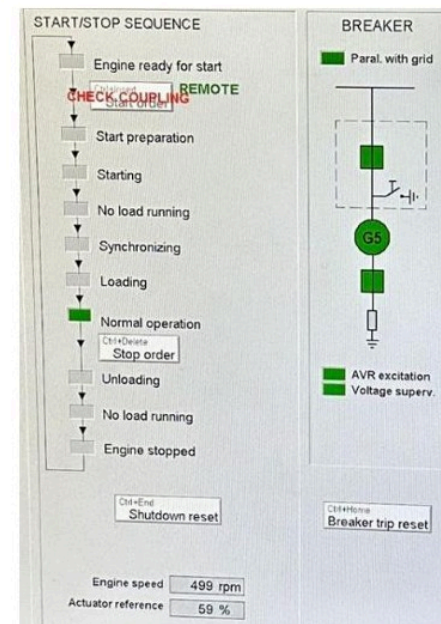


Figure 4 Control Room Conditions of Generators

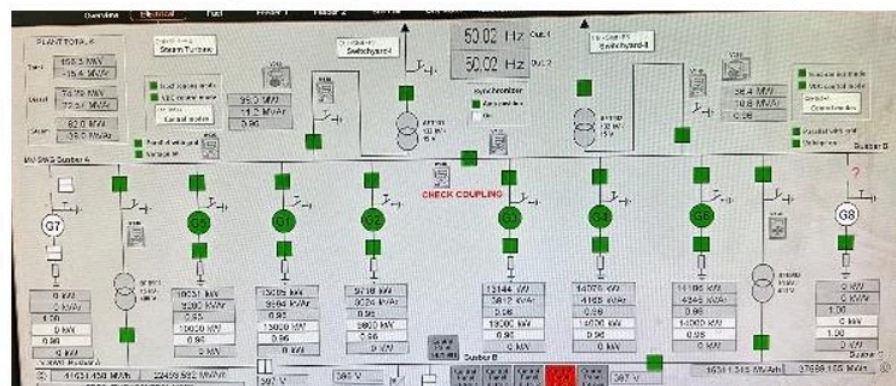


Figure 5 Control Room Electrical Conditions of Generators

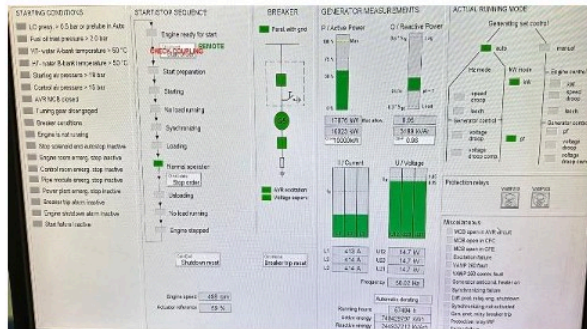


Figure 6 Control Room Electrical Conditions of Generators

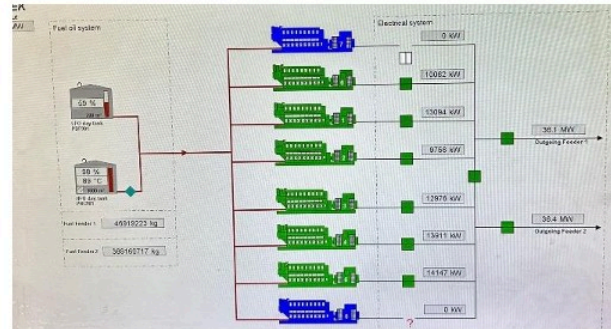


Figure 7 Control Room Overview of Generators

2.2.2 Maintenance Department:

Working alongside the skilled technicians of the Maintenance Department, I learned about the intricate machinery and equipment that keep the plant operational. I assisted in routine maintenance tasks, observed equipment inspections, and became familiar with troubleshooting procedures to ensure the plant's reliability.

2.2.3 Electrical Engineering Department:

As an electrical and electronic engineering student, the Electrical Engineering Department was particularly intriguing. Here, I had the chance to delve into the design and maintenance of power distribution systems, transformers, and generators. I also participated in schematic diagram analysis and contributed to identifying areas for potential improvements.

2.2.4 Environmental and Sustainability Department:

The plant's commitment to sustainability was evident through its dedicated Environmental Department. I gained insights into the plant's efforts to minimize its environmental footprint by adhering to emission standards, waste management protocols, and adopting eco-friendly technologies.

2.2.5 Research and Development Department:

This department intrigued me with its focus on innovation. I participated in discussions about exploring new technologies for enhanced efficiency and cleaner energy production. These discussions highlighted the dynamic nature of the power generation industry and the ongoing pursuit of advancements.



Throughout my internship, I had the opportunity to work alongside professionals from each of these departments. This exposure not only broadened my understanding of the power generation process but also allowed me to witness the synergy that arises when diverse experts collaborate toward a common goal. In the following sections, I will delve into specific projects and tasks I engaged in within these departments, detailing the skills I acquired and the challenges I encountered along the way.

CHAPTER 3: GENERATION OF ELECTRICAL ENERGY

3.1 Thermal Power Plant

Introduction to Steam Turbine Power Plant:

A steam turbine power plant is a type of thermal power plant that generates electricity by harnessing the energy stored in steam. Steam turbines are widely used for their efficiency and reliability in converting thermal energy into mechanical work, which is then further converted

into electrical energy. This type of power plant is commonly employed in various industries and utilities to meet the increasing demand for electricity.

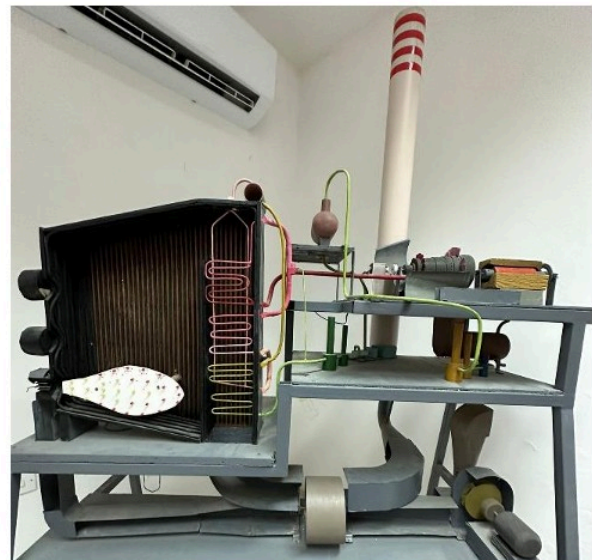


Figure 8 Real template of steam turbine (supervisor made presentation)

Plant Configuration and Components:

The steam turbine power plant you're inquiring about consists of two steam turbines, each with a capacity of 50 MW. What sets this power plant apart is its location near the sea, which plays a significant role in its cooling system. The plant follows a conventional Rankine cycle for power generation, with the following components:

- **Boiler:** The boiler generates high-pressure steam by burning fossil fuels such as coal, natural gas, or oil. The

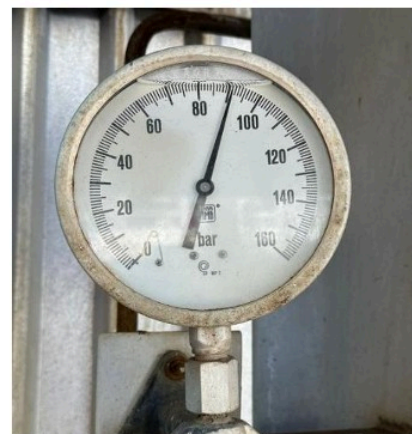


Figure 9 Pressure of the steam



heat released during combustion is absorbed by water, producing high-pressure, high-temperature steam.



Figure 11 Burning fuel inside the boiler

The fuel burns like the sun in the boiler and produces steam by evaporating the water passing through the metal tubes at high temperature and pressure.



Figure 10 Turbine Information

- **Turbine:** High-pressure steam (87 bar, 515 °C) from the boiler flows into the turbine's inlet. Inside the turbine, the steam's thermal energy is converted into kinetic energy, driving the turbine blades to rotate.
- **Generator:** The generator is connected to the turbine shaft and converts the mechanical energy from the rotating turbine into electrical energy using electromagnetic induction principles.



Figure 12 Generator Part of the Turbine



- **Condenser:** The low-pressure steam ($110\text{ }^{\circ}\text{C}$, 1 bar) exiting the turbine is condensed back into water in the condenser. This phase change releases latent heat, converting the steam back into water for reuse.



Figure 14 Condenser view from front

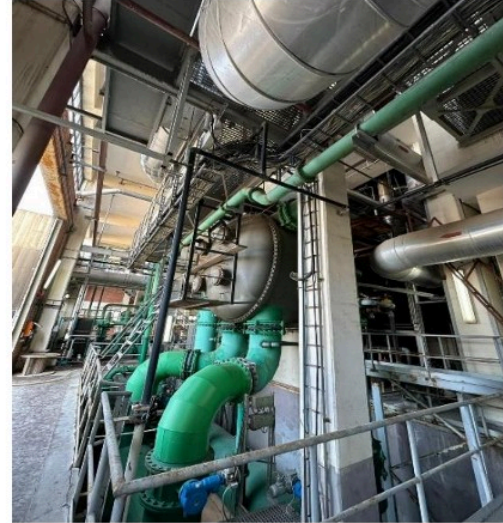


Figure 13 Condenser view from side

- **Cooling System:** Being located near the sea, this power plant employs the cold sea water for cooling. The condenser transfers the heat absorbed during condensation to the cold sea water, which in turn releases the heat into the sea. This efficient cooling process allows the cycle to restart by sending the condensed water back to the boiler.
- **Feedwater Pump:** The feedwater pump delivers water from the condenser to the boiler at high pressure, completing the water-steam cycle.
- **Operation and Efficiency:** The power plant operates by continuously circulating steam through the cycle. High-pressure steam generated in the boiler expands through the turbine, driving the generator to produce electricity. The condensation of low-pressure steam in the condenser completes the cycle. The plant's efficiency is influenced by various factors, including the efficiency of the boiler, turbine, generator, and auxiliary systems.



Advantages and Considerations: This steam turbine power plant offers several advantages, including its ability to utilize various fuel sources and its high efficiency. The use of cold sea water for cooling enhances the plant's efficiency and minimizes environmental impact. As with any power plant, regular maintenance and inspections are essential for safe and efficient operation.

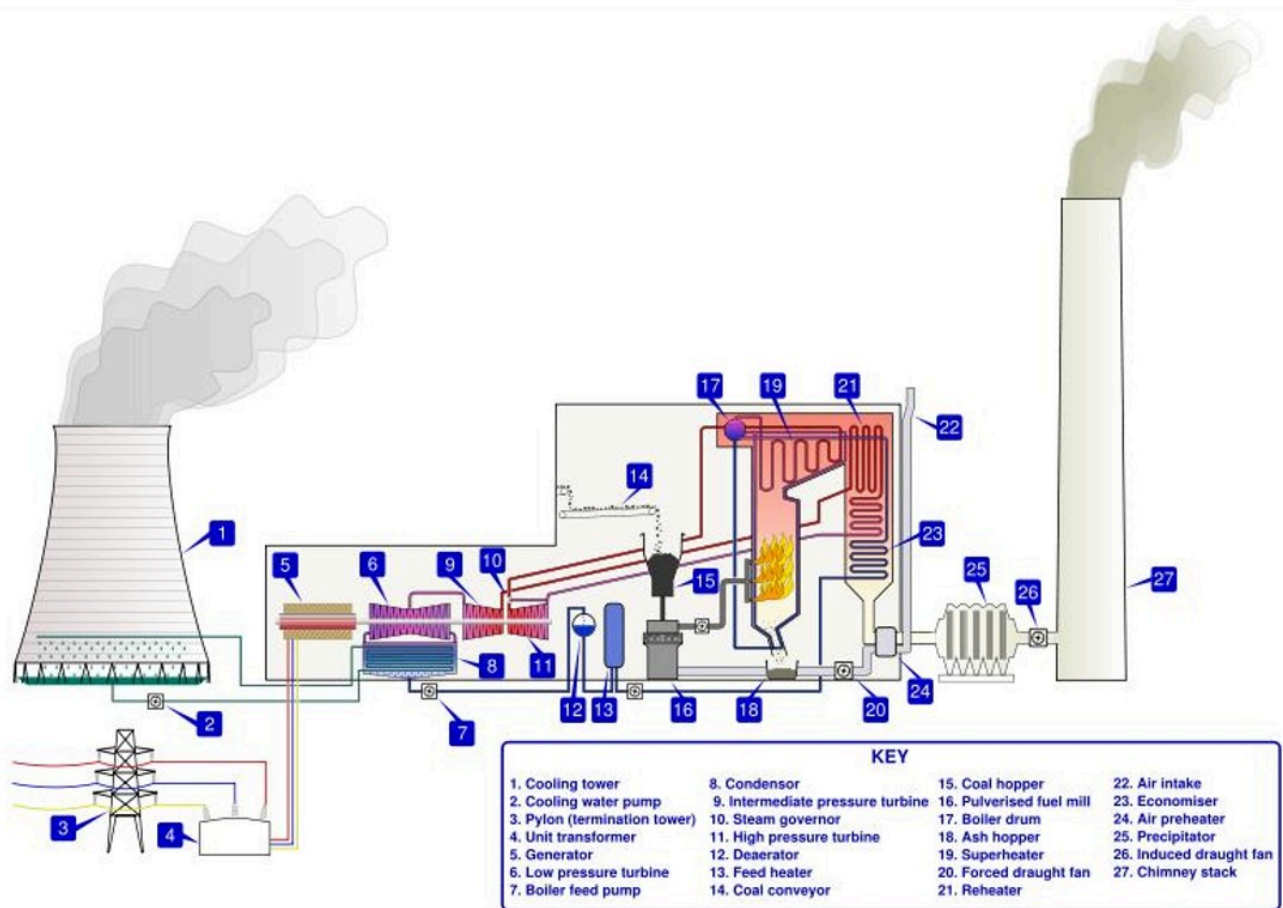


Figure 15 Demonstration of the Stream Turbine Logic



3.2 Diesel Generators

Diesel Generators in Teknecik Power Plant (17.5 x 8):

A diesel generator power plant is a type of facility designed to produce electricity using diesel engines coupled to generators. These power plants are commonly used as backup or standalone sources of electricity, particularly in areas with unstable or unreliable grid connections. Diesel generators are known for their quick start-up capabilities and relatively high efficiency, making them suitable for providing immediate power during grid outages or peak demand periods.

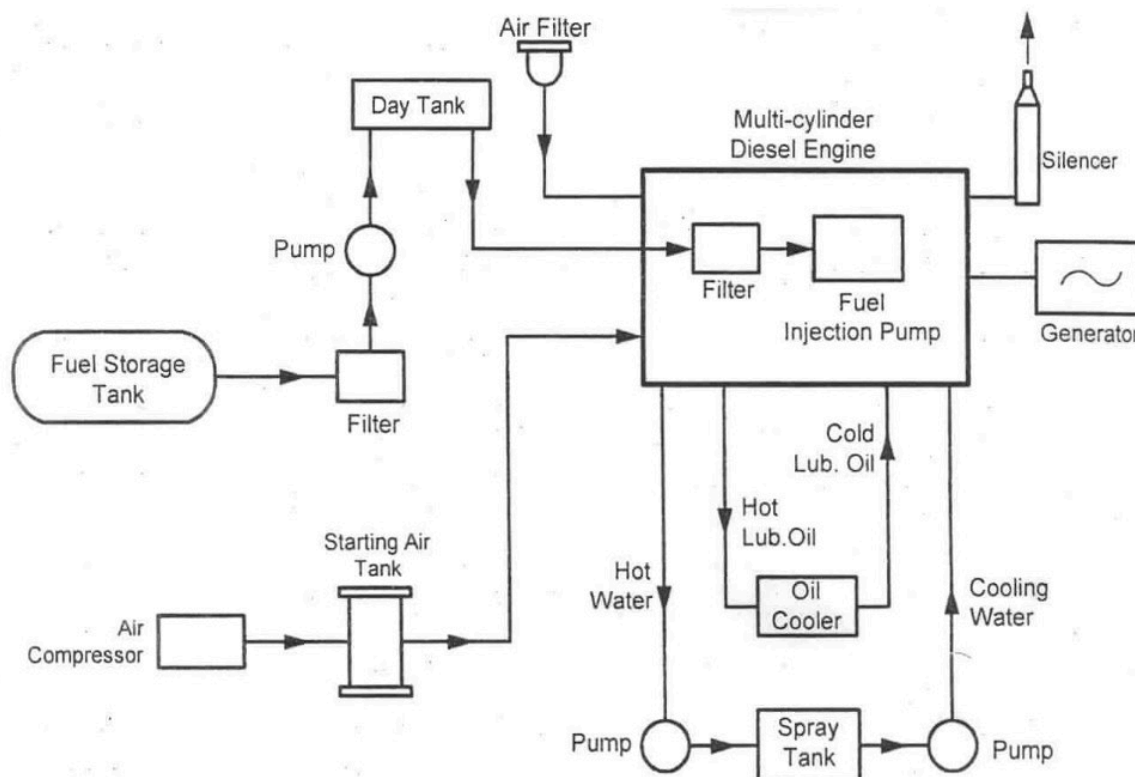


Figure 16 Demonstration of Diesel Generators



Technical Specifications:

The described diesel generator power plant comprises 8 individual generators, each with a capacity of 17.5 MW. This implies a total capacity of 140 MW for the entire power plant. The capacity of each generator refers to the maximum electrical power it can produce under optimal conditions.



Figure 17 Diesel Generator Chimneys
(8 Chimneys for 8 Generators)

Generator Components and Operation:

Each generator in the power plant consists of several key components, including a diesel engine and an alternator. The diesel engine is responsible for converting chemical energy in diesel fuel into mechanical energy through combustion. This mechanical energy is then used to drive the alternator, which converts it into electrical energy.

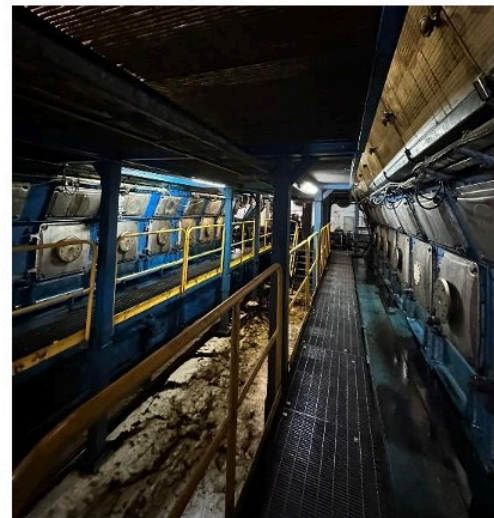


Figure 18 Inside view of the Diesel Generators

The process begins with the combustion of diesel fuel within the engine's combustion chamber. The controlled explosions of fuel-air mixture drive the engine's pistons, generating rotational motion in the engine crankshaft. This rotational motion is transmitted to the alternator through a mechanical coupling, causing the alternator's rotor to spin within a magnetic field. This motion induces an electrical current within the alternator's windings, resulting in the generation of electricity.

Control and Synchronization:

Efficient operation of a multi-generator power plant requires careful control and synchronization. Synchronization ensures that the generated electricity from each individual generator is in phase and frequency with the grid or other generators, allowing them to be connected in parallel. This is



Figure 19 Me while giving a helping hand (There is too much noise so that we need to use earplugs)



crucial to prevent issues like power surges or frequency mismatches that could damage equipment.

Modern diesel generator power plants use advanced control systems to monitor and manage each generator's output. These systems regulate fuel intake, monitor engine performance, manage load distribution, and ensure synchronization with the grid.

Maintenance and Environmental Considerations:

Regular maintenance of the generators is essential to ensure optimal performance and longevity. Diesel engines require routine checks, oil changes, and component replacements to prevent breakdowns and maintain efficiency. Additionally, environmental concerns such as emissions from burning diesel fuel should be addressed. Diesel engines emit pollutants like nitrogen oxides (NOx) and particulate matter, which can have adverse effects on air quality and public health. To mitigate these impacts, emissions control technologies and cleaner fuels can be employed.



Figure 20 Diesel Generator Chimneys

Regulations and Compliance:

The operation of a diesel generator power plant is subject to a range of regulations and compliance requirements to ensure safety, environmental protection, and reliable power generation. These regulations are typically established by governmental agencies and industry standards organizations. Here are some key areas of regulations that the described 8-generator, 17.5 MW diesel power plant would need to adhere to:



Figure 21 Diesel Generator Piston view in different location



- **Environmental Regulations:** Diesel generator power plants must adhere to emissions standards set by environmental agencies. These standards limit the number of pollutants that can be emitted from the combustion of diesel fuel. Regulations often include limits on nitrogen oxides (NOx), sulfur dioxide (SO₂), particulate matter, and other pollutants. Compliance may involve the use of emissions control technologies such as selective catalytic reduction (SCR) and diesel particulate filters (DPF) to reduce emissions to acceptable levels.
- **Noise Regulations:** Power plants can generate significant noise levels, which may impact nearby communities. Noise regulations set limits on the permissible noise levels at various distances from the plant. The power plant would need to implement noise-reducing measures such as acoustic enclosures, mufflers, and sound barriers to meet these requirements.
- **Safety Standards:** Diesel generator power plants are hazardous environments due to the presence of flammable fuels, high-voltage electricity, and rotating machinery. Occupational safety regulations mandate proper training for plant personnel, safe operating procedures, and the installation of safety features such as emergency shutdown systems, fire suppression equipment, and proper ventilation.
- **Grid Connection Regulations:** If the power plant is connected to the electrical grid, it must adhere to regulations governing grid synchronization, frequency regulation, and power quality. These regulations ensure that the power plant's output is stable and compatible with the grid, preventing disruptions and instability.
- **Zoning and Land Use Regulations:** The location of the power plant is subject to zoning regulations that dictate where industrial facilities can be situated. Compliance with these regulations ensures that the power plant is appropriately situated with regard to land use, environmental impact, and community planning.



- **Emissions Reporting and Monitoring:** Many jurisdictions require regular reporting of emissions data and monitoring of pollutant levels. Power plants may need to install monitoring systems to track emissions and demonstrate compliance with established limits.
- **Permitting and Licensing:** Establishing and operating a diesel generator power plant often requires obtaining various permits and licenses from regulatory authorities. These permits cover aspects such as air quality, water usage, land use, and construction.
- **Energy Efficiency Standards:** Some regions may have energy efficiency standards that power plants must meet. This might involve using energy-efficient technologies, adhering to efficiency benchmarks, or implementing demand-side management strategies.



Figure 22 Exhaust gas going through the chimney

Compliance with these regulations is crucial not only for legal and ethical reasons but also to ensure the safe and sustainable operation of the power plant. Power plant operators and owners must work closely with regulatory agencies to meet all necessary requirements and maintain a high standard of environmental stewardship and public safety.

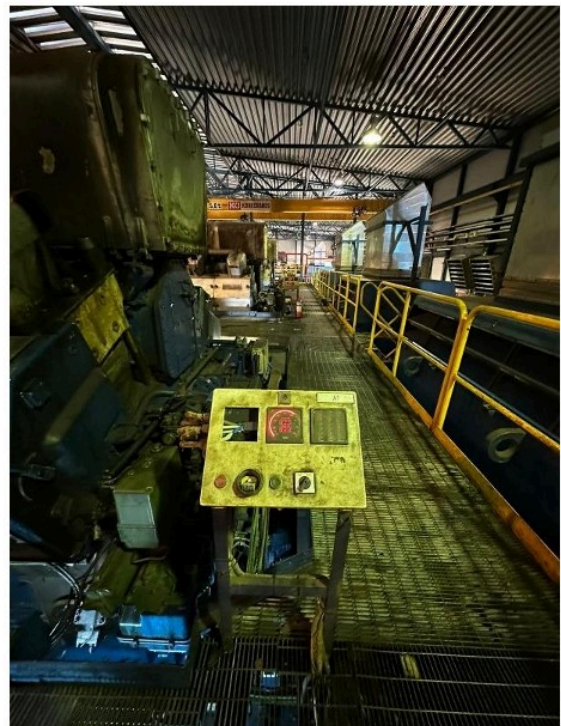


Figure 23 Generator Building inside



Fuel Separator Room

In a diesel generator power plant, the fuel separator room is an important area where they make sure the fuel used in the generators is clean and free from any impurities. This room has special machines and tools to filter out things like dirt and water from the fuel before it goes into the generators. This is really important because if the fuel has any dirt or impurities, it can cause damage to the generators and make them work less effectively. Skilled technicians work in this room to keep an eye on the equipment and make sure the fuel is always in good condition. This helps the generators run smoothly and keeps the power plant working well.



Figure 24 Fuel Separator Room

Circuit Breakers in Diesel Generators

There were some topics that I enjoyed learning like Circuit Breakers. Circuit breakers play a crucial role in electrical systems by interrupting the flow of current in case of faults or abnormal conditions.

Here's a comparison of circuit breakers used in diesel generators, specifically focusing on SF6 gas circuit breakers, and thermal vacuum circuit breakers used in thermal power plants:



Figure 25 Circuit Breaker with vacuum inside



1. SF6 Gas Circuit Breakers in Diesel Generators:

SF6 (sulfur hexafluoride) gas circuit breakers are commonly used in various applications due to their high dielectric strength and excellent arc-quenching properties. Here's how they relate to diesel generators:

- **Dielectric Insulation:** SF6 gas provides effective insulation between the contacts, preventing arcing and ensuring a safe interruption of the circuit.
- **Arc Quenching:** SF6 gas quickly absorbs the energy produced during arcing, cooling and extinguishing the arc. This property is essential for interrupting fault currents and protecting the generator and connected equipment.
- **Maintenance:** SF6 gas circuit breakers require regular maintenance to ensure proper functionality. Periodic checks on gas quality and pressure levels are necessary.



Figure 26 Circuit Breaker

Codrey Electronics

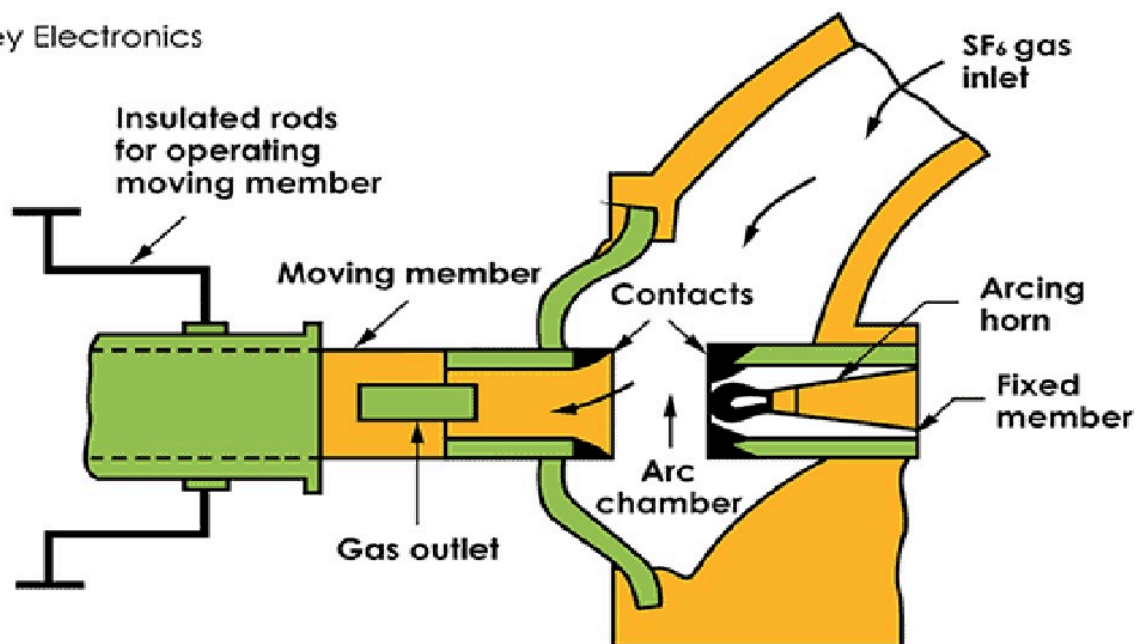


Figure 27 Circuit Breaker Logic



2. Thermal Vacuum Circuit Breakers in Thermal Power Plants:

Thermal vacuum circuit breakers are commonly used in power generation and transmission systems, including thermal power plants. They have unique features suited for these applications:

- **High Current Ratings:** Thermal vacuum circuit breakers can handle high current ratings, making them suitable for power generation environments.
- **Longer Interruption Time:** These circuit breakers are designed to handle sustained arcs associated with high inrush currents or faults in power generation systems.
- **Low Maintenance:** Thermal vacuum circuit breakers require less maintenance compared to SF6 gas circuit breakers. They don't rely on gas for insulation and arc quenching, simplifying the maintenance procedures.
- **Environmentally Friendly:** Thermal vacuum circuit breakers do not use greenhouse gases like SF6 gas, making them a more environmentally friendly choice.



Figure 28 Circuit Breaker Room

Considerations:

When selecting a circuit breaker for a specific application, factors like the type of fault currents, operational conditions, maintenance requirements, environmental impact, and cost-effectiveness should be considered. Each type of circuit breaker has its advantages and disadvantages, and the choice depends on the specific needs of the system.

In summary, while SF6 gas circuit breakers are effective for interrupting high-voltage currents and are used in various applications, thermal vacuum circuit breakers are preferred in thermal power plants due to their ability to handle high current ratings, longer interruption times, and lower maintenance needs.



3.3 Gas Turbines

Teknecik Power Plant features two gas turbines, each with a capacity of 25 megawatts (MW). These gas turbines are integral to meeting the electricity demands of the island. In a collaborative effort to address the energy needs of the region, the power plant was procured with assistance from



Figure 29 Gas Turbines

Turkey. The introduction of gas turbines significantly bolsters the plant's overall generating capacity, providing a reliable and efficient means of electricity production. This strategic investment not only enhances the island's energy security but also reinforces the partnership between North Cyprus and Turkey in the pursuit of a stable and sustainable power supply. The utilization of gas turbines represents a versatile approach to power generation, allowing for quick ramp-up times and responsiveness to fluctuating energy demands, which is crucial for ensuring uninterrupted electricity supply to the island.

Working Principles of Gas Turbines:

Gas turbines, often referred to as combustion turbines, are a versatile and efficient means of generating electricity. They operate on the Brayton cycle, a thermodynamic process characterized by four key stages: compression, combustion, expansion, and exhaust.



Figure 30 Gas Turbines inner view

- **Air Intake and Compression:** The process begins with the intake of atmospheric air into the turbine. This air is then compressed by a series of axial or centrifugal compressors, significantly increasing its pressure.
- **Combustion:** The high-pressure, compressed air is mixed with fuel (typically natural gas or diesel) and ignited in the combustion chamber. This combustion



Figure 31 Gas Turbines Pressure Room



process releases a tremendous amount of thermal energy, creating a high-velocity stream of hot gases.

- Expansion: The high-velocity hot gases are directed through a series of turbine blades. As they pass over these blades, the gases' kinetic energy is converted into mechanical energy, causing the turbine shaft to rotate rapidly.
- Electricity Generation: The rotational motion of the turbine shaft is harnessed by a generator connected to it. This mechanical energy is converted into electrical energy using electromagnetic induction principles. The resulting electricity is then integrated into the power grid for distribution.

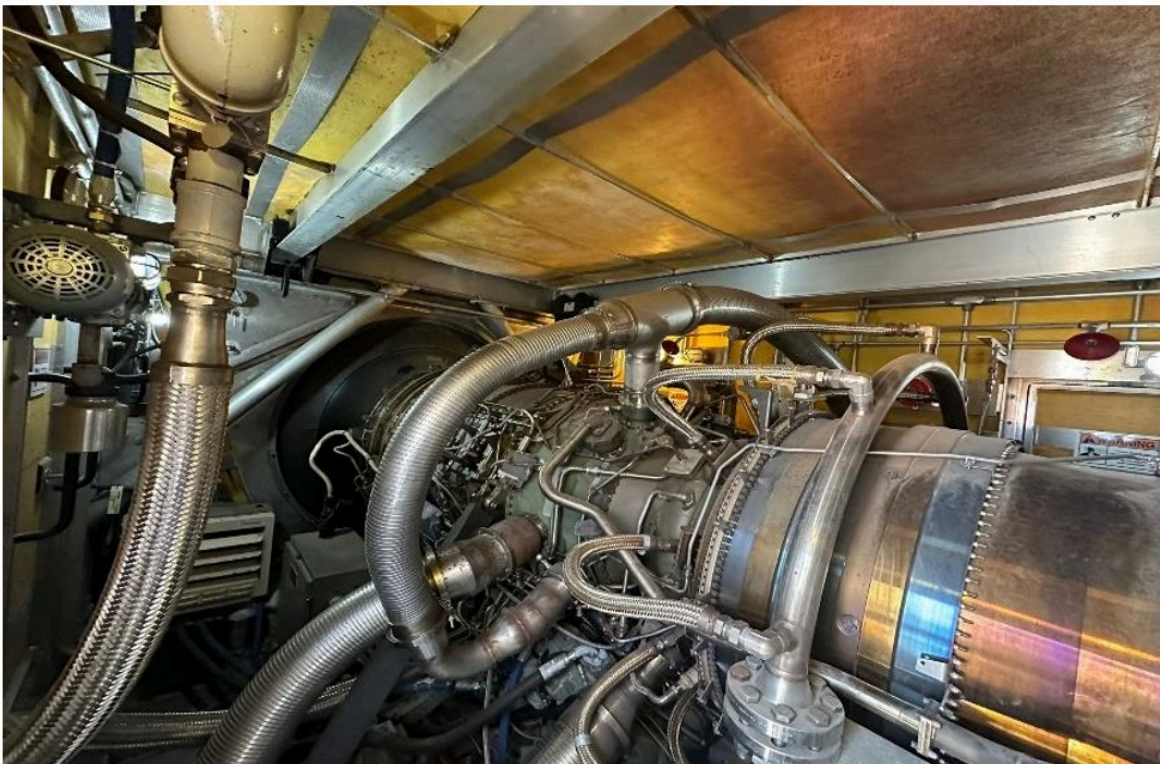


Figure 32 Closer view of turbines

I watched the engineers at the power plant doing their tasks. It was like they were the brain behind the big machines, especially the gas turbine. They made sure everything ran smoothly and safely.

First, they paid close attention to how fast the turbine was spinning. It was important to them that it stayed just right, not too fast or too slow. They said this was how the turbine made



electricity effectively. Then, they talked about making the turbine produce the right amount of electricity. It seemed they could control it like a knob, adjusting how much fuel and air went in. This way, the turbine could give out the exact amount of power needed.

I saw them checking the temperatures all the time. They wanted to make sure the turbine didn't get too hot, which could be a problem. If it did start to heat up, they did something to cool it down.

They also made sure the fire inside the turbine was just right. It was like they were chefs, mixing the fuel and air in a way that made the turbine work efficiently and safely.

I learned that they kept an eye on what came out of the turbine's tailpipe, too. They wanted to make sure nothing bad for the environment came out of there. When they wanted to turn the turbine on or off, they followed a specific order of steps. It was like a careful dance to do it safely without any issues.

Safety was a big deal for them. They had features to protect the turbine from things like spinning too fast or getting too hot. It seemed like they were always ready to step in and keep things safe.

They also made sure the turbine worked well with the electrical grid, which was like a big web of electricity. They wanted to make sure the turbine fit in perfectly with the rest of the grid. I saw them checking the turbine's health all the time. They looked at screens and numbers to make sure everything was okay. If they saw something not quite right, they fixed it before it got worse.

In some parts of the power plant, they could control everything from a room with lots of screens. It made things easier because they didn't have to be right next to the machines all the time. So, those engineers were like the guardians of the turbine. They made sure it worked its best, stayed safe, and followed all the rules. It was pretty cool to see how they made electricity happen!



Figure 33 Control Room of Gas Turbines

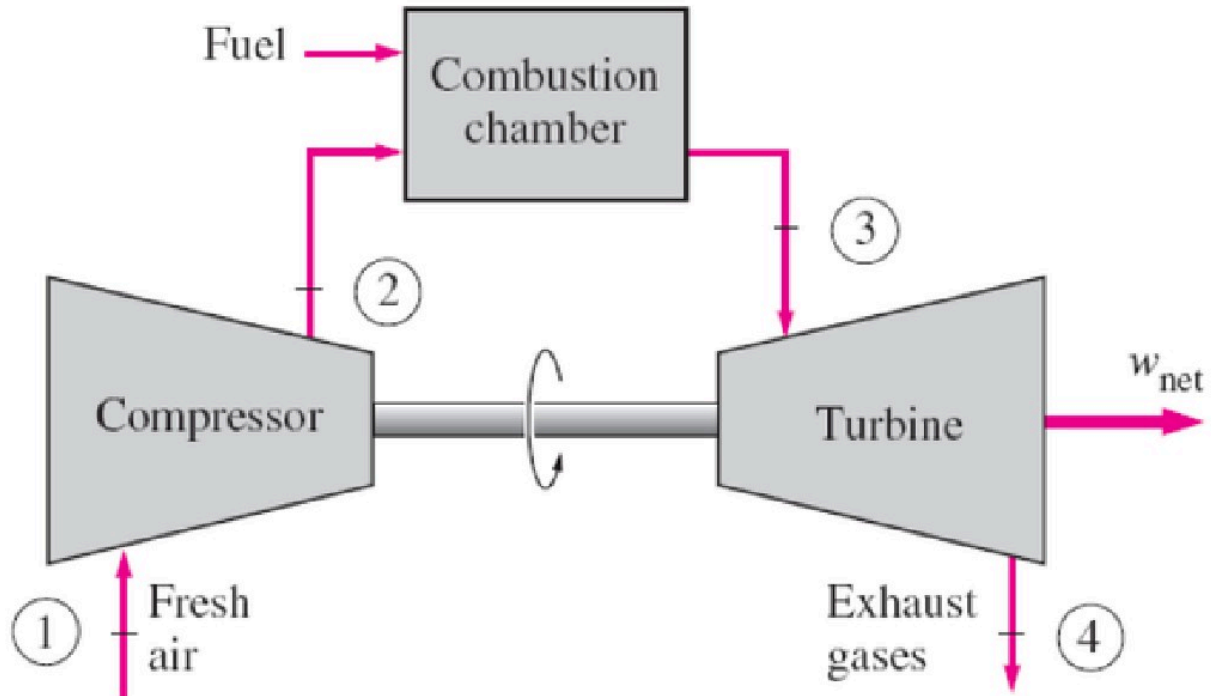


Figure 34 Demonstration of the Gas Turbines

CHAPTER 4: STUDIES AND EXPERIENCES

Gas turbines are known for their quick startup times and the ability to rapidly adjust their power output to meet changing electricity demands. This flexibility makes them valuable assets in maintaining a stable and reliable electrical supply, especially in regions where energy requirements can vary significantly. Additionally, their high thermal efficiency and relatively lower emissions make them an environmentally favorable choice for power generation.

AC Motor Maintenance and Repair:

AC motors are used in Teknecik power plant for various critical tasks, such as driving air compressors that regulate air supply for combustion, operating pumps to transport fluids like fuel, water and coolant throughout the plant, driving fans for cooling systems, powering conveyor belts for material handling, and controlling the movement of valves and dampers that regulate fluid flow and system processes, ensuring efficient and smooth operation of power generation and distribution processes.



Figure 35 AC motor



I would like to talk about the AC motor replacement that we did so many times in Fuel Oil tanks. Since there are three giant fuel oil tanks in the power plant, it needs high amount of power to transport fuels to the turbines.



Figure 36 AC Motor

During a part of my internship, I participated in the maintenance and repair of AC (Alternating Current) motors, which play an important role in the power generation of the plant. AC motors serve as a fundamental component in energy conversion. This experience provided the opportunity to learn the maintenance strategies necessary to maintain the healthy functioning of the engines.

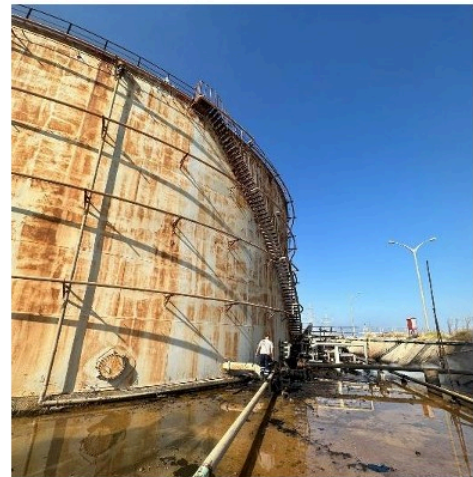


Figure 37 Fuel Tanks

Taking care of AC motors in a power plant involves a set of important steps to make sure the motors work well and last a long time. First, people need to look at the motors often to see if anything is broken or looks strange. They should check if wires are connected properly, if the motor is getting too hot, if it's shaking in a strange way, or if there are any leaks of liquids.

The motors also need to be kept greased up. This means putting a special kind of slippery stuff on the parts that move. But it's important to use the right amount – not too much and not too little. If there's too much grease, it can cause problems too.



Figure 38 AC motor Coil making



People should also watch the temperature of the motors. They can use tools that tell them if the motor is getting too hot. If it is, it could mean there's a problem with how it's cooling down.

Another thing to do is to see if the motor is shaking more than it should. Shaking too much might mean that the motor's parts aren't lined up correctly or that something is off balance.

The wires and connections in the motor need to be checked as well. Sometimes, the metal parts can get rusty or too loose, which can be dangerous. If they're not in good shape, they should be fixed.



Figure 39 Heating Bearing with Electromagnetic Induction

It's important to keep the motor and the area around it clean too. Dust and dirt can make the motor get too hot, so cleaning it helps it stay cool and work better.

If the motor has a fan or something that cools it down, that needs to be checked and cleaned too. If it's not working like it should, the motor could get too hot.

The parts that help the motor spin, called bearings, need to be looked after. They should be checked and greased to keep them from wearing out.

Making sure the motor is in line with the other machines it's connected to is also important. If it's not lined up right, it can cause problems for the motor and the machines it works with.

People should also remember to work on the motor when it's not too hot, so they don't get hurt. And if something goes wrong unexpectedly, they need to have a plan to fix it quickly.

In short, taking care of AC motors in a power plant means regularly looking at them to catch any issues, making sure they're greased properly, checking their temperature and vibrations,



and keeping everything clean and in good condition. This helps the motors run well and prevents bigger problems down the line.

Diesel Generator Transformer Maintenance:

Maintaining diesel generator transformers is crucial to ensure reliable and efficient power generation. Here's an overview of the maintenance process, including the use of silica gel for moisture control:

Visual Inspection: Regular visual inspections are conducted to identify any visible damage, leaks, or signs of wear on the transformer, such as rust, corrosion, or loose connections.

Oil Analysis: Oil samples are collected from the transformer for analysis. This helps assess the condition of the insulation, detect any contaminants, and monitor degradation over time.

Dissolved Gas Analysis (DGA): DGA is performed to detect and analyze the presence of gases dissolved in the oil. Abnormal gas levels can indicate potential internal issues within the transformer.



Figure 40 Step up Transformers to transport electricity easily

Insulation Resistance Test: This test measures the insulation resistance between windings and between windings and ground. It helps evaluate the insulation's condition.

Winding Resistance Test: The winding resistance is measured to identify any changes that could indicate deteriorating winding connections or internal faults.

Cooling System Inspection: Cooling systems, such as radiators and fans, are inspected and cleaned to ensure proper heat dissipation.

Conservator Inspection: The conservator, which manages the oil level in the transformer, is checked for leaks and proper operation.

Silica Gel Usage: Silica gel packets are placed within the transformer housing to absorb moisture and prevent condensation. This helps maintain the insulation's dielectric strength and reduces the risk of insulation breakdown due to moisture.

Bushings Inspection: Bushings are checked for any signs of damage, leakage, or wear. These components facilitate the electrical connection between the transformer and external equipment.



Tap Changer Inspection: If the transformer has a tap changer, it is inspected and tested to ensure its proper operation for adjusting the voltage ratio.

Control and Protection System Check: Control panels and protection systems are inspected to ensure they function correctly and respond to abnormal conditions.

Documentation: All inspection results, test data, and maintenance activities are documented for future reference and analysis.

Repairs and Replacements: If issues are detected, necessary repairs or component replacements are carried out to restore the transformer's proper function.

Moisture Control: In addition to silica gel, other moisture control methods, such as breathers, can be employed to maintain low moisture levels in the transformer's oil and insulation.

Regular maintenance not only extends the lifespan of diesel generator transformers but also ensures their safe and efficient operation. The use of silica gel and other moisture control measures plays a significant role in preventing moisture-related issues and maintaining the insulation's integrity.

SOME POINTS THAT TOOK MY INTEREST

In the production area, a low-pressure air flow pump is placed between the pipes before the main electrical outlet passes through the transformer to prevent moisture accumulation and corrosion.

Since the power plant is by the sea, a ship is used for fuel exchange. After the ships approach the land, they are fixed with the help of divers. This oil is then transferred to the power plant through long pipes under the sea. Diver's measure because of the kinetic energy that will be created by the friction of the ships. Avoiding this kinetic energy eliminates the risk of flare-ups.



CHAPTER 5: CHALLENGES AND SOLUTIONS

5.1. Dealing with Daily Challenges at the Power Plant:

During my time at the Teknecik Thermal Power Plant, I learned how to handle everyday issues that pop up in the plant. Power plants can have unexpected problems, so I had to be ready to fix things quickly. Here's how I managed these situations:

I noticed the importance of keeping an eye out for anything unusual that could cause problems in the plant. I watched the equipment closely and paid attention to any signs that something might go wrong. If I spotted a small issue, I tried to fix it before it turned into a bigger problem.

Teamwork was key when something went wrong. I worked closely with people from different parts of the plant. We talked a lot to figure out what caused the problem. Getting input from experts in different areas, like operations and maintenance, helped us find the best solutions.

When we found out what was wrong, I helped figure out how to fix it. I used tools to check what was going on and used what I learned to pinpoint the problem. After we knew what it was, we worked together to make things better.

After we fixed a problem, I watched to make sure it didn't happen again. This was important to make sure everything stayed okay. We wanted to make sure the problem was really solved.

I also wrote down everything we did. This was important to remember what happened and what we did to fix it. It helped the team know what to do if the same thing happened again. Learning from what happened before made us better at dealing with issues.

Handling everyday problems at the power plant improved my problem-solving skills and taught me how to handle pressure. Teamwork, talking openly, and finding solutions were the most important things I learned. This experience made me better at understanding technical things and showed me the value of being ready for anything in the world of electrical engineering.

Cooling System Trouble: Once, the cooling system for a machine started making strange sounds. I checked the system, and it turned out that a part was loose. I tightened it, and the noise stopped.

Power Outage Investigation: On a windy day, the power went out in one part of the plant. I had to find out why. I checked the electrical connections and found a loose wire due to the wind. I fixed the connection, and the power came back.



Motor Overheating: One of the motors was getting really hot. I had to figure out why it was happening. I checked the cooling fans and saw that they weren't working properly. I cleaned them and got them working again, which helped the motor cool down.

Alarm Trigger: Sometimes, an alarm would go off unexpectedly. I needed to find out why. It turned out that a sensor was dusty, which made it give wrong signals. I cleaned the sensor, and the alarm stopped going off.

5.2 Risks

The power plant is located near the sea in North Cyprus, there can be certain drawbacks associated with this specific coastal location:

- **Corrosion Risk:** Being close to the sea exposes the power plant's structures and equipment to saltwater, which can accelerate corrosion and lead to increased maintenance costs and reduced equipment lifespan.
- **Salt Deposition:** Salt particles carried by sea breezes can deposit on surfaces, causing wear and tear on equipment, reducing efficiency, and potentially leading to premature failures.
- **Cooling System Challenges:** Seawater used for cooling purposes can contain impurities that contribute to fouling and scaling in cooling systems, reducing the effectiveness of heat exchange and requiring more frequent cleaning.
- **Environmental Impact:** The discharge of heated seawater back into the sea after being used for cooling can alter local marine ecosystems, potentially harming marine life and coastal water quality.
- **Infrastructure Vulnerability:** Coastal areas are more susceptible to the impacts of storms, hurricanes, and rising sea levels, which could result in damage to the power plant and disruption of operations.



- **Public Opposition:** Proximity to residential areas might lead to concerns about noise, emissions, and potential health risks, which could result in opposition from local communities.
- **Regulatory Compliance:** Coastal power plants might need to adhere to stricter environmental regulations due to their potential impact on marine and coastal ecosystems.
- **Maintenance Challenges:** Frequent exposure to saltwater and humidity can lead to increased wear and tear on equipment, requiring more frequent maintenance and replacement of parts.
- **Aesthetic Impact:** Coastal power plants, particularly those with visible emissions, could impact the scenic beauty of the coastline and local tourism.
- **Emergency Response:** Coastal locations might face challenges during extreme weather events, making emergency response and recovery efforts more complex.
- **Infrastructure Costs:** Building and maintaining the necessary infrastructure to handle seawater intake, cooling, and discharge can add to the overall costs of the power plant.
- **Permitting and Approval:** Regulatory agencies may require more stringent permits and approvals for power plants located near sensitive coastal areas, adding to project timelines and costs.
- **Erosion and Land Degradation:** Coastal erosion and land degradation due to natural processes or human activities could impact the stability of the power plant's foundations and surrounding infrastructure.



Figure 41 Control Panel



Mitigating these potential drawbacks could involve using corrosion-resistant materials, implementing effective cooling water treatment systems, adhering to environmental regulations, and engaging with local communities to address concerns and ensure transparency.

CONCLUSION AND EVALUATION

In conclusion, my internship experience at the power plant as a candidate engineer has been an invaluable opportunity for professional growth and practical learning. Over the course of my internship, I have gained a comprehensive understanding of the intricate workings of power generation systems and their underlying components. The exposure to various departments, hands-on tasks, and collaborative projects has not only deepened my theoretical knowledge but also honed my problem-solving skills in real-world scenarios.

One of the significant highlights of my internship was the exposure to air compressors and their pivotal role within the power plant's operational framework. Learning about the different types of compressors, their components, and the intricacies of maintenance has equipped me with crucial insights that are directly applicable to ensuring the plant's operational efficiency and reliability. Through active participation in maintenance routines, performance analysis, and troubleshooting exercises, I have witnessed the tangible impact that diligent maintenance practices have on optimizing the compressors' functionality and extending their operational lifespan.

I believe my contributions during this internship, including my dedication to following maintenance protocols, keen attention to detail during inspections, and active engagement in collaborative projects, have demonstrated my commitment to the power plant's success. Furthermore, the guidance and mentorship provided by the experienced professionals on the team have been instrumental in shaping my practical skills and professional demeanor.



Figure 42 Me and my colleague



As I reflect on my internship journey, I am confident that the knowledge acquired and the experiences gained will significantly contribute to my academic and professional pursuits. This internship has not only provided me with insights into the power generation industry but has also fostered a sense of responsibility towards maintaining critical equipment and systems.



Figure 43 Me and my friends in the first day of internship

Moving forward, I am eager to continue building upon the foundation laid during this internship, seeking further opportunities to refine my technical skills and contribute meaningfully to future endeavors. I am deeply grateful for the chance to have been part of the power plant team and look forward to the continued growth that lies ahead in my engineering career.



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