ASIA PACIFIC UNIVERSITY OF TECHNOLOGY AND INNOVATION SCHOOL OF ENGINEERING

ENGINEERING INDUSTRIAL PLACEMENT REPORT

An Industrial Placement report submitted in partial fulfilment of the requirement of

For the degree of
BEng (Hons) in Electrical and electronic Engineering

Student Name:	DAMIAN ETIENNE ERNESTA
Student TP:	TP064815
Intake:	APD4F2411EEE
Company Name:	Public Utilities Corporation (PUC) Seychelles.
Company Address:	Electricity House, Roche Caiman, Mahe, Seychelles

Clearance form

EE026-6-3-Industrial Placement Handbook

Appendix 8

INDUSTRIAL PLACEMENT CLEARANCE FORM

This form must be given to the company supervisor for clearance. Please ensure that this form is attached to your Report.

Student's Particulars	
Name of Student	DAMIAN ETIENNE ERNESTA
Department (School)	ENGINEERING
Student ID No	TP064815
Intake (Year 3)	APD3F2308EEE
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Company Details	
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Contact Person (Supervisor)	William Joubert
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Industrial Placement Report Clearance by Company Supervisor

Signature	**Company Stamp**	**Date**
SAA	PUBLIC UTILITIES CORPORATION P.U.C	25/11/14

Note: If the company wishes to have a copy of the report, the arrangement is left between the company and the trainee.

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Summary report

My name is Damian Etienne Ernesta, I am an electrical and electronics engineering student. I completed my 16 weeks internship at a company named Public Utilities Corporation (PUC) Seychelles. I was attached in different sections such as Inspectorate Section, Planning Section, Distribution and Underground Construction Section, Underground Project Section, Power Station C Operations, Power Station C Maintenance (Mechanical Section), Power Station C Maintenance (Electrical Section), Wind Turbine Section, and Solar PV Section.

In the Inspectorate Section, I learned about how the single and three phase meters is programmed and tested before it is deployed to customers, as well as solar panel meter how it is installed at customers home. I also got a chance to see newly smart meters in development phase, which gives the company authority to connect and disconnect customers immediately without being on site at customers house. I participated in underground cables fault detection for faulty cable joints using equipment's from BAUR cable test vans and system, the method used was Arc Reflection Method (ARM). Additionally, I gained hands on experience while performing electrical safety tests at well known hotels, test performed included loop impedance test, perspective short circuit (PSC) test, polarity test, voltage measurements and phase rotation which all complied with BS 7671 standards. These activities showed me the importance of precision and following safety standards in electrical engineering.

In the Planning Section, I was introduced to different processes of how service connections requested from customers are designed using Geographic Information Systems (GIS). I was tasked in preparing some electrical drawings and got help wherever needed, ensuring the electrical drawing complied with safety regulations for overhead and underground cables. Moreover, I participated in site visits for inspections to see if new installations comply with regulations, and I helped in drafting some Service Connection Enquiries (SCE) for customers. These activities showed me the importance of proper planning and design in ensuring efficient and safe power distribution in the industry of electrical engineering.

In Distribution and Underground Construction Sections I got knowledge into how substations and respective electrical components such as transformers, switch gears, smart relays and breakers operate and maintain. I also seen how overhead transmission cable on electric poles is connected for new connections or maintained. I saw the testing of transformer insulation, and switchgear maintenance. I saw an additional replacement of faulty cable joints using the Arc Reflection Method (ARM), working with inspectorate division, and conducted insulation tests to verify the integrity of high-voltage cables. These activities enhanced my knowledge of power transmission systems and their weaknesses.

In the underground project section, the focus was on maintaining and commissioning new substation. I helped in joint repairs, low-voltage cable adjustments, and substation

maintenance, including grounding procedures and working on SF6 DMI panels. This experience provided hands-on exposure to underground cable systems, safety protocols, and fault finding techniques.

In power station C, the experience provided me with an overview of power generation processes. I saw how the SCADA system works in operations, monitored generator performance, and assisted in the maintenance of critical components of generators such as turbochargers and fuel pumps. Additionally, during those activities I gained practical experience in testing electrical equipment like three phase motors and relays.

Finally, in the Renewable Energy Section I worked on the maintenance of solar PV systems and wind turbines. At the solar farm on Ile de Romainville, I helped in doing RISO insulation tests and leakage current measurements on PV panels and inverters. Maintenance tasks on the wind turbines included greasing rotor bearings, tensioning generator bolts, and replacing backup batteries. These activities showed me the importance of renewable energy systems in achieving sustainability goals and the technical difficulties involved in their maintenance.

The number of activities and exposure to numerous sectors enabled me to experience some areas of electrical engineering, including generation, transmission, distribution, and renewable energy. I gained a greater understanding of safety regulations and procedures in the energy sector operations and ability to adapt to new challenges, which are important in maintaining the accuracy and effectiveness of electrical systems. This internship was an amazing experience, connecting university studies with work in the industry. It gave me my confidence to make important contributions to this industry while promoting an active dedication to lifelong learning and innovation. I am excited to use the skills and knowledge gained from my internship in my future studies and to contribute positively to the practice of electrical and electronics engineering.

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CHAPTER 1: Business Report

This report provides an overview on the company named Public Utilities Corporation (PUC) Seychelles which is a government owned company responsible for production, transmission and distribution of electricity, water production, and wastewater services across the Seychelles. The company was established under the Public Utilities Corporation Act of 1986 as seen in (PUC, 2023). PUC makes sure that the delivery of essential utilities is reliable while promoting sustainability. During my 16-week internship, I worked in various departments in the electricity sector, including Inspectorate Section, Planning Section, Distribution and Underground Construction Section, Underground Project Section, Power Station C Operations, Power Station C Maintenance (Mechanical Section), Power Station C Maintenance (Electrical

Section), Wind Turbine Section, and Solar PV Section. Which all helped me gained insight into the corporation's operations and contributions to Seychelles development goals.

Since the company was established in 1986. PUC has been responsible for being the main electricity and water utility provider in Seychelles. PUC operates in three main sectors, such as electricity, water, and wastewater. The organization with about 1,200 individuals oversees a large infrastructure, including power stations, desalination plants, and renewable energy wind turbines and solar farms. Serving over 45,000 electricity and 37,000 water customers as of 2023, as seen in (PUC, 2023). Factoring in the fact that Seychelles has only a population of a hundred thousand people. The aim of the company is to deliver cost effective, and reliable utility services while supporting national sustainability goals. Achieved a revenue of SCR 1.87 billion in 2023, with SCR 95.8 million in profit. The corporation has progressively expanded its operations to include renewable energy sources, aligning with the government's goal of achieving 15% of energy production from renewables by 2030.

PUC is the only utility provider in Seychelles, therefore putting itself in a unique environment, which can be an advantage and a disadvantage. The challenges faced firstly are that Seychelles itself is made up of an island archipelago far from major cities and countries, which puts a toll on having high taxes to import fossil fuel because of the need for fossil fuel to generate electricity. Secondly, with the rise of material it has made it costly to maintain and expand generating capacity for growing demand. But despite these challenges, PUC has made significant efforts to seize its opportunities to use renewable energy project instead of fossil fuel generators for capacity expansion. Such as 5.8 MW floating solar PV plant and staying committed to increasing renewable energy share from 4.92% in 2023 to 15% by 2030, as seen in (PUC, 2023). By maintaining its position as a monopoly in the energy market by being the soul provider of utilities in Seychelles, the company has maintained a consistent income while being efficient and reliable.

The key areas and departments within PUC are as followed, firstly Electricity Generation, Transmission and Distribution which deals with multiple power stations, grid operations, and renewable energy integration. With also an ongoing motivation for upgrades to improve capacity and efficiency. Secondly, Water Supply and Treatment which deals with providing clean water to customer through dams from La Gogue Dam and from desalination treatment plants. Thirdly, Wastewater Management which deals with sewage systems and treatment facilities to help with environmental protection. Lastly, Renewable Energy Division deals with wind turbines and solar PV farms at Ile de Romainville while integrating that clean energy into the grid. The solar and wind generations can be closely monitored using SCADA for real-time monitoring.

My internship exposed me to several technical and operational tasks spread among several PUC departments in the electricity division. Every department is believed to be essential in guaranteeing the generation, transmission, distribution and integration of electrical power. My participation from the internship gave me some understanding of their main purposes and their contribution to PUC general goal of giving customers dependable and sustainable electricity supply. The Inspectorate Section ensures that the industry standards and customer safety is maintained through activities such as meter installations and underground cable fault inspections. I saw the programming of smart meters for efficient connection and the conduct of safety tests for products that meet the BS 7671 standard. The Planning Section is responsible for the development of new service connections and network expansion and uses GIS to

generate accurate overhead and underground cable mapping. I participated in site visits for inspections and the creation of electrical drawings.

The Distribution and Underground Construction Section is responsible for the management of electricity transmission lines with emphasis on the substations, transformers and underground cables. The Underground Project Section deals with the installation of high voltage underground cables and the management of substations, with fault finding techniques for fault detection and commissioning. At Power Station C, I have seen the monitoring of generators through SCADA and the details of generator maintenance. In the Mechanical and Electrical Maintenance Sections which are in charge with the maintenance of mechanical parts and electrical systems for the generators. In the Wind Turbine and Solar PV Sections, I helped in the checking and maintenance activities which are both crucial in achieving PUC renewable energy objectives.

PUC Seychelles has implemented some form of communication and IT systems to improve the performance of the organization and the quality of service to the consumers. The company is also enhanced through meetings and other forms of communication as well as through the Employee Representative Committee that was formed in 2023 to represent the employee's concerns. PUC also interacts with the customers through a digital portal where they can report and request for services, make bill payments, and receive outage. Also, PUC has made improvements in digital transformation, such as SCADA for managing electricity in real time and inclusion of renewable energy information to enhance grid integration and management, and finally GIS for planning of new infrastructure.

Due to customer tariffs, government subsidies and international funding, PUC can run its company and has made a revenue of SCR 1.87 billion and profit of SCR 95.8 million in the year 2023. Some of the strategic investments that have been made in the infrastructure include the 33kV South Mahé Project that helped in cutting down the transmission losses from 16% to 6%, the La Gogue Dam was also expanded which enhanced the water storage capacity of the dam by 60%, as seen in (PUC, 2023). These initiatives were financed with the help of international financial institutions such as the European Investment Bank (EIB), the French Development Agency (AFD) among others and renewable energy projects including a 5. 8MW floating solar PV plant. Due to the increase in the operation cost PUC is still financially stable due to tariff analyses, the ability of the utility to provide sustainable energy at an affordable cost to the customers and this is in line with the company's long term environmental goals.

My internship at PUC Seychelles made me gain a better insight into the working of the organization and the part it plays in the development of Seychelles. Looking at renewable energy projects to the power station maintenance, PUC's actions prove the organization's focus on sustainability and progress. This experience has also helped me gain a better perspective on utility management and has also made me want to be more involved in the electrical energy sector.

CHAPTER 2: Technical Report

The Public Utilities Corporation (PUC) Seychelles is a government owned company responsible for production, transmission and distribution of electricity, water production, and wastewater services across the Seychelles. In my 16 weeks of internship at PUC, I was able to be exposed to several departments where I was able to learn practical application of various

technical concepts in power generation, distribution and renewable energy systems. This report aim is to describe the technical tasks carried out in Inspectorate Section, Planning Section, Distribution and Underground Construction Section, Underground Project Section, Power Station C Operations, Power Station C Maintenance (Mechanical Section), Power Station C Maintenance (Electrical Section), Wind Turbine Section, and Solar PV Section. Also discussing the engineering challenges faced, and the solutions proposed during the internship.

Inspectorate Section:

In the Inspectorate Section, I was exposed to several activities that are directly related to safety and compliance during my time there. I learned how to program and test single phase and three phase meters to make sure that they are in good condition before being given to customers. This included setting up meters for solar panel systems for residential use and as well as smart meters with remote connect and disconnect feature. Also, I was involved in underground cable fault detection scenarios whereby the Arc Reflection Method (ARM) were used by using BAUR equipment. The location of the faults in high voltage cables was established in order to enable proper repair. I also personally carried out detailed electrical safety testing of some of the country's best known hotels including loop impedance, polarity and phase rotation tests all done by following the BS 7671 standard. These tasks also highlight how small errors can lead to big problems when it comes to ensuring that electrical installations are safe and reliable.

A big problem that was identified in the Inspectorate Section was the detection and management of faults in underground cables particularly cable joints that caused intermittent power failure. The problem was that it was impossible to determine the exact locations of the faults in the vast underground network. To this end, the Arc Reflection Method (ARM) was adopted, and this was done using BAUR cable testing equipment. This technique involves applying high voltage pulses to the cable in order to break down the cable at the fault location and cause an arc. The arc creates a characteristic pattern in the waveform and this is captured by the test equipment.

The process started with an initial insulation resistance (RISO) test to check if the cable would be capable of withstanding the diagnostic pulses without being damaged further. The cable was inspected and deemed safe for testing after which ARM was conducted. From the reflected waveforms I was able to determine the time it took for the pulse to be generated and the time it took for the pulse to return, and this gave me the distance to the fault. A TDR (Time Domain Reflectometer) function was incorporated in the ARM system and the cable's propagation velocity was calibrated to enable accurate measurement. These include changes in waveform features for instance sharp peaks or dips which helped in determining the exact location of the fault. The faulted segment was then identified and the necessary repair work including joint replacement was done to ensure that the cable was in good condition.

This approach helped in accurate fault localization and thus reduced the time and effort needed for fault isolation as compared to conventional techniques. Then the effectively repaired cables helped to enhance system reliability and prevented frequent interruptions in the supply of power to customers. This experience helped to increase my technical knowledge in cable fault finding and underlined the importance of the application of sophisticated diagnostic methods in managing power transmission networks.

Planning Section

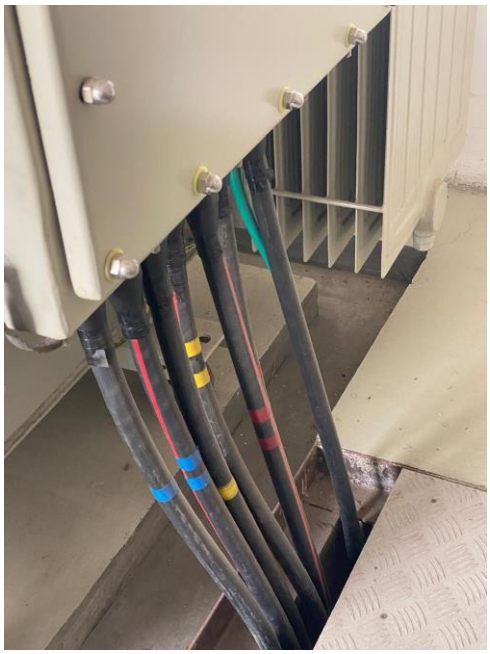
During my time in the Planning Section, I worked on developing service connections for customers and making sure that they met the safety and legal requirements. GIS was used in creating electrical network maps and in the identification of new service connection routes as well as the changes to be made to existing ones. These designs include both overhead and underground cables in which the placement of such was done in a way that would allow for efficient distribution of load and adequate safety clearance. I also visited the sites to establish the viability of the proposed connections and ensure that the installations met the set standards. Also, I worked with engineers to type Service Connection Enquiries (SCE), which included technical details of the works, materials to be used and the estimated costs of installing new customer connections. This work needed a high level of accuracy since it was the basis for the electrical distribution network and its effectiveness.

One of the challenges that I faced in the Planning Section was how to design service connections where there is little or no infrastructure in place or where the location presents difficulties such as congested areas or difficult terrain. It involved working out how best to lay the cables and the most economical way of doing so while meeting all the legal requirements. To this end, GIS techniques were employed to compute the route and potential conflicts, in order to identify the best solution. For instances where the cables to be laid were underground, I had to work with engineers to ensure that the right depths and distances of the trenches were achieved so as not to interfere with other utilities. Also, I checked that the chosen cable cross sections were adequate for the load to be carried and that there was no excessive voltage drop through the use of calculations based on the relevant industry standards. The effectiveness of these designs helped deliver safe and effective service connections with minimum energy loss and improved the reliability of the distribution network. This experience enhanced my skills of applying technical planning methods and working on engineering projects that may be considered complex.

Distribution and Underground Construction Section

In the Distribution and Underground Construction Section, I was engaged in the management and enhancement of the electrical distribution infrastructure. The duties I helped performed included checking and servicing of substations, transformers, and other switchgear to guarantee their proper functioning and safety. I also helped performed insulation resistance tests on high voltage transformers and cables with the help of special testing instruments in order to assess the condition of their insulation and to find out if there were any faults in them. Furthermore, I observed and helped in setting up overhead transmission lines on poles for new service feeders and ensured that the tension and the distance from the ground was right for safe working. Another important duty was the replacement and fixation of cables with faulty joints which were identified through ARM. These activities helped me gain experience in both preventive and corrective maintenance of the distribution network which is crucial to its reliability.

This was a reoccurring problem in this section and involved identifying and managing issues with high voltage cable joints that led to intermittent faults and black out. Solving these problems was not an easy task and needed the use of special diagnostic equipment such as TDR which is combined with ARM to determine the fault location along the cable. The accurate analysis of the reflected waveforms was very vital in determining the exact location of the fault out of the numerous possibilities due to interference from other connections. After the fault had been found the cable joint replacement process included the appropriate insulation layering and sealing to restore the dielectric feature of the cable. Another challenge was on the transformers because they tended to get overloaded especially during peak load and this called for load analysis and balancing across the network. Together with the engineers, we worked on the load balancing and insulation problems and thus enhanced system reliability and minimized power failures. It also helped me to gain the understanding of the high voltage cable systems and the need of preventing the problems and using advanced diagnostic methods for cable fault detection in the power distribution systems and infrastructure.

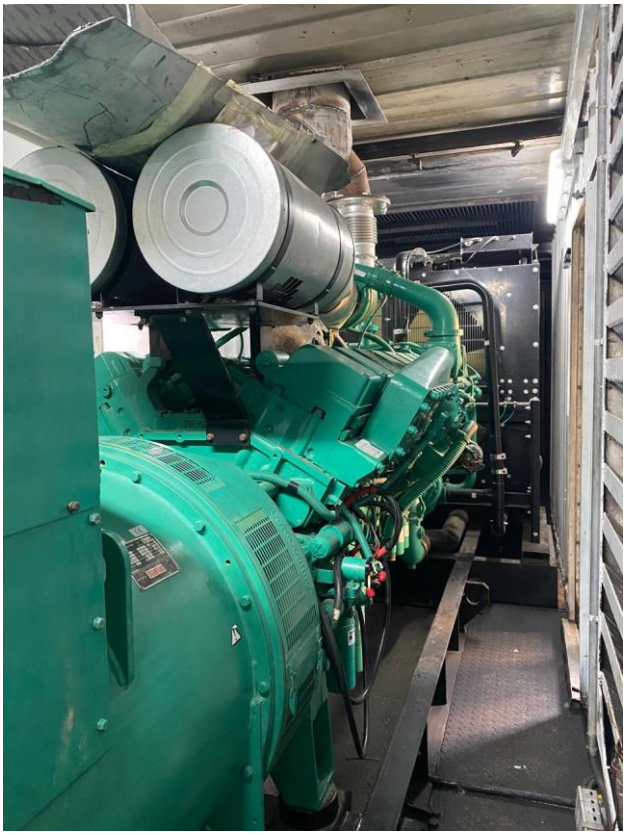


Underground Project Section

In the Underground Project Section, I was involved in the management and supervision of important parts of underground electrical systems including cable networks and substations with high voltage cable networks and substations. I was also involved in the detection and the repair of cable faults by the use of diagnostic equipment like the Arc Reflection Method (ARM) to determine the location of the faults within the network. Some of my duties were to help with joint repair of damaged cables, ensure that the insulation was correct and then test it to ensure that it was working properly. I also engaged in earthing of high voltage cables where mild steel coated copper rods were used to guarantee the right earthing system that met safety requirements. Furthermore, I was also involved in the setup, construction, and commissioning of SF6 insulated DMI panels at the substation and ensured that all the operations conducted on the pressurized equipment were in the right manner. The above activities called for accurate performance and good knowledge of the underground electrical systems.

One of the major issues that I faced in this section include the detection and management of faults in high voltage cables that caused intermittent power failure and poor system performance. This was because the underground network was extensive, and the faults were hard to isolate as they were often trapped in hard to access places. Together with the team, ARM technique was employed to send controlled high voltage pulses to the cable and make the cable arc at the point of fault. Thus, by observing the shape of the reflected waveform and time delays, we were able to determine the fault within the cable. These faults were repaired after proper preparation that included the stripping of damaged insulation, installation of new joints and application of heat shrink sleeves for dielectric stability. One of the issues was how to make sure that grounding systems provide the desired resistance so that voltage does not rise to dangerous levels. This was done by measuring the resistance and the changing the depth of installation of grounding rods. The above problems were handled, and cable integrity was

enhanced while system reliability was enhanced and downtime reduced. These experiences enhanced my problem solving skills and also helped me gain knowledge on advanced diagnostic and maintenance measures of underground power systems.

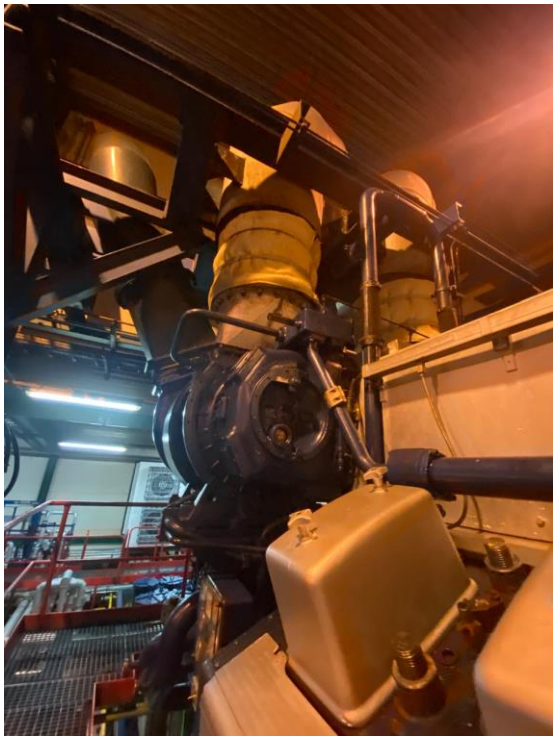


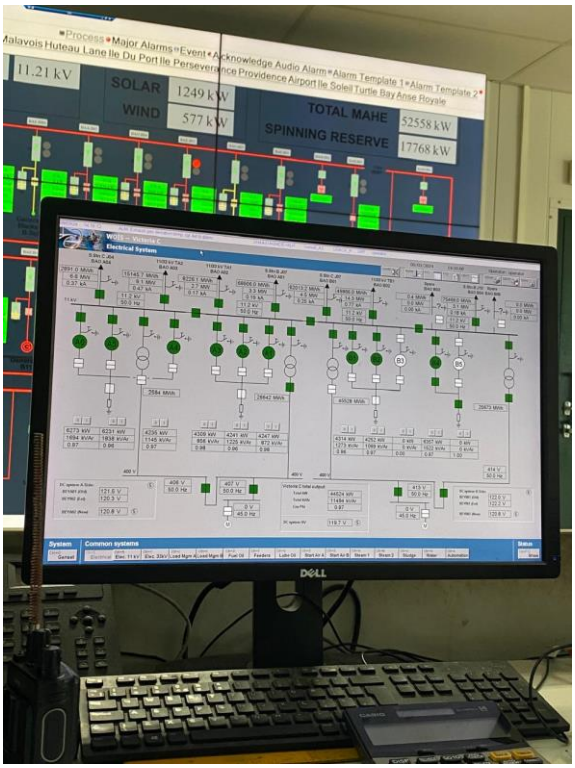
Power Station C Operations

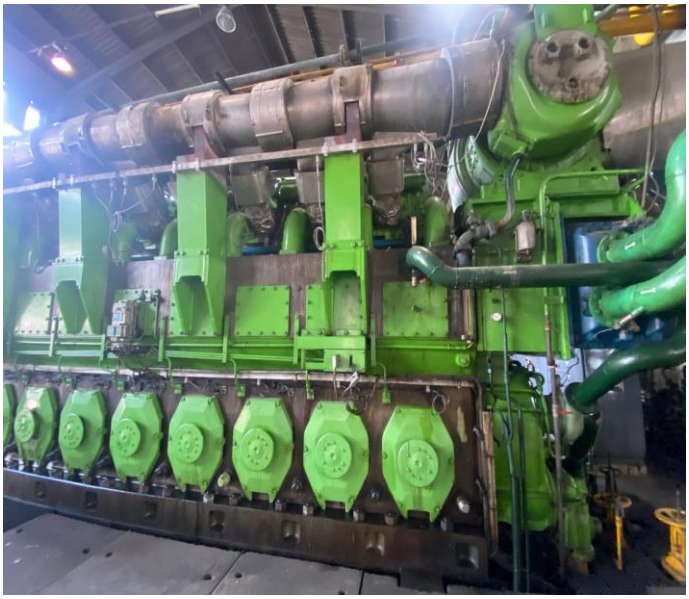
During my time in the Power Station C Operations section, I was exposed to the management of large scale power generation units and learned about the operation and function of such systems. My duties included the observation of generator performance and the writing of various operational variables including power, frequency, voltage and power factor. Through the application of the SCADA system, I was able to monitor the generator performance and the grid stability in real time and thus the supply of power was effectively controlled. I also engaged in black start generator testing which is used in restoring power systems after a blackout and is an important aspect in enhancing grid reliability. Furthermore, I helped in the operation such as in observing the synchronization of generators to make sure that they are in harmony with the grid and the daily check up on the system in order to find out if everything is normal. This experience helped me gain a good understanding of the power station operations and the importance of SCADA in the modern power systems.

There were some challenges in Power Station C Operations and these include the challenge in maintaining grid peak stability demand during and challenge in generator synchronization. The challenge with synchronization is that one has to ensure that the generator's frequency, voltage and phase angle are in harmony with the grid to avoid disturbances. I also engaged with engineers to study the SCADA reports to monitor the load variations and modify the generator settings accordingly. Another problem was that some of the generators developed some issues that reduced their efficiency due to wear and tear in the course of operation. This was done

through predictive maintenance strategies where through SCADA, monitoring of critical parameters such as exhaust gas temperature and load profiles was made to identify inefficiencies at the earliest. When it comes to black start generator tests it was important to confirm that the fuel system was properly prepared and that the batteries were in good condition in order to perform the task effectively. These solutions not only effectively balanced the grid but also enhanced the generators performance and the lifespan of equipment. This experience also helped me gain more understanding on the power generation process, the grid system and the use of SCADA in the management of power plant operations.



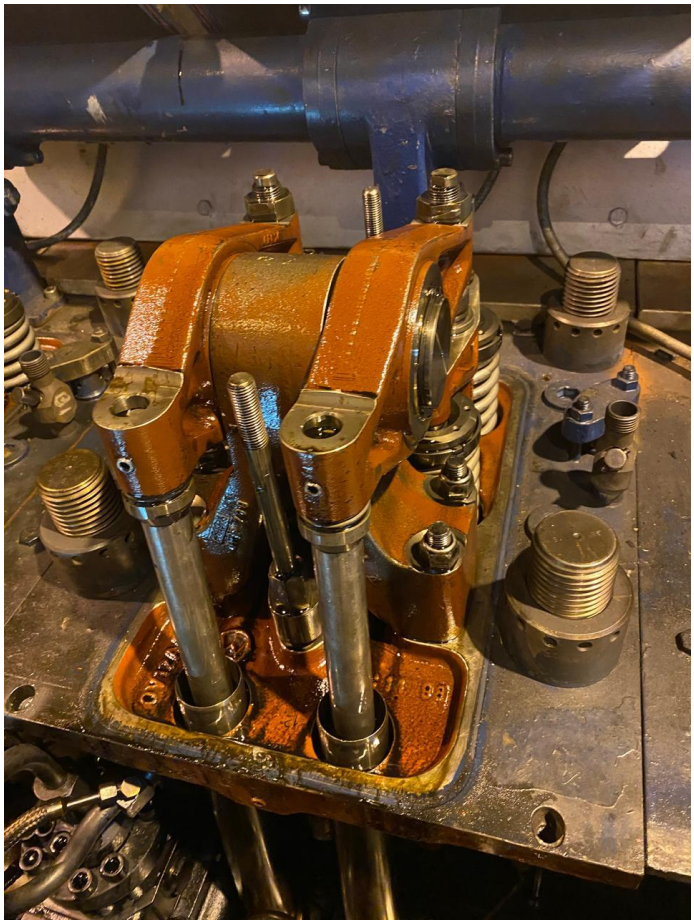


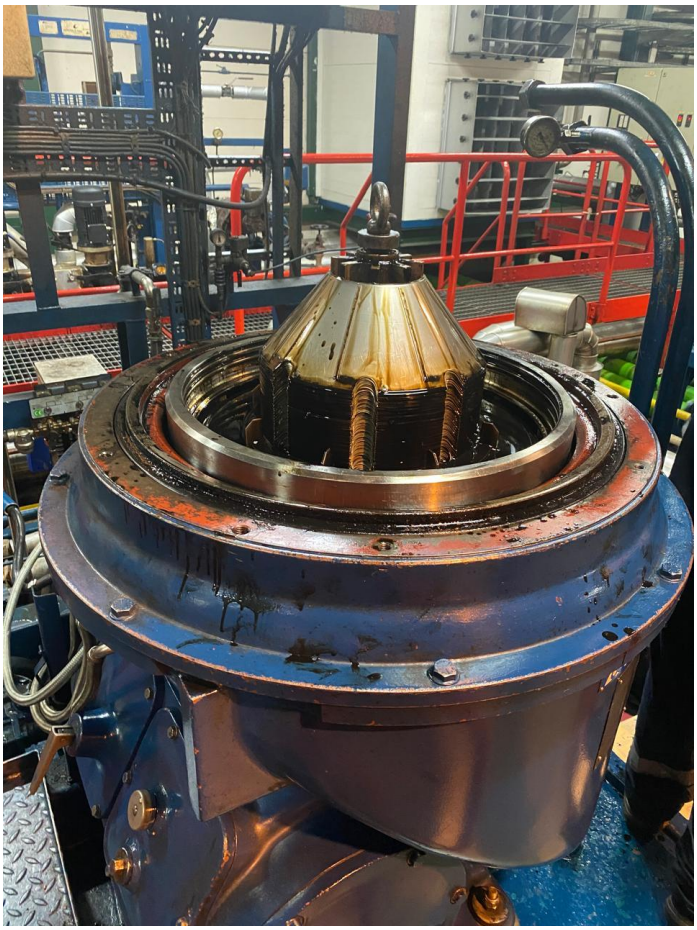


Power Station C Maintenance (Mechanical Section)

In the Mechanical Section of Power Station C, my job was to help maintain and repair generator engines and other mechanical systems in order to produce the best results. Some of the tasks I helped performed include replacement of turbocharger rotors and silencers which are elements that help improve the efficiency of the engine and also in reducing noise pollution. I was also involved in the intermediate overhauls of lube oil separators where it was established that some separator discs had developed cracks and were replaced to enable the system to filter out particles from the oil used for lubrication. Furthermore, I helped in the fuel pump repair, which involved taking the part apart, washing it and then putting all the parts back together to ensure that there is a constant supply of fuel to the generators. These activities called for accuracy and timely completion within the prescribed maintenance schedule to avoid down time and to ensure the reliability of the operation.

The major problem in the Mechanical Section was to identify and fix the problems related to turbocharger which include rotor wear and carbon deposit. These problems resulted into poor performance of the engine and high exhaust temperature. The solution comprised of disassembly of the turbocharger assembly for cleaning of the rotors and replacement of damaged parts. Turbocharger assembly was re-examined in order to check if it has been put back together in a way that it would cause vibration within the allowed limits. Another problem was the lube oil separators where damaged discs led to oil contamination in the lubrication system thus having the potential of damaging the engine. To this end, we carried out a comprehensive assessment of the system, undertook replacement of the affected parts and also adjusted the system to work efficiently. Also, the proper alignment of the rotating machinery called for accurate measurements using laser alignment tools in order to minimize on mechanical stress and or future wear. These measures helped in enhancing the efficiency of the generator, increasing the lifespan of some major components and increasing the reliability of the system. This experience also helped me appreciate the mechanical details of power generation and cemented the need for regular maintenance and repair.

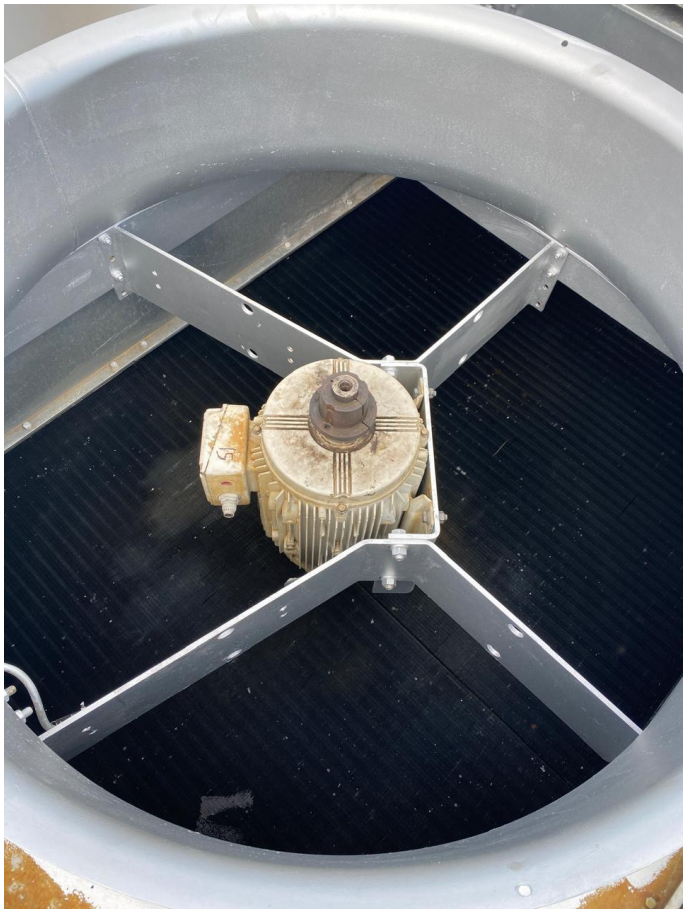




Power Station C Maintenance (Electrical Section)

In the Electrical Section of Power Station C, my duties were to help manage and fix electrical fittings used in generator operations in the Electrical Section. The duties and responsibilities that I helped performed include the following. Conducting insulation resistance tests on three phase motors to check whether the winding insulation of the motors is adequate for the operating conditions that the motors are likely to be subjected to. I also helped in assessing and changing radiator motors that play a vital role in the cooling of generators and ensured that they were working within the required voltage and amperage range. In the course of normal operation, I helped in the maintenance of oil cooled breakers whereby the following were among the tasks to be done. Checking bushings and dealing with oil leaks that pose threat to dielectric integrity. Furthermore, I helped in the testing and setting of the protective relays to guarantee that fault detection and isolation in the system is accurate. These activities helped me gain experience in electrical system diagnosis and preventive maintenance.

The most significant difficulty in the Electrical Section was the diagnosis of the insulation system failure of three-phase motors, which led to the fluctuations in performance and increased probabilities of short circuits. In order to measure insulation resistance, I helped in the use of a megger tester and compare the results with the manufacturer's recommendations to identify the motors that needed more examination. When problems were identified, I worked with the team to repair and re-insulate the motor windings and thus enhance their reliability. Another problem was oil leakage from high voltage breakers which affected their insulation rating and may lead to dielectric failure. This was done by first disassembling the breakers, replacing the damaged gaskets and then refilling oil to the recommended level. These measures helped in promoting the reliability of the electrical systems, decreased the chances of equipment malfunction and improved the fault reaction capabilities. This experience also helped to enhance my knowledge in the electrical maintenance and underlined the significance of precise testing and calibration in the power station.

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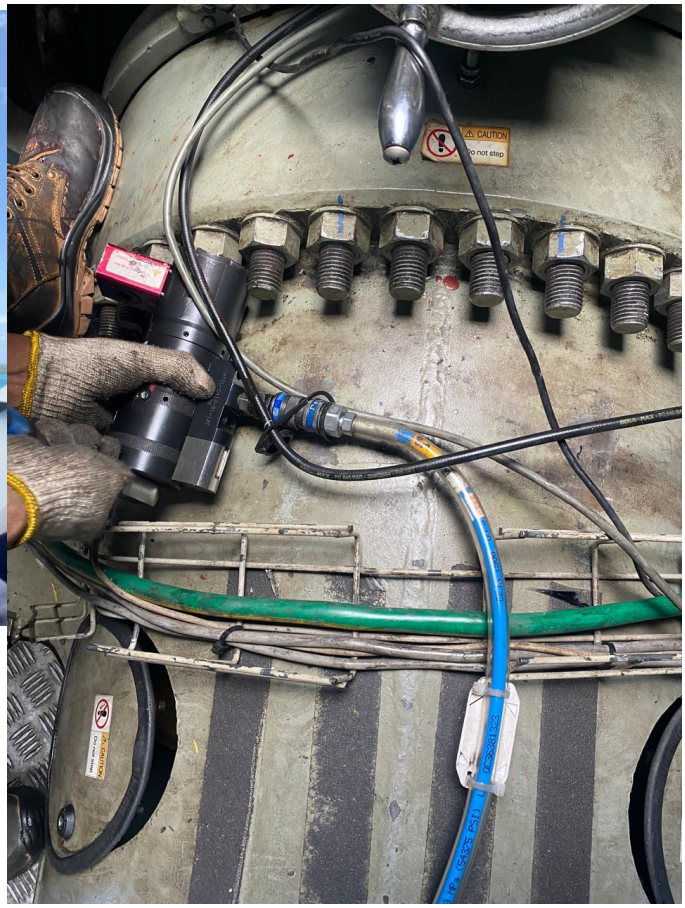
Wind Turbine Section

In the Wind Turbine Section, my responsibility was to help monitor 750 kW wind turbines that were installed at Ile du Port and Ile de Romainville which are part of PUC's renewable energy generation capacity. Some of the duties I helped performed include carrying out torque tests on rotor and generator bolts to check on the structural integrity of the structure with a view of avoiding mechanical failures when in use. I also used to lubricate the rotor bearings and generator parts as a preventive measure to minimize on friction and enhance the longevity of the parts. Another important task was to fill up the water in generator cooling systems as this is used in the regulation of heat to avoid over heating. In this section, I also helped in the testing and changing of batteries that are usually situated in the turbine nacelles to power the safety and operational systems that are crucial during grid disturbance. Further, I was also involved in the testing of nacelle circuit breakers to ensure that they have the right capacity to handle overload and protect the delicate turbine parts. All these tasks involved precision and knowledge of how wind turbines are supposed to function and operated.

The major problem that was identified during turbine maintenance include the diagnosis of the irregular torque levels in rotor and generator bolts which may lead to mechanical failure under high wind loads. To this end, I helped employed high precision torque wrenches in order to make sure that all bolts were tightened to the recommended torque values by the manufacturer so that the structure was not subjected to high levels of stress during operation. Another problem was that the rotor bearings made excessive noise and suffered from wear due to lack of lubrication. This was done by use of high performance grease that was suitable for the turbine and which helped in reducing the friction and hence improved the efficiency of the turbine. When it came to coolant refills, the issue was how to ensure that the cooling system had no airlocks which could hinder the efficiency of heat transfer. The system was thoroughly flushed and then tested in order to ensure that it was providing proper coolant circulation. Some of the backup batteries showed that their storage capacity had been reduced and such were replaced to guarantee adequate power supply to the turbine safety systems. The solutions enhanced the efficiency of the turbines, enhanced productivity and reduced on time losses. This experience enhanced my knowledge in the technical aspect of renewable energy systems and also emphasized the need for proper maintenance of the systems.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Solar PV Section

In the Solar PV Section, I helped with the maintenance and inspection of the solar farm located on Ile de Romainville which has an installed capacity of 5 MW and 1 MW respectively. The main duties I helped performed were to check the insulation resistance of PV panel strings and inverters using RISO and perform leakage current tests to ensure that all the systems were working at their best and to the recommended safety standards. I also helped in the observation of the PV modules to check for any physical damages, soiling or faulty panels that can lead to inefficiency. I also engaged in fixing of faulty communication cables associated with the SCADA system that manages the power output of the solar farm. Another important duty was to diagnose and fix problems with demarcation lights that are used along the perimeter of the solar farm to guarantee safety and enhanced visibility especially during the dark hours. These activities involved a good knowledge of the solar photovoltaic systems and their connection to the electrical grid.

The one challenge that was identified in the maintenance of the solar PV system include the challenge that was faced in identifying and solving the problems of high leakage current in some PV panel strings. To identify the affected strings, I helped in the measurement of the PV system using a PV meter where leakage paths due to degradation of the insulation or moisture intrusion was determined. The faulty panels were changed and retested to check on the insulation resistance thresholds. Another challenge that was experienced on the solar PV farm, was communication loss between the SCADA sensors and the control system, which affected the real time monitoring of power generation and fault detection. This was done by tracking and restoring the damaged communication cables and assessing the signal quality in order to normalize operation. Also, the demarcation lights presented some problems with the power supply which was as a result of corrosion of the connectors. The connectors were, therefore, changed to enable proper functioning. These solutions helped to increase the efficiency and reliability of the solar farm in addition to improving the accuracy of the monitoring systems and guaranteeing constant energy generation. This experience enhanced my technical knowledge in the area of solar PV maintenance and also underlined the need for preventive management of renewable energy systems.


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Conclusion

My internship at Public Utilities Corporation (PUC) Seychelles was very enriching and I was able to apply electrical and renewable energy engineering in a real life situation. In the course of my internship, I was exposed to various sections namely Inspectorate, Planning, Distribution and Underground Construction, Underground Projects, Power Station C Operations and Maintenance, Wind Turbine, and Solar PV Sections and I was able to apply theoretical knowledge to practical situations. The activities comprised of high level tasks including diagnosis of cable faults by advanced methods like Arc Reflection Method (ARM), design of service connections using Geographic Information Systems (GIS) and comprehensive maintenance of transformers, generators and renewable energy systems. These tasks involved the application of engineering knowledge, attention to detail and adherence to best practices and standards that are applicable in the industry with emphasis on the reliability and safety of high voltage and renewable energy networks. This has been helpful in understanding the role of renewable technologies including wind turbines and solar PV systems in the development of sustainable energy systems.

During the internship, I faced various engineering challenges including identifying the cause of insulation failure of high voltage motors, rectifying the issues of torque fluctuations in wind turbine parts and solving the problems related to SCADA linked communication in the solar PV farm. To solve such challenges it was necessary to use advanced diagnostic methods, team work in solving the problems and understanding of the design and working solutions from equipment. Thus, improving the reliability and effectiveness of PUC's infrastructure in addition to boosting my skills in diagnostics, and maintenance. It helped me to connect the academic learning with the practical application in the industry and thus prepare me to be more productive in the energy sector. This has also enhance my passion for engineering as well as my determination to seek new ways of improving the power generation, transmission and distribution as well as the renewable energy systems.

CHAPTER 3: Conclusions & Recommendations

Conclusions

The internship at Public Utilities Corporation (PUC) Seychelles was undergone for a period of 16 weeks and it was a great way through which I was able to apply the theoretical knowledge that I have learnt in the class to practical engineering works that was carried out in the different departments of the company which include the Inspectorate, Planning, Distribution and Underground Construction, Underground Projects, Power Station C Operations and Maintenance, Wind Turbine, and Solar PV Sections. The activities I undertook ranged from identifying faults in high voltage cables by the Arc Reflection Method (ARM) and conducting transformer insulation tests to managing wind turbines and solar PV farms. These tasks involved the use of engineering skills, team-work in solving the problems and adherence to certain standards such as BS 7671 standards. The experience with the conventional power plants and renewable energy systems enriched my knowledge on today's power systems and

the part they play in the provision of energy with an emphasis on sustainability. Also, the chance to use the SCADA and GIS tools increased my technical skills and helped me understand the role of modern technology in the management of power infrastructure.

Recommendations

From the experience I have had in the field, I suggest that proactive maintenance measures should be maintained in all the sections to avoid downtime and enhance system reliability. In order to further enhance the efficiency of fault detection and repair in the Inspectorate and Underground Projects Sections, there is a need to embrace improved diagnostic tools and systems that have enhanced fault isolation capabilities. Also, more training for technicians in renewable energy systems, for instance wind turbines and solar PV farms can be improved to ensure that the systems are performing at their best and losses are minimized. In the Planning Section, increasing the utilization of GIS for the prediction of load and the planning of infrastructure would enhance the effectiveness of service connections. At Power Station C, the integration of more Predictive Maintenance techniques plus with Real Time SCADA analysis could enable identification of potential equipment failures prior to their occurrence thus reducing risks involved. Last but not the least, PUC should increase its investments on renewable energy technologies and improve the integration of these technologies to the grid in order to address the increasing demand for energy solutions that are sustainable. The following measures would help PUC to bring its operations in compliance with the best practices globally and at the same time ensure that the systems are sustainable in the long run.

APPENDICES:

Reference

PUC. (2023). ANNUAL REPORT. https://www.puc.sc/wp-content/uploads/puc-doc/reports/2023.pdf

Offer Letter

PUC PUBLIC UTILITIES CORPORATION

HEAD OFFICE: ELECTRICITY HOUSE, PO BOX 174, ROCHE CAIMAN, MAHE, SEYCHELLES
Tel: (+248) 4678000 | Website: www.puc.sc | Email: ceo@puc.sc

Enquiries To: R. Matombe (Miss)
Ext No: 8211
Date: 18th March 2024

Mr Damian Ernesta
Student
Asia Pacific University

Dear Mr Ernesta

Re: Offer for Placement of Internship

With great pleasure, we are sending you this offer letter for an internship at Public Utilities Corporation (PUC).

The internship will be for a period of 16 weeks from 17th June to 4th October 2024.

You will be based within the Inspectorate unit of the Electricity Distribution section, which is based at the Electricity House, Roche Caiman. Your working hours will be from Monday to Friday 8.00am to 4.00pm. However, you may be required to work longer hours depending on the nature of the departmental functions.

The PUC management look forward to welcoming you on board for your internship.

For any further information or query please do not hesitate to contact the undersigned.

Yours sincerely,

R. Matombe (Miss)
Personnel Manager
Public Utilities Corporation
Mobile: +248 2822459

PUBLIC UTILITIES CORPORATION P.U.C HUMAN RESOURCES DIVISION

ELECTRICITY DIVISION: Electricity House, Roche Caiman
WATER & SEWERAGE DIVISION: New Port
COMMERCIAL & CUSTOMER SERVICES DIVISION: Creole Spirit Building, Victoria
HUMAN RESOURCES: Maison de Malavois, Bois De Rose Avenue
FINANCE DIVISION: Maison de Malavois, Bois De Rose Avenue
PRASLIN: Baie St Anne | LA DIGUE : La Passe

Chairman: Mr. Stephen Rousseau
Vice-Chairman: Mr. Dilip Shah
Ex-officio member/CEO: Mr. Joel Valmont
Non-executive members:
Ms. Irene Croisé, Mrs. Nanette Laure, Ms. Taryn Auguste, Mr. Bertrand Belle, Ms. Ingrid Sinon, Mr. Mike Tirant, Mr. Naddy Banane

bsi. ISO 9001 Quality Management FS 592953 ISO 14001 Environmental Management EMS 581975

Approval form

EE026-6-3-Industrial Placement Handbook

Appendix 1

INDUSTRIAL PLACEMENT AGREEMENT / APPROVAL FORM

This Agreement outlines specific responsibilities and expectations accepted by:
*(*Must be filled up by the industrial supervisor)*

STUDENT EMPLOYER

Company:	Public Utilities Corporation (PUC), Seychelles
Supervisor's Name / Title:	William Joubert Electrical Engineer
Company Street Address:	Electricity House, Roche Caiman
City / States:	mahe
Industrial Supervisor's Phone Number:	+248- 2638137
Industrial Supervisor's Email:	wjoubert@puc.sc
Internship Student:	DAMIAN ETIENNE ERNESTA
Student Position Title (in industry):	INTERN
Student Address:	BEL-OMBRE, MAHE, SEYCHELLES
Student Email:	damianernesta@gmail.com
Student Phone:	+60182134132

This internship provides a comprehensive training experience for the student by performing duties including:

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Conditions of Employment

1. The student must be placed in technical/ engineering related areas and not administrative/ QC areas.

2. The internship period will be for [4] months with a minimum average of allowances of RM [1300] per month.

3. The internship will begin on [01/07/2024] (day/month/year) and will end on [18/10/2024] (day/month/year)

4. Benefits supplied by employer to employee:

[ ]

5. Overtime wages (state conditions of)

[ ]

Provisions of the Internship Program

The Employer Will:

1. Enable the student to gain experience in a variety of positions (jobs) within the firm.
2. Assign the student new responsibilities when the employer feels the student can handle them.
3. Collaborate with the University in evaluating the students learning experience.
4. Notify the internship coordinator of any significant deficiencies in the student's performance.
5. Assure compliance with all applicable employment laws and regulations.

The Student Agrees to:

1. Perform assigned duties to the best of his/her ability.
2. Keep the employer's best interest in mind at all times and be punctual, dependable and loyal to the firm.
3. Follow directions, avoid unsafe acts, and be honest in all dealings with the employer and or customers.
4. Submit records and reports as required by either the employer or the University when due.
5. Ask for clarification if unsure of any procedure or expectation of either the employer or the University.

6. Keep the employer and the coordinator informed of any change in his/her program or intentions.
7. Send a follow up thank you letter to the employer upon completion of the internship.

The University Agrees to:

1. Assist the student in securing on the job training related to his/her career goals.
2. Assist the student in times of need.
3. Work with the employer in developing training plans consistent with the student's career goals.
4. Report problems related to the internship experience program to appropriate persons or officials.
5. Terminate this agreement if, after other appropriate investigation, no other mutually agreeable alternative is available.

Agreed to by: **(Name, Date, Signature & Stamp)**

Internship Employer Name: Ismail-Shiv Apte		
S Apte	PUBLIC UTILITIES CORPORATION P.U.C	25/10/24
Signature	**Company Stamp**	**Date**

Internship Student Name: DAMSAN ETIENNE ERNESTA	
D. Ernesta	18/10/2024
Signature	**Date**

Internship Placement Officer Name: Ir Eur Ing Ts Dr Lau Chee Yong	
	18/10/2024
Signature	**Date**

Student feedback form

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Appendix 9

INDUSTRIAL PLACEMENT STUDENT FEEDBACK FORM

Please fill in the form diligently and ensure that it is **attached at the back of your Industrial Placement Report** before submitting it to your APU supervisor to grade.

General Information	
Student's Name	DAMIAN ETIENNE ERNESTA
Student ID No	TP064815
Intake (Year 3)	APD3F2308EEE
Student Passport / IC no	NP011936
School	APU
Period of Placement (Start Date and End Date)	1/07/2024 to 18/10/2024
APU Supervisor	Ir Eur Ing Ts Dr Lau Chee Yong

Feedback on Company	
Company's Name	Public Utilities Corporation (PUC), Seychelles
Company's Address	Electricity House, Roche Caiman, Mahe, Seychelles
Company Supervisor & Contact no / email address	William Joubert +2482638137 wjoubert@puc.sc
Department Student was Attached to	Electrical and Mechanical
Briefly describe the nature of work performed: During my internship I was involved in maintenance and operation of electricity generation systems, including generators, wind turbine and solar panel. My work included troubleshooting, system inspections, performance monitoring and reliability of power generation equipment	
Was the nature of work assigned to you challenging?	(Yes) / No *(delete accordingly)*
If not, please elaborate:	
Briefly comment on the level of supervision provided: I was under constant supervision throughout the internship which allowed me to observe and learn how the task was performed correctly.	

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Would you recommend that we continue to assign students to this company in future?	**Yes / No** *(delete accordingly)*
Suggest ways in which you think the Industrial Placement Program offered by the company could be improved: No further improvements needed.	
Overall, how do you rate the company in providing you with this training?	**Excellent / Good / Satisfactory / Poor** (Delete accordingly)
If poor, please elaborate:	
Allowance Paid	Yes

General Feedback (optional)
Suggest ways in which you think the Industrial Placement Program in APU that can be improved:

Date: 16/11/2024

Signature of Student: O. Ernesta.

Visit assessment form

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Appendix 11

INDUSTRIAL VISIT ASSESSMENT FORM

THIS IS TO BE COMPLETED BY COMPANY INDUSTRIAL SUPERVISOR

Student's Name	DAMIAN ETIENNE ERNESTA
Company's Name	Public Utilities Corporation
Name of Industry Supervisor	William Joubert
Start Date	01/07/2024
End Date	18/10/2024

STUDENT'S PROFILE

Please rate the student's performance using the following: A=Excellent, B=Good, C=Satisfactory, D=Poor, U=Untested).

	Rating	Comment (if any)
Attitude to supervision	A	
Social integration	A	
Motivation	A	
Perseverance	A	
Technical knowledge	B	
Productivity	B	
Capacity for teamwork	A	
Problem solving ability	B	
Communication skills - written	A	
Communication skills - oral	A	
Others (please specify)		

(*Will be used only as feedback and not for grading)

OVERALL GRADE – [CLO2, PLO6]

The mark awarded will used only as feedback and not for grading. Please tick ONE box **(double click the box to tick).**

Unsatisfactory	Weak		Satisfactory		Good		Very Good		Exceptional
☐	☐	☐	☐	☐	☐	☐	☐	☒	☐
1	2	3	4	5	6	7	8	9	10

Comment (if necessary):

Signature: Joubert

PUBLIC UTILITIES CORPORATION P.U.C

Date: 25/10/24

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ASIA PACIFIC UNIVERSITY OF TECHNOLOGY AND INNOVATION SCHOOL OF ENGINEERING

ENGINEERING INDUSTRIAL PLACEMENT LOGBOOK

INDUSTRIAL PLACEMENT LOGBOOK

Week: 1	Start Date: 01/07/2024	End Date:05/07/2024
Objective of the activity: Inspectorate Section		
Content:		

Accompanied by the respective engineer:

On Monday 1st July I was given an introduction to the inspectorate section. This section is responsible for inspecting houses and commercial properties whereby customers have requested new electricity supply or complained about faulty single or three phase meters and breakers. I have seen how the team handle these customer complaints and requests, including solar panel meter installation. They demonstrated how an electricity meter is programmed and tested before it is given to the customer. This section also has all the equipment to dealt with underground cable fault finding.

On Tuesday 2nd July I visited 11KV to 33KV transformer at PUC main generation station and gained knowledge on the operation of high voltage transformers and their role on stepping up voltage for efficient long-distance transmission. I also seen how smart 3 phase meter was installed. I also witness the installation of a smart three phase meter. This advanced meter has the ability to give real time data on electricity consumption to both utility and customer.

On Wednesday 3rd July I visited Anse La Mouche 33KV substation and I was able to trace the electricity conversion from 33KV to 11KV to 415V to observe the step down transformers at each stage to a nearby hotel. I also seen the working principal of different step up and step-down transformers and how transformer taping mechanism works, which include off load tap changers and on load tap changers that changes the number of turns to adjust the secondary winding voltage. Later I also seen how protection relays operate in 33KV and 11KV circuit breaker panel. Surge protection Device (SPD) which protects from overvoltage and withdraw excess energy to protective earth was discussed. Additionally, Automatic Transfer Switch (ATS) was also seen which switches the power supply to another source in the case of power failure.

On Thursday 4th July I visited Avani Hotel at Babaron in Grand Anse District to perform some test to meet the BS 7671 standard. The test performed includes loop impedance test, perspective short circuit (PSC) test, polarity test, voltage measurements and phase rotation, which was all done in 12 rooms before being connected to main electricity supply. I also learned the three types of faults which include overload, short circuit and earth fault.

On Friday 5th July I visited Canopy hotel at Anse La Mouche to perform some test on three phase supply and earthing systems. I learned the working principle of Miniature Circuit Breakers (MCB), Molded Case Circuit Breakers (MCCB), Residual Current Devices (RCD), Residual Current Breaker with Overcurrent Protection (RCBO) circuit breaker.

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Industry Supervisor Signature and Stamp:

EE026-6-3-Industrial Placement Logbook

INDUSTRIAL PLACEMENT LOGBOOK

Week: 2	Start Date: 08/07/2024	End Date: 12/07/2024

Objective of the activity: Inspectorate Section

Content:

Accompanied by the respective engineer:

On Monday 8th July I visited Avani hotel to perform some test to meet the BS 7671 standard. The test performed includes loop impedance test, perspective short circuit (PSC) test, polarity test, voltage measurements and phase rotation, which was all done in 12 rooms before being connected to main electricity supply. I also witnessed the battery bank which powers the relay, coil and LEDs in a substation. Gained knowledge of TNCS earthing system.

On Tuesday 9th July I visited Hilton Northolme hotel to check and fix a faulty meter in substation. The fault was due to a burnt fuse which needed replacement. Later I went to Indian Ocean Tuna factory substation to install four Current Transformer (CT) three phase meter.

On Wednesday 10th July I visited Avani hotel to perform some test to meet the BS 7671 standard. The test performed includes loop impedance test, perspective short circuit (PSC) test, polarity test, voltage measurements and phase rotation, which was all done in 20 rooms before being connected to main electricity supply. I learnt about three phase rectifiers and how capacitor banks are used to adjust power factor. Diodes or thyristors in a three phase rectifier turns AC from a power supply into DC. The DC output here is smoother and has less ripple than single phase rectifiers, making the configuration more efficient for industrial use. In terms of capacitor banks, it affects the power factor in an electrical system. Capacitors banks reduce voltage current phase difference by compensating reactive power and reducing losses thus improving the power transmission efficiency.

On Thursday 11th July, I learned about optimum operating load to have minimal loss in distribution and power transformers. I discovered that distribution transformer works well when loaded at 50% to 60% of rated capacity, at this load core losses and copper losses become equal therefore minimizing total losses and giving the best efficiency. For power transformer, works well when operating at 100% load, which is the full rating capacity, copper losses and core losses become same at full load, which results in minimizing overall losses and maximizing efficiency.

On Friday 12th July, I visited the Canopy Hotel at Anse La Mouche to witness the inspection and reinstallation of Current Transformer (CT) and the relay system for their backup generator, which activates during main power supply outages. I have also seen how the relay settings are set so that when there is a power failure, the backup generator would switch on automatically.

Industry Supervisor Signature and Stamp:

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INDUSTRIAL PLACEMENT LOGBOOK

Week: 3	Start Date: 15/07/2024	End Date: 19/07/2024

Objective of the activity: Planning Section

Content:

Accompanied by the respective engineer:

On Monday 15th July and Tuesday 16th July, I was assigned in planning section. This section has three subdivision which includes planning, survey and invoices. All is responsible to carry out customers wishes which is filled on a form called Service Connection Enquiry (SCE). In this form it has several options, some of which are requesting new electricity supply, change meter position, additional load, rewire, and alteration of service position. Depending on the options the customer requested, the planning section will investigate the plot of land using Graphical Information System (GIS) and draw the electrical drawing on GIS map. Some drawing components includes High Voltage (HV) and Low Voltage (LV) underground and overhead cables and poles. Overhead HV and LV cables must be 3 meters away from any construction building and housing. While HV and LV underground cable must be 2 meters away.

This planning division also monitors the load on the path of feeder and transformer specifications if client request for new installation, then the engineer and team will check if load is within limits to supply client, if not then need to replace and upgrade transformer.

On Wednesday 17th July, Thursday 18th July, Friday 19th July I was in survey and drawing and costing division, the process is as follows: Receive SCE from clients which includes customer ID and location plan, network is taken from GIS. Then go to site for inspection to check the distance of HV and LV cables from building or housing. And add any recommendation if needed. Then back at the office, the site plan is drawn based on that SCE and later request approval from engineer. After approval, the documents are sent to the Invoice division to get the approval letter and costing list. Contractors form, site plan and costing list are attached to customers copy. While the SCE, client form, ID copy, location plan, site plan drawing is attached and sent to distribution section to act on what is needed to be done on site.

I also got a chance to witness some site visits for inspection in certain district and sub district such as Bel-Ombre, Glacis, Pascal Village, Le Niol. Whereby the customers requested new supply, temporary supply, and change meter position. And later helped in drawing the site plan proposal for the Service Connection Enquiry (SCE).

Industry Supervisor Signature and Stamp: S/AP for ERWIN ORPHEE

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EE026-6-3-Industrial Placement Logbook

INDUSTRIAL PLACEMENT LOGBOOK

Week: 4	Start Date: 22/07/2024	End Date: 26/07/2024

Objective of the activity: Distribution and Underground construction Section

Content:

Accompanied by the respective engineer of Distribution and Underground construction Section:

On Monday 22nd July I went to a sub district of Grande Anse Mahe called Babaron. A customer requested a new supply of electricity. They had a PV system; therefore, two meters was installed. One to measure how much electricity from solar was produced and one measured electricity taken from PUC which provides electricity in Seychelles. Cable which was from PUC and solar system was passed underground from electric poles and house respectively and connected to their meter in meter cubicle. Later I went to another house which requested supply and cables were passed from electric poles to meter.

On Tuesday 23rd July I went to Takamaka district, a customer requested a new supply of electricity. Connection was taken from electric poles and cables were passed underground and connected to meter box attached on the wall of house.

On Wednesday 24th July I went to visit 4 substations to inspect switchgear and step-down transformer which converts voltages from 11KV to 415V.

On Thursday 25th July, I went to perseverance district substation, insultation test using megger instrument was done on switchgear and 11KV to 415V transformer. The insulation test of the switchgear should give a resistance value in Mega Ohms. 100MΩ for the switchgear and 45MΩ for the transformer was recorded. The switchgear test consists of ground and each phase of L1 L2 L3 for with a 5KV DC supply. The transformer test consists of a 1KV DC supply applied to ground and primary side, ground and secondary side, primary and secondary side. The transformer test gave the conclusion that the primary and secondary winding was not touching. I also learned about the different open points in distribution of electricity.

On Friday 26th July I went to a newly built substation at Perseverance district. Inside the substation there was a new transformer and switchgear. Control cables were needed to be connected from transformer to switchgear. These cables were for protecting the transformer in the case were oil temperature rises, oil level drops below certain level, the transformer will trip. These trips are made by switchgear. After that I witness the switching off electrical supply at another substation, thereby creating an open point at which the workers can safely work on the line. In this, engineers at both the substations, which are at each end of the line, communicate and instruct each other to open the line at both ends. This won't allow the flow of electricity at either end of the line, thus making it fully isolated.

Industry Supervisor Signature and Stamp: S. Ah. for JOSEPH SERVINA

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INDUSTRIAL PLACEMENT LOGBOOK

Week: 5	Start Date: 29/07/2024	End Date: 02/08/2024
Objective of the activity: Distribution and Underground construction Section		
Content:		
Accompanied by the respective engineer of Distribution and Underground construction Section: **During this week, I went to sewage plant at Providence industrial zone to witnessed diversion of high voltage. To be able to divert the high voltage electrical cables, switching off electrical supply at both ends of lines create open point was needed to be done. This allowed the workers to work safely.** **After the first task was completed, I went to Perseverance substation and witnessed how 3 joints on high voltage 11KV cables for L1 L2 L3 was done. Later, insulation test using megger instrument was done to check the integrity of the high voltage cable by applying a high DC voltage. The results obtain was in Mega Ohms. This indicated that the cable joints were done properly.**		
Industry Supervisor Signature and Stamp: S. ARR for JOSEPH SERVINA PUBLIC UTILITIES CORPORATION P.U.C		

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INDUSTRIAL PLACEMENT LOGBOOK

Week: 6	Start Date: 05/08/2024	End Date: 09/08/2024

Objective of the activity: Underground Project Section

Content:

Accompanied by the respective engineer of Underground Project Section:

On Monday, 5th August, I visited the airport substation at Point Larue district. There was a voltage drop in the battery storage system that powers the circuit breaker protection relay. After testing the batteries, an additional battery was installed to address the issue. Later, equalization was performed on the battery system.

On Tuesday 6th August I went to Serret substation. Three phases low voltage 415V cables were needed to shorten to create space for construction. This was done by removing the Low voltage supply cables from the pillar box to cut it and make termination at the ends. Then reconnect it and switch on the supply.

On Wednesday 7th August I went to Huteau Lane substation to switch off high voltage supply to Serret substation at St Louis district so that workers can have access to high voltage 11KV cable at Serret substation. St Louis feeder was put in earth position. The overhead high voltage line exiting from Serret substation was also grounded using mild steel cotted copper rod. All three phases were short together with earth.

The work assigned was to cut and shorten high voltage cable then make joints. Some maintenance was also done on the respective SF6 DMI panel with breaker included. After the work was completed, earth rod was removed on overhead high voltage line and the panel at Serret and Huteau Lane substation was switched on.

On Thursday 8th August, I went to Grand Anse district, to investigate a complaint whereby the customer claimed that smell was coming out of three phase 415V cutout box. The three phase cutout box had 6 customer house connected to it, each phase had two customers at 240V. Decision was made to remove cutout box completely. Therefore, supply was switched off by removing fuse in mini pillar box. The three phase 100A cutout was replaced with new. Supply was later switched on by putting fuse back in the mini pillar box.

On Friday 9th August, I visited transformer maintenance section. There were two types of transformers, pole and ground mounted transformer. Firstly, I have seen how transformer oil is removed and then filtered in a machine. Secondly, seen where the tapping of transformer winding is done.

Industry Supervisor Signature and Stamp: SAR for ROGER TOULON

PUBLIC UTILITIES CORPORATION P.U.C

EE026-6-3-Industrial Placement Logbook

INDUSTRIAL PLACEMENT LOGBOOK

Week: 7	Start Date: 12/08/2024	End Date: 16/08/2024
Objective of the activity: Underground Project Section		
Content:		
Accompanied by the respective engineer of Underground Project Section: **I went to Praslin Island for 5 days with the Underground Project team, to install a breaker on a newly installed generator. This generator produces 415V, then supply go step up transformer which step up the voltage to 11KV. Then 11KV supply goes to SF6 panel which have a switch which allows supply to go to 11KV bus bar in substation.** **The breaker was attached to the generator. Jumper wires was connected from alternator bus bar to breaker terminals, then low voltage cables were connected on breaker terminals below which goes to step up transformer.** **I also seen that QM SF6 panel is for transformer and have a fuse inside which depends on the rating of the transformer being used.**		
Industry Supervisor Signature and Stamp: Staff for Roger Toulon PUBLIC UTILITIES CORPORATION P.U.C		

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INDUSTRIAL PLACEMENT LOGBOOK

Week: 8	Start Date: 19/08/2024	End Date: 23/08/2024

Objective of the activity: Underground Project Section

Content:

Accompanied by the respective engineer of Underground Project Section:

I visited eight 33KV substation for inspection, these include:

- **Perseverance**
- **Providence**
- **Ile Solei**
- **Aux Cap**
- **Anse Royale**
- **Quatre Bornes**
- **Anse La Mouche**
- **Anse Boileau**

I also witnessed a breakdown of an underground cable near capital City substation in town. The length at which the cable fault occurred was found using a cable fault finding technique called Arc Reflection Method (ARM). Pulse was sent through the faulty cable, and it concluded that the fault occurred 16 meters from substation. It was seen that this was caused by joints failure, later joints were made to remove fault.

I also seen two types of joints transition and inline joints.

Also witnessed how phasing, and phase rotation of 3 phase cables is done.

Industry Supervisor Signature and Stamp: S Alp for D. Assan

PUBLIC UTILITIES CORPORATION P.U.C

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INDUSTRIAL PLACEMENT LOGBOOK

Week: 9	Start Date: 26/08/2024	End Date: 30/08/2024

Objective of the activity: Underground Project Section

Content:

Accompanied by the respective engineer of Underground Project Section:

On Monday 26th August I witnessed a high voltage 33KV underground cable fault at Ile Solei substation on L3 blue phase. The length at which the cable fault occurred was found using a cable fault finding technique called Arc Reflection Method (ARM). Pulse was sent through the faulty cable, and it concluded that the fault occurred few meters. It was seen that the fault was caused by joints failure. The joints were replaced. Later insulation test was done on the cable using high voltage insulation tester by applying 5KV supply to the cable which resulted in a high value of resistance in Giga Ohms.

On Tuesday 27th August, there was a voltage drop at the airport substation on the batteries which supply the protection relay of circuit breaker in case of fault. The engineers went to investigate.

Later I went back to Ile Solei substation to test the integrity of the L3 blue phase high voltage cable. Tan Delta (TD) and Partial Discharge (PD) test was done using Very Low Frequency (VLF) Tester at f=0.1Hz.

On Wednesday 28th August I went to sewage substation. New low voltage 415V cables was needed to be connected to low voltage side of transformer.

On Thursday 29th August I visited Chinese ambassy newly built substation for inspection before transformers and switchgear to be transported and installed.

On Friday 30th August I had seen how transformer and switchgear was transported to Chinese newly built substation for installation. Later I went to independent school substation to help insert new earth rod which will connect to the already built earthing system. This was needed, because after testing the resistance of the earthing system results were a higher resistance value than expected. After connecting the earth rod, the results were acceptable for a substation which showed a lower resistance value.

Industry Supervisor Signature and Stamp: for D-ASAN

PUBLIC UTILITIES CORPORATION P.U.C

EE026-6-3-Industrial Placement Logbook

INDUSTRIAL PLACEMENT LOGBOOK

Week: 10	Start Date: 02/09/2024	End Date: 06/09/2024

Objective of the activity: Power Station C Operations

Content:

Accompanied by the respective engineer and technician:

On Monday 2nd September I was assigned in control room to see how the operation of power station C works. Power station C is the main power station which provide electricity to Mahe island Seychelles it has a total of 11 generators. In control room whole electrical system and SCADA is seen for the generator, wind turbine can be seen. Operator in control room take note of the total power produced, active power, reactive power, power factor, frequency for each running generator engine in a logbook for every 30 minutes interval. The SCADA system has every substation, generator, feeder and breaker on Mahe, Praslin and La Digue island. The generator engine has a 4-stroke diesel engine with direct fuel injection, the engine drives a synchronous three phase generator.

On Tuesday 3rd September I went for site visit at power station C, to see the components of the generator engine. These consist of water pump, fuel pump For Low Fuel Oil (LFO) and Heavy Fuel Oil (HFO), lube oil pump, LFO and HFO tanks, separator for HFO, incinerator to burn remaining HFO and lube oil. I also seen the 11KV bus bar on SCADA that all generator connects to it.

On Wednesday 4th September I have seen the black start generator for power station C and how it operates. I also witnessed a breakdown of an engine generator whereby the mechanical team had to replace the piston and liner. I helped to insert new lube oil filter for the generator engine. After that the running in process was done on the engine, before it runs for 24/7.

On Thursday 5th September and Friday 6th September I moved to power station B which serves as a backup if some of power station C generators fails and needs more generators. Power station B has two generator that runs 24/7 and three backup generator which is only switched on if needed. The two running generator engine is a new generation 18-cylinder V type 6MW Wartsila brand and an old generation 8 cylinder in line 4MW. The 4MW generator engine water pump, lube oil pump and HFO pump is switched on manually compared to the new generation which is fully automated. For HFO, it is pumped from HFO storage tank, then pass through two tanks and separator is used to clean and heat up the HFO, then pumped into daily tank for the generator to use as its running. Compressors are also used to store compressed air for the engine generator to use.

Industry Supervisor Signature and Stamp: 25/10/24

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EE026-6-3-Industrial Placement Logbook

INDUSTRIAL PLACEMENT LOGBOOK

Week: 11	Start Date: 09/09/2024	End Date: 16/09/2024

Objective of the activity: Power Station C Maintenance Mechanical Section

Content:

Accompanied by the respective engineer:

Monday 9th September and Tuesday 10th September I was sent to maintenance mechanical section, I witnessed the replacement of turbo charger rotor for A4 engine generator.

On Wednesday 11th September I witnessed how turbo silencer replacement is done on B5 generator. Plus, replacement of two rotor for turbo charger.

On Thursday 12th September an intermediate overhaul was done on lube oil separator on generator engine B5 because fault was detected when operating. The separator disc was changed due to some being fractured.

On Friday 13th September I witnessed a fuel pump replacement on generator engine.

Industry Supervisor Signature and Stamp:

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INDUSTRIAL PLACEMENT LOGBOOK

Week: 12	Start Date: 16/09/2024	End Date: 20/09/2024

Objective of the activity: Power Station C Maintenance Mechanical Section

Content:

Accompanied by the respective engineer:

On Monday 16th September I witnessed the changed of fuel pipe for A3 generator engine, and turbo rotor on A3 generator was removed.

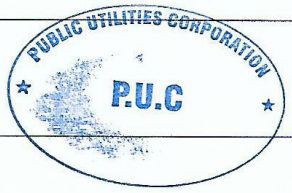
On Tuesday 17th September I witnessed removal and replacement of an injector on A3 generator. Also installing new turbo rotor on A3 generator. Replacement of two turbo charger radiator cooler.

On Wednesday 18th September there was a problem on lube oil separator on B5 generator, disc and bowl was replaced. I also helped to take measurements for two new turbo charger using micrometer. Seen how maintenance is done on injectors for generators in injection room. Seals and injector bits were replaced for each injector.

On Thursday 19th September I witnessed the installation of two turbo charger rotors. Also worked on the lube oil separator on B5 generator.

On Friday 20th September I witnessed a fuel pump replacement.

Industry Supervisor Signature and Stamp:



EE026-6-3-Industrial Placement Logbook

INDUSTRIAL PLACEMENT LOGBOOK

Week: 13	Start Date: 23/09/2024	End Date: 27/09/2024

Objective of the activity: Wind Turbine Section

Content:

Accompanied by the respective engineer:

From Monday 23rd September I was assigned in wind turbine section. In total there are eight 750KW capacity wind turbines which have a combined capacity of 6MW. Three turbines are located at ILE DU PORT and five are on ILE DE ROMAINVILLE Island. The wind turbine has a height of 68m and a rotor diameter of 57m. Production starts at 9rpm and reaching a maximum output of 750KW at 25rpm. Maintenance is done every 6 months (E6), 12 months (E12), 24 months (E24).

Maintenance started on wind turbine 1, by torquing the bolts of wind turbine tower base and brake caliper. Applied grease to the rotor and generator bearing and refilled water coolant in generator cooler at 3.5 bar using water pump.

On Tuesday 24th September maintenance continued wind turbine 1, by testing the breakers in nacelle controller panel of wind turbine to see if it breaks when there is current overload. Tensioning of bolts for generator shaft was also done.

On Wednesday 25th September, the tensioning of rotor bolts for wind turbine number 1 was completed. Then moved to wind turbine number 2 and torqued the bolts at the tower base.

On Thursday 26th and Friday 27th September grease was applied to the rotor and generator bearing, and refilled water coolant in generator cooler at 3.5 bar using water pump.

Industry Supervisor Signature and Stamp:

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INDUSTRIAL PLACEMENT LOGBOOK

Week: 14	Start Date: 30/09/2024	End Date: 04/10/2024

Objective of the activity: Wind Turbine Section

Content:

Accompanied by the respective engineer:

On Monday 30th September two batteries were removed in blade of wind turbine number 2 and replaced. Once the new batteries were installed, all connections were checked for proper voltage levels. The batteries are part of the turbine's backup power system, ensuring that control and safety systems remain operational during power disruptions.

On Tuesday 1st October performed tensioning of generator shaft bolts.

On Wednesday 2nd October, Thursday 3rd October and Friday 4th October, moved to wind turbine 3. Similar maintenance performed on turbine 1 and 2 was done on turbine 3.

Industry Supervisor Signature and Stamp:

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INDUSTRIAL PLACEMENT LOGBOOK

Week: 15	Start Date: 07/10/2024	End Date: 11/10/2024

Objective of the activity: Power Station C Maintenance Electrical

Content:

Accompanied by the respective engineer:

On Monday 7th October I was assigned to Power Station C Maintenance Electrical section, I saw how insulation test is done on three phase motor. I also seen the working principle of contactor, relay and breakers.

On Tuesday 8th October I witnessed the installation of radiator motor for the fan blade. This radiator is for the engine generators at power station C. Also, I have seen the removal of pressure differential for lube oil and fuel for the generator. This pressure differential was to be tested on ground and temperature sensor to switch off generator engine when too hot.

On Wednesday 9th October, I saw how the wiring of the three-phase radiator motor for the fan blade was done and later the fan blade was attached to the motor.

On Thursday 10th October the angle of the fan blade was adjusted so not to touch the metal barrier on the side when rotating and checked the rotation of the fan blade. Later tested the starting current and running current of each phase L1 L2 L3 of the radiator motor with multimeter and checked if it matches the name plate of motor.

On Friday 11th October the radiator fan protective grill was installed, I also witnessed a generator breakdown which was caused by a fuel pump failure. The fuel pump was replaced, and the temperature sensor linked to that fuel pump was tested using a boiler to acquire a higher temperature needed for the test.

Later, I went to power station B. A breaker which is cooled by oil and prevents arching had a problem which was caused by oil leaking from the bushing of the Potential Transformer (PT). The PT steps down voltage from 11KV to 120V for measurement instruments. Therefore, the leak was fixed by draining the oil, removing the PT completely and tightening the bolts of bushing. The PT and oil were put back, no leak was seen later.

Industry Supervisor Signature and Stamp:

EE026-6-3-Industrial Placement Logbook

INDUSTRIAL PLACEMENT LOGBOOK

Week: 16	Start Date: 14/10/2024	End Date: 18/10/2024

Objective of the activity: Solar PV section

Content:

Accompanied by the respective engineer:

On Monday 14th October till Friday 18th October, I was assigned to solar panel section at ILE DE ROMAINVILLE Island solar farm and helped with maintenance. The island consists of two projects for solar, one is 5MW installation and the other is 1MW installation. These projects are part of the government's initiative to achieve 15% of the country's total electrical energy demand from renewable sources by 2030.

One of the 5MW panel produced 340WP (Watt Peak), in total the system has 14850 panels, 84 inverters, and 1 string has 18 panels. The electricity generated from the 5MW project is as followed, 800V DC is produced from the solar panels and goes into inverter which converts to 415V AC, the AC voltage then goes into Sub Main Distribution Board (SMDB), and then through the Main Distribution Board (MDB). A step up transformer in RMU steps up the voltage to 33KV, then through the 5MW substation and Battery Energy Storage System (BESS), then connect with grid through 33KV substation.

For the maintenance I witness RISO which is an insulation resistance test, and leakage current test performed on several inverters on the 5MW project using PV meter and normal voltmeter. To perform the RISO test, the PV meter is connected to positive and negative terminal of one solar panel string and ground to inverter box. Measurement from one test resulted in 746V and 11.5Mohm RISO which indicates good insulation quality in one string. The leakage test was performed using normal voltmeter, positive dc terminal connected to one string and negative terminal to inverter ground. After waiting few minutes for the voltage to stabilize, the results were 66V which indicates minimal leakage current in one string.

I also witnessed maintenance on faulty demarcation lights and communication cable needed repair in inverter panel which is linked to SCADA.

Industry Supervisor Signature and Stamp:

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Proof of Attendance

PUC PUBLIC UTILITIES CORPORATION

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Our Ref: PUC/ADMIN/132
Enquiries To: M. Naiken (Mrs)
Ext No: 8102
Date: 6th November 2024

Mr Damian Etienne Ernesta
Asia Pacific University of Technology & Innovation
Malaysia.

Dear Mr Ernesta

Re: Completion of Internship

We are pleased to acknowledge the successful completion of your internship with PUC. Your internship, which began on 1st July 2024 and concluded on 18th October 2024, has been both productive and rewarding.

We appreciate your hard work and dedication and are confident that the skills and experience you have gained will be beneficial in your future career endeavors. We wish you continued success and hope that you carry forward the insights and experiences from your time here.

Yours sincerely,

PUBLIC UTILITIES CORPORATION P.U.C HUMAN RESOURCES DIVISION

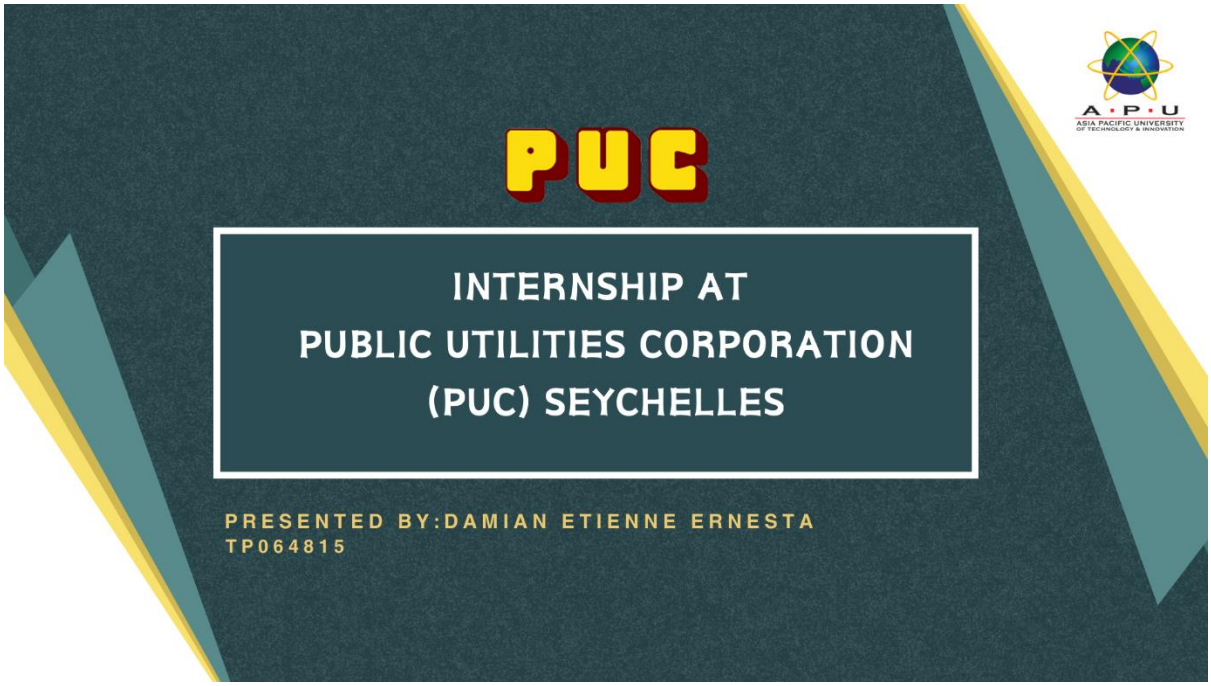
M. Naiken (Mrs)
Human Resources Manager
Public Utilities Corporation
Mobile: +248 2713035

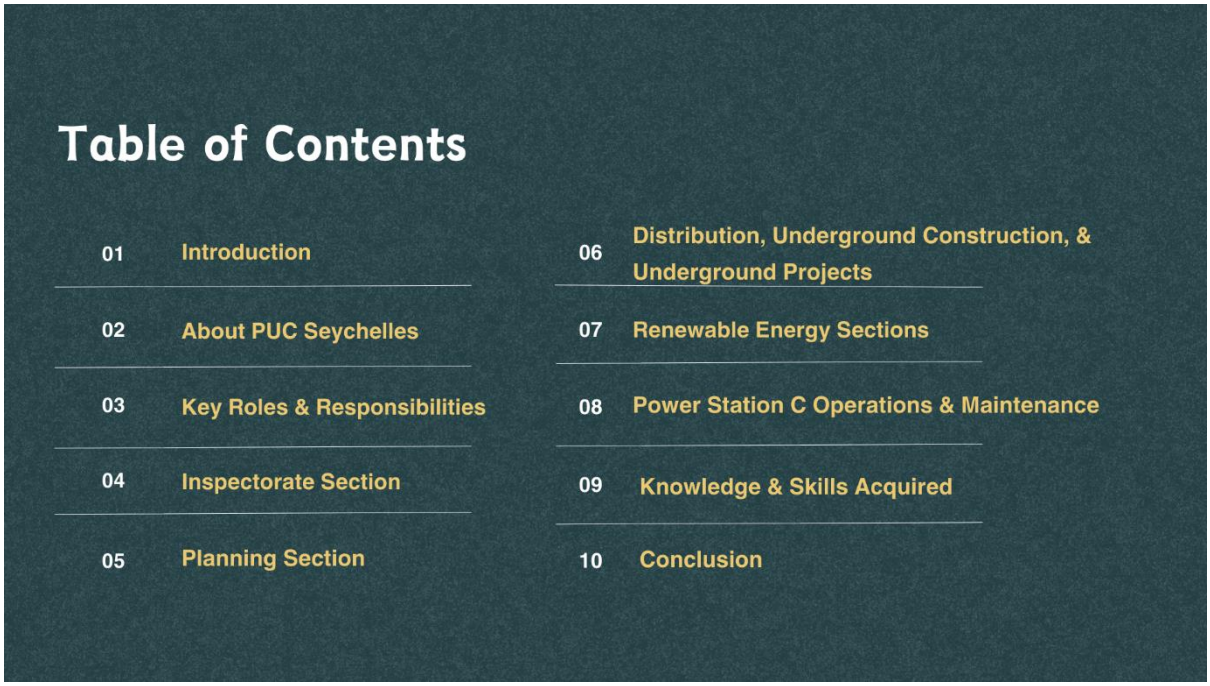
ELECTRICITY DIVISION: Electricity House, Roche Caiman
WATER & SEWERAGE DIVISION: New Port
COMMERCIAL & CUSTOMER SERVICES DIVISION: Creole Spirit Building, Victoria
HUMAN RESOURCES: Maison de Malavois, Bois De Rose Avenue
FINANCE DIVISION: Maison de Malavois, Bois De Rose Avenue
PRASLIN: Baie St Anne | LA DIGUE : La Passe

Chairman: Mr. Stephen Rousseau
Vice-Chairman: Mr. Dilip Shah
Ex-officio member/CEO: Mr. Joel Valmont
Non-executive members:
Ms. Irene Croisé, Mrs. Nanette Laure, Ms. Taryn Auguste, Mr. Bertrand Belle, Ms. Ingrid Sinon, Mr. Mike Tirant, Mr. Naddy Banane

bsi. ISO 9001 Quality Management FS 592953 ISO 14001 Environmental Management EMS 581975

Slides used for presentation





Introduction

Internship Duration: 01 July 2024 – 18 October 2024.
Company: Public Utilities Corporation (PUC), Seychelles.

Key Departments:

- Inspectorate Section
- Planning Section
- Distribution and Underground Construction
- Underground Project Section
- Power Station C Operations
- Power Station C Maintenance (Mechanical and Electrical)
- Wind Turbine Section
- Solar PV Section

About PUC Seychelles

Overview

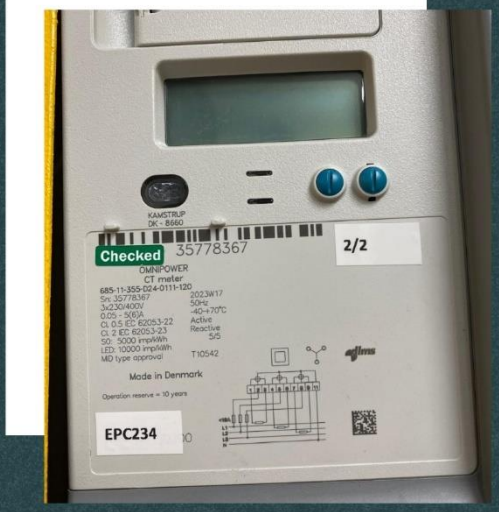
- Government owned corporation managing electricity, water, and wastewater services.
- Key focus: Reliable energy supply and renewable energy integration.

Key Achievements

- 4.92% of electricity from renewable sources (PUC, 2023).
- Major infrastructure projects: 33kV South Mahé Project, La Gogue Dam expansion.

Key Roles and Responsibilities

1. Programmed and tested single-phase and three-phase meters.
2. Designed service connections using GIS.
3. Conducted transformer maintenance and cable fault detection.
4. Performed RISO and leakage current tests on solar panels and inverters.
5. Maintained wind turbines (greasing, torque testing, battery replacement).
6. Assisted in generator maintenance at Power Station C.



Inspectorate Section

Activities Performed

- Safety compliance testing (BS 7671 standards).
- Fault detection in underground cables using ARM.
- Programming and installation of smart meters.

Skills Acquired

- Electrical testing and diagnostics.
- Attention to safety and precision.

Planning Section

Activities Performed

- Designed service connections with GIS.
- Conducted site inspections for regulatory compliance.
- Drafted Service Connection Enquiries (SCE).

Skills Acquired

- Infrastructure planning and technical drawing.
- Collaboration with engineering teams.

Distribution, Underground Construction, & Underground Projects

Activities Performed

- Inspected and maintained substations, transformers, and switchgear.
- Conducted insulation tests on high-voltage cables and transformers.
- Identified cable faults using the Arc Reflection Method (ARM) and repaired faulty joints.

Skills Acquired

- Hands-on experience with high-voltage equipment and cable fault diagnostics.
- Understanding of safe grounding procedures and maintenance practices.

Renewable Energy Sections

1 Solar PV Section:

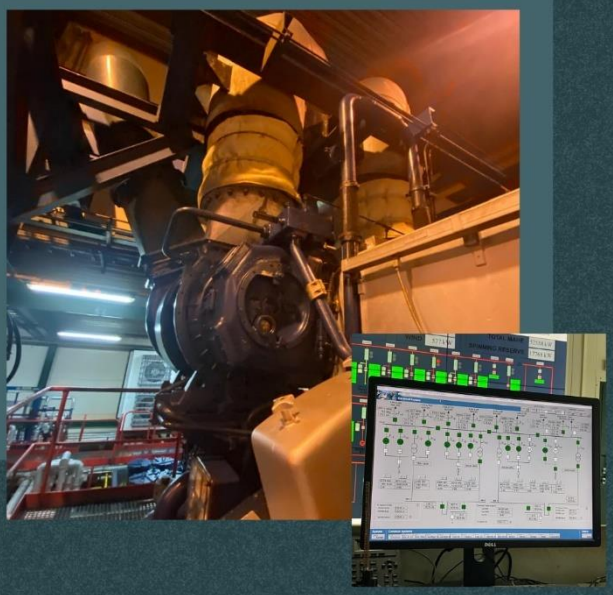
- Conducted RISO and leakage current tests.
- Repaired SCADA-linked communication cables.

2 Wind Turbine Section:

- Maintained turbines: greasing, bolt tensioning, coolant refilling.
- Replaced backup batteries in nacelles.

3 Skills Acquired:

- Renewable energy maintenance.
- Integration of clean energy into the grid.



Power Station C Operations & Maintenance

Operations

- Monitored generators using SCADA.
- Logged performance metrics (output, frequency, power factor).

Mechanical Maintenance

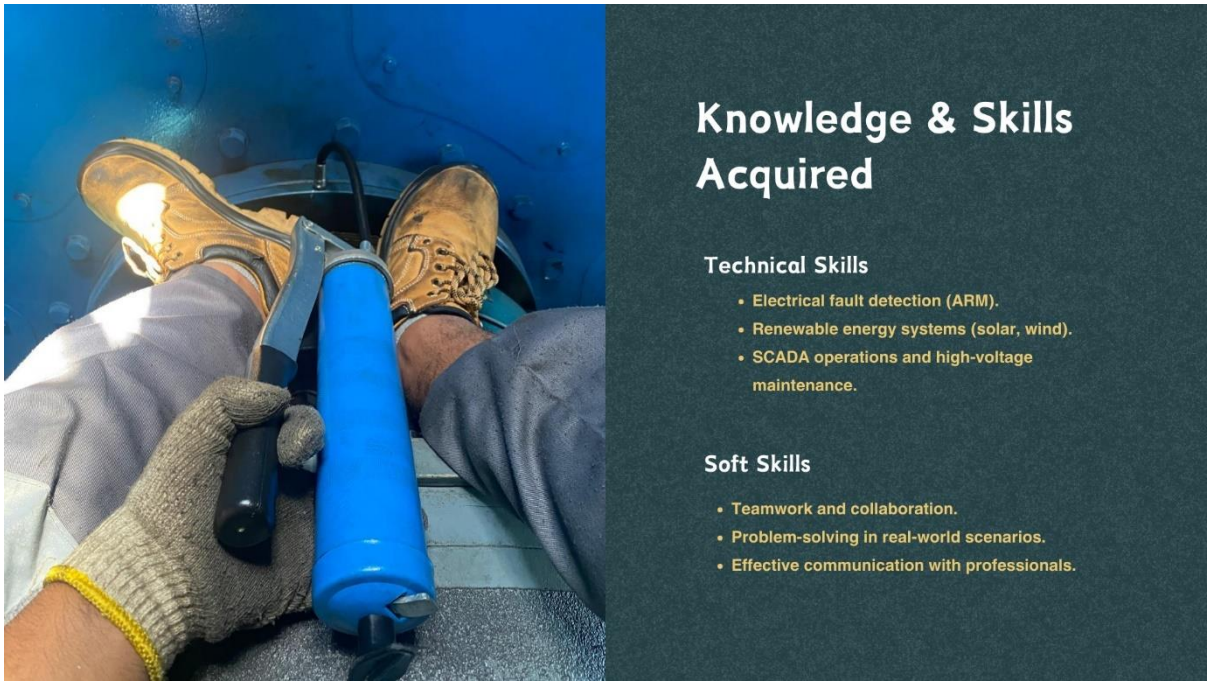
- Replaced turbochargers, silencers, and fuel pumps.
- Overhauled lube oil separators.

Electrical Maintenance

- Tested insulation on motors and breakers.
- Installed radiator motors for cooling systems.

Skills Acquired

- Power generation systems.
- SCADA monitoring and mechanical diagnostics.


Knowledge & Skills Acquired
Technical Skills
• Electrical fault detection (ARM).
• Renewable energy systems (solar, wind).
• SCADA operations and high-voltage maintenance.
Soft Skills
• Teamwork and collaboration.
• Problem-solving in real-world scenarios.
• Effective communication with professionals.


Conclusion
Internship Impact:
• Gained practical exposure to the energy sector.
• Enhanced technical and problem-solving skills.
• Strengthened passion for electrical engineering and renewable energy.
Lessons Learned:
• Importance of adhering to safety standards and protocols.
• Practical application of theoretical knowledge to real-world scenarios.
Challenges Faced:
• Diagnosing complex cable faults in high-voltage systems.
• Adapting to the technical demands of different sections
Future Aspirations:
• Contribute to sustainable energy development.
• Continue learning and innovating in the energy field.


THANK YOU