I | E | N CONSULTANTS

Internship Report

Name: Siew Zhi Tao

University: The University of Manchester

Year of Study: Year 3

Company: IEN Consultants Sdn Bhd

Internship Period: 9 June 2020 – 18 September 2020

Verification Statement

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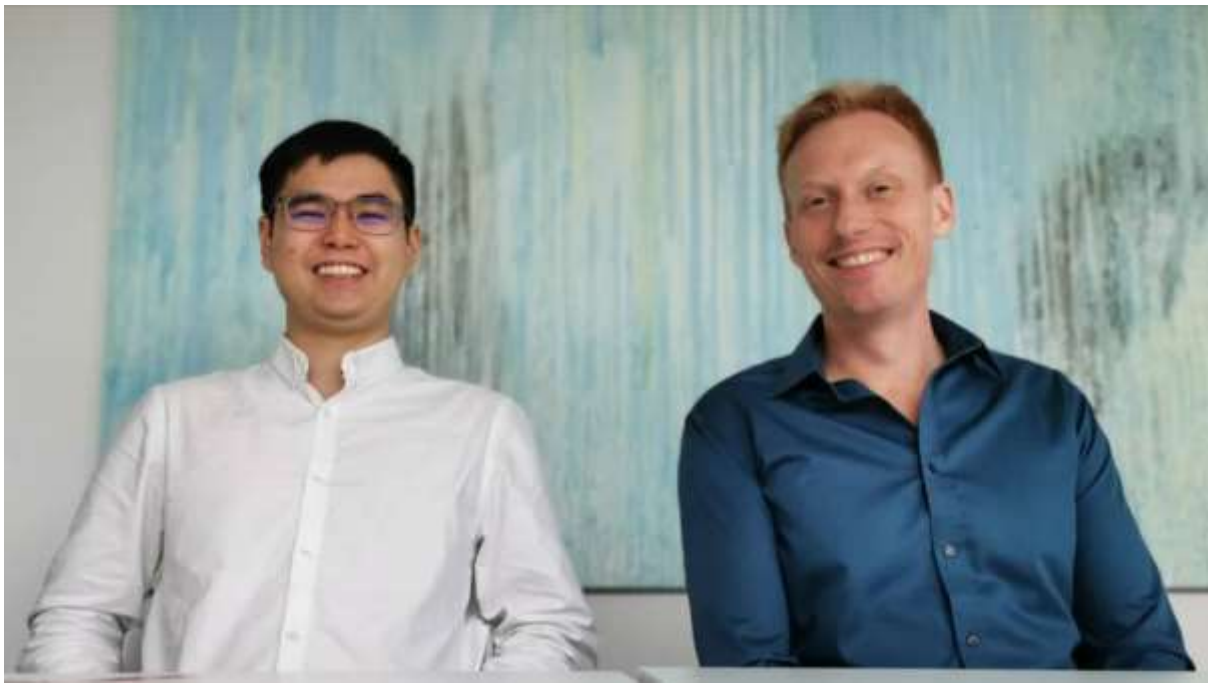


Siew Zhi Tao (left) with Gregers Reimann (right)

I hereby verify that this report is written by **Siew Zhi Tao** and that all information regarding the company and projects contained in this Internship Report are NOT confidential.

ENDORSED BY:

Host Company Signature & Stamp: …….

Name: Gregers Reimann

Designation: Managing director

Host Company: IEN Consultants Sdn Bhd

Date: ……

Acknowledgement

This internship with IEN Consultants Sdn Bhd was a great opportunity for learning as well as professional and self development. I would consider myself to be very fortunate as I was given a chance to be an intern of this company. I am also very grateful as I had the chance to meet many wonderful people from different professional backgrounds during my internship.

I would like to take this opportunity to express my deepest gratitude to the managing director of the company, Gregers Reimann, who had guided me and provided me feedback on every work that I have done throughout this internship despite of his extraordinarily busy schedule. I am very grateful for his precious guidance and feedback which were very imperative to my personal and professional development.

I would also like to express my deepest thanks to all my colleagues who have given me advice on my work as well as giving me a helping hand when I was lost. I am grateful for their help and guidance which have indirectly improved my theoretical and practical knowledge.

I perceive this opportunity as a huge milestone in my career. I will strive to use the skills and knowledge that I have garnered in the best possible way in the future.

1. Introduction

1.1 General Overview of the Company

IEN Consultants Sdn Bhd is a green building consulting company based in Malaysia. It is one of the forerunners of the green building industry in Malaysia and have undertaken various projects both locally and overseas, including government offices, office towers, hospitals, residences, airports and retails.

IEN Consultants is capable of optimising building in an integrated design process which takes passive design, lighting equipment and ACMV systems into consideration to achieve supreme energy and environmental performance and optimal indoor air quality. All these elements of building are optimised through energy, daylight and CFD simulation. IEN Consultants also has vast experience in designing according to various green building rating tools such as Leadership in Energy & Environmental Design (LEED), Green Building Index (GBI) and Green Mark.

1.2 Vision and Mission

IEN Consultants' mission is that building and transport are low carbon and in balance with what the Earth can handle while its mission is to develop and demonstrate low carbon environmentally friendly building and to practise a low carbon professional life regarding transport and office premises.

2. Working Experience

2.1 Skills gained

2.1.1 Communication skill

I have learned that communication plays an important role in the working environmental as any miscommunication will eventually lead to misunderstanding as well as delays. It is important to communicate in a clear and concise way to prevent confusion as any misunderstanding in a project meeting would lead our counterparts to the wrong direction causing unnecessary delays. To prevent the occurrence of misunderstanding, I found that it is useful to write a summary email to our counterparts after any meetings to ensure all suggestions made are accurately conveyed and picked up by our counterparts. I also find that people from different background may speak a different technical language, for instance, an architect would convey his or her ideas from a more artistic point of view while engineers tend to speak in a very technical way. Therefore, it is extremely important to present our ideas in a way that suits the audience best to achieve effective communication.

2.1.2 Presentation Skill

I have undertaken some presentation during this internship and I found that an effective presentation requires some techniques. First, the audience would prefer having more graphics than words as a picture is worth a thousand words. It is also useful to use graphs or charts to deliver numerical data as it gives a clearer interpretation rather than just numbers. Next, I find that comparison is key too, as audience would often like to see their initial position and then their new position upon further cost investment. I also find that it is important to present numerous ideas and their corresponding costs and outcomes during proposing period as people like to have a few choices rather than one solid substantiated solution.

2.1.3 Commitment & Taking Initiatives

Going the extra mile is one of the values that I learned during this internship as taking initiatives to approach fellow colleagues to clarify things is very important in workplace. Taking initiatives such as consulting or asking for opinion from others helps me to understand a problem better and thus able to provide a better solution to it. Being committed to a task is the prerequisite of achieving success as additional commitment such as doing background research, referring to case studies online and take up extra readings can broaden my knowledge and exposure, thus, improving my solution to a task.

2.2 Knowledge Gained

2.2.1 UniKL Living Lab

This is the first project I was given to work with when I first joined the company as an intern. UniKL Living Lab is designed to be a net zero building, thus, it is equipped with numerous energy storing mechanisms which help to attain the net zero building status. Being a tropical country, Malaysia is blessed with extensive amount of sunlight, which can be turned into energy. This Living Lab is mainly powered by solar energy whereby PV panels are designed to be the roof of the building and Building Integrated Photovoltaic Panels (BIPV) are also being installed on the façade.

It is common that excess solar energy produced is often being fed back to the grid or stored. In the project, I have learned a few methods to store excess energy which are battery storage, thermal storage and also through slabs cooling. In battery storage, excess energy is stored in the battery and to be used during the time with low solar energy production such as during night time. As observed in the charging of our cell phones, batteries turn hot while being charged, thus, it is important to bring the temperature down in the battery room to maintain an optimum operating temperature for the inverters and batteries. In order to reduce cooling load, louvres windows and ventilation fans were designed to allow cross ventilation in the battery room to bring down the temperature.

Next, energy generated from PV panels can also be stored in the form of thermal energy. In this project, a thermal storage is designed to store chilled water. Chilled water is produced from chiller and then fed into the thermal storage. During low cooling load period, thermal storage can be tapped to cool down the building. In the thermal storage designed, I have learned a little about tank insulation. For instance, the tank can be insulated by PU foam while the bottom of the tank can be insulated by Styrofoam to avoid thermal bridge with reinforced concrete plinths. If the insulation is not done properly, not only the chilled water will heat up, but also the slabs will be cooled, leading to condensation in the building. I have also learned about thermal stratification when completing this task. Thermal stratification is the phenomena where warm water will always be on top of a tank of water as it is less dense than chilled water. This is perfect for building cooling as a dedicated tank is not

needed for chilled water return since it can be fed back into the thermal storage tank without mixing with the chilled water.

Energy can also be stored in the slabs by cooling them using floor slabs cooling method. Chilled water can be pump into the slab, reducing its temperature, therefore reducing the cooling load of the building. Since slabs has large thermal mass, it can release its coolness slowly thus reducing maximum demand in the morning.

Another area of knowledge that I have gained is the chiller plant. I have learned about the common heat gain in a building which must be included in the cooling load estimation. Heat gain involves sensible gain and latent heat gain. Sensible heat gain includes heat generated by occupants, electrical appliances and also through the windows. To minimise sensible heat gain through the window, low E glazed, shading device and blinds are preferred. Humidity does affect the thermal comfort of a workplace, thus removing latent heat is as important. Since the cooling tower of this building is place very close to the PV panels, it is worried that the vapour from the cooling tower may degrade the PV panels. Thus, a non-chemical water treatment cooling tower was proposed to minimise the damage dealt to the PV panels. However, due to lack of funds, this suggestion was not implemented. I also had the chance to be exposed to M&E CAD drawings when all these cooling systems are put together, which was eye opening as I have not had the opportunity to see the MEP drawings before this internship.

2.2.2 Parcel F

I was tasked to analyse the water usage and energy consumption of all the buildings in Parcel F Putrajaya. First, I learned that all the water usage and energy consumption can be traced using Building Management System (BMS) with all the digital water meters and digital power meters connected to it. However, these meters may undergo some glitch during its operation, resulting wrong values recorded by the BMS. Thus, it is important for the facility manager to monitor the BMS regularly to ensure only the right values are recorded. Next, I have also investigated the power loss during transmission from the grid to the main switch board of the building. There are times where the power loss is greater than 4% which is unacceptable, thus, further action is required to rectify the problem.

While analysing the water usage of the building, I also had the chance to learn about the water piping system which includes AHU condensate recovery, rainwater harvesting and greywater recovery. Since the humidity in Malaysia is quite high (approximately 70% RH), the air handling units often dehumidify the air before distributing into the building. The process of dehumidification yields some condensate water and it can be collected and used. In addition, harvested rainwater can be used for irrigation as well as toilet flushing which serves as a good way to minimise water consumption. Lastly, greywater collected from taps and ablution can be treated and used for irrigation too. However, the entire system has to be synchronised and programmed correctly to ensure the system to work cohesively.

2.2.3 Air Quality

An air quality sensor was used to detect the air quality in the office when the office next door underwent renovation. It was found that the indoor air quality was at hazardous level when the contractors were painting the new office as the paint they used emitted high amount of volatile carbon compound (VOC). Since the entire floor shares the same AHU system, some of the VOC was recirculated into my office. Some colleagues suffered from headache and nausea. I then processed the data obtained from the air quality sensor and sent it to the management office, suggesting them to develop a new guideline on office retrofitting as the use of high VOC emitting paint will affect staffs productivity. During this small study, I have also learned more about the particulates and harmful gas that present indoor as well as in the atmosphere. The present of such substances in the air will affect one's health and the productivity of a company's employees. Thus, it is vital to adhere to the indoor air quality standards to maintain a healthy workplace.

2.2.4 Little Houses

I participated a few meetings with the architect in this Little Houses project, the client would like to build a bungalow that mimic the styles of kampong houses. Thus, natural ventilation is a key part of this project as most traditional houses are ventilated naturally through windows openings. However, such natural ventilation designs were difficult to be implemented as the architect has almost finalised his drawings. Thus, I learned that implementation of green elements such as natural ventilation and daylighting features are often difficult to apply in the late stage of design. Therefore, it is utmost important that

green building features must be proposed and presented during early stage of design as this would allow the designer or architect to start its initial sketching and drafting based on the proposed green features. I also learned that, in order to build a sustainable green building, it is not only the green building consultants should push for the sustainability items, but also the design team. The entire design must have a same goal since day one, which is to build a sustainable building, in order to achieve success.

I also learned that it is imperative for me to learn how to read and analyse architectural drawings as it is the backbone of a project. All other systems are designed and put in place base on the drawings. Misunderstanding of any elements of the drawings would result in other design errors.

2.2.5 American Air Filter (AAF) Factory Visit

I had the chance to visit the AAF factory in Shah Alam during this internship. Training on air filter was given on-site and I have learned so much about air filter. In lights of Covid-19, everyone has paid much more attention on indoor air quality than never before, thus, air filter manufacturers are now racing to develop air filter that can filter out small particulates as well as bacteria and viruses. I was exposed to air filter systems that contain UV radiator or electrostatics generators to wipe out viruses from the indoor air. Through this training, I also learned that pressure drop is an important factor to determine the lifetime of an air filter. Pressure drop across air filter must be monitored regularly to ensure that the air filter is still functioning well. I also learned that there is a type of air filter can be placed above the diffuser unit which particularly useful when the AHU system is facing problem of space constraint. I am also exposed to a few indoor air quality standards such as ASHRAE 52.2 and MERV standards which allows me to implement them on future design tasks.

I have learnt about Kaizen (continuous improvement) and Muda (waste) reduction in school and I had the chance to witness it in AAF factory. Monthly reports are published and placed on the wall of the factory, allowing all employees to improve themselves based on the suggestion provided following a Kaizen meeting. Waste reduction was seen during lunch hour as the factory switched off all the lights and machines to minimise unnecessary electricity usage. I also observed that the Quality Assurance (QA) team was constantly monitoring the product supply chain to ensure on the qualified products are delivered to

the customers. This led me to think about I have to always checked my work before presenting to others to ensure only the right information is delivered to clients and design team.

2.2.6 Hospital Energy Benchmarking

I had the chance to attend the meeting with Ministry of Health (MoH) regarding the study involving energy benchmarking for all government hospitals. This study is to develop a formula to determine the projected annual electricity consumption of a hospital. This study was done using multi-regression analysis which involved a lot of data-crunching. However, through this small study, I have witnessed the downside of the working world, which is poor response from the respondents (the hospitals). The hospitals were supposed to provide data to academicians for further analysis. However, some hospitals provided incorrect information while some hospital did not respond. I have to admit that such situation is not uncommon in the working world and I have to learn to deal with such situation in the future. Through this study, I had learned a little about multi-regression analysis and some other statistical parameters. It is also found that the number of people present in the hospital does not have strong corelation with the energy consumption as most systems in current hospitals are not variable.

2.2.7 Knowledge Sharing

Friday knowledge sharing is one of the events that I look forward to during my internship. Through sharing from the other colleagues, I get learn more about green buildings as well as other information such as healthy lifestyle. There are two particular sharings I find most interesting, which are the Solar Scandal and the cost benefit analysis of increased ventilation rates.

In the solar scandal sharing, I learned that, during the solar bloom in Europa in year 2010-2013, the backsheet of most PV panels were made of polyamide, which has very low lifetime. Being a dielectric insulation, the backsheet has to be robust for the PV panel to be operating correctly. However, it is found that PA backsheets have defect rates of 90% 6 to 10 years after commission. This figure is unacceptable as the defect will allow moisture to enter and damage the other components of the PV panel. Therefore, it is important to

understand the structure of a PV panel before purchasing as it is a waste of money if the PV panel has a very short lifetime.

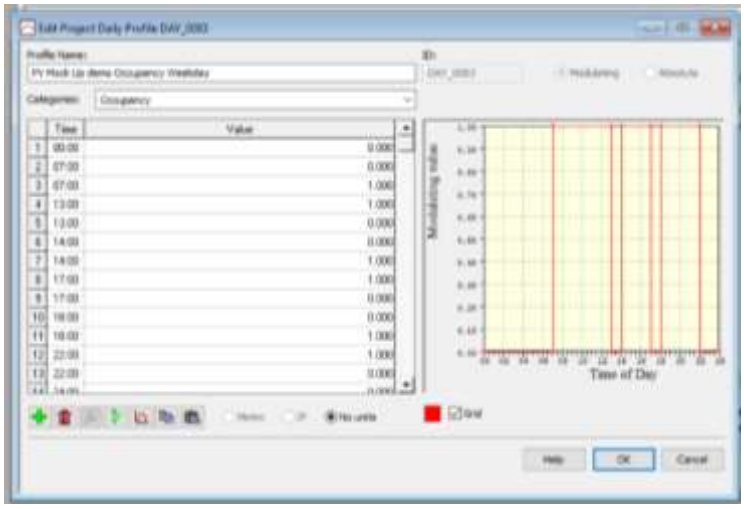
From the cost benefit analysis, it is shown that the ventilation rate plays a significant role in determining the productivity of the people in the building. From the analysis, cognitive and decision-making performance decrease with increased carbon dioxide concentration. It is also found that there is a reduction of illness when the ventilation rate increases. Thus, it is utmost important to building services engineers to increase the ventilation rate to improve well being and productivity of the tenants. The payback time for this improvement in ventilation for a school is only less than a year. Nonetheless, not only schools should have high ventilation rates, but also offices as this can allows all the employees to work efficiently and productively.

2.3 Software Learned

2.3.1 IES Virtual Environment

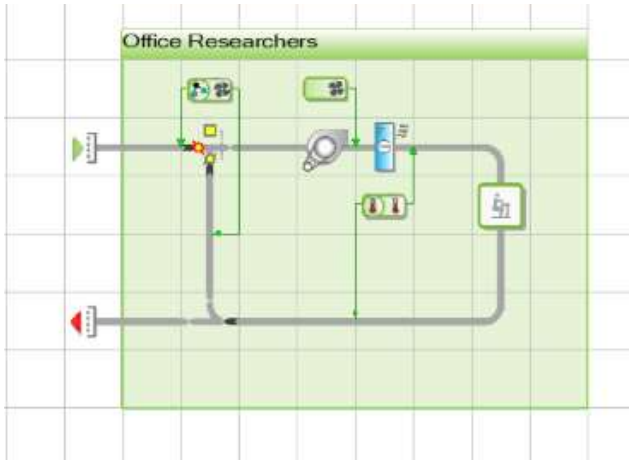
During my internship, often times IES Virtual Environment (VE) is used to simulate the performance of a building. Its results are extremely useful to me as a trainee consultant as these simulation results allows us to back our arguments up as well as to determine the estimated energy consumption and daylight profiles. The phrase “garbage in, garbage out” is applicable to IES VE simulation. Thus, I have learnt to put in the right input to ensure that the results are as accurate as the actual building performance. First, the building model has to be built and this can be done by using AutoCAD and SketchUp and then import the model into IES VE. Next the geographical location of the building and the orientation of the building have to be set as shown in the figure below.

The thermal template is then needed to be created. Through this process, I learnt about the occupancy rate, operating duration of small power appliances and lightings fixtures. It is important to reduce the occupancy rate as well as the lighting fixtures operating time to a lower degree during lunch hour to reflect the true energy usage. On top of that, small power appliances must not be tuned down to zero outside of office hours as there are certain electrical loads such as server room and charging ports that are not switched off.

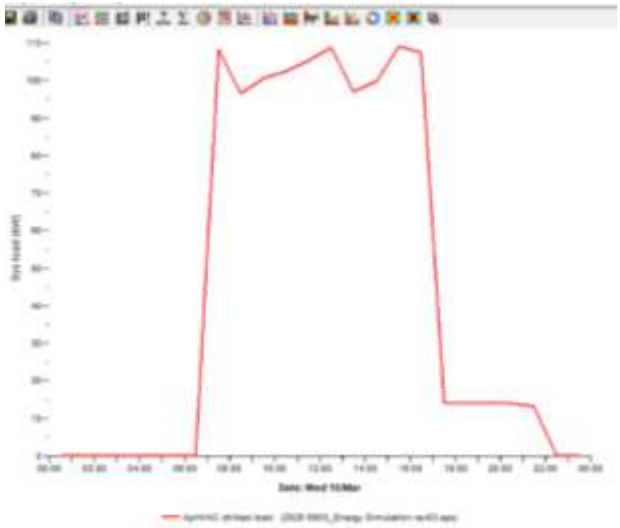


I have also learned a little about the cooling system while doing the building modelling. For instance, CO2 controls and temperature sensor can be installed to increase or decrease the

temperature of the cooling coils. In the chiller modelling, I learned variable speed drive can be installed in chilled water pump, condenser pumps and cooling tower fans to optimise the performance if the building has a different cooling load throughout the day.



Lastly, when all the inputs have been inserted completely, simulation can be run and a thorough results can be obtained. The figure below shows the 24 hours cooling load of a building. It is worth notice that the peak loads are often during the first hour of operation, midday and late afternoon. In this case, there is a low late night cooling load. Thus it is imperative to use VSD in the cooling system to avoid using full load at nights.



I have also learned about Overall Thermal Transfer Value (OTTV) and Roof Thermal Transfer Value (RTTV). Ideally, the OTTV and RTTV have to be below 50 and 25 W/m^2 to avoid large amount of heat gain through windows.

3. Conclusion

From deep inside my heart, I would say that this three-and-a-half-month long internship at IEN Consultants is by far the best experience I have ever gained. Not only I get to meet many amazing and bright minds but also the chance to further enhance my technical and soft skills as well as broaden my vision in the consultancy industry. The working environment in IEN Consultants is always very welcoming and relaxing as it just felt like home. It led me to understand the true meaning of work life balance as all colleagues are very friendly outside of work and I had the chance to social with them after working hours. I also have the sense of accomplishment during this internship as I was able to contribute to the company by assisting and completing tasks assigned to me. Not only I was able to learn from day-to-day work in the office but also from external meeting with other design teams. Through these meeting, I got to gain an insight of how a design meeting progresses. In short, I believe my internship at IEN Consultant has been a successful one and I could not be more thankful.