Electric Energy Consumption of the University of Mandalay

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Abstract

Electric energy plays a vital role in our day-to-day life activity. The amount of energy consumption at the university campus has become huge. Therefore, the energy consumption reduction in the University of Mandalay has been critical. It is due to the increase in the use of electrical appliances at the department laboratories as well as to the increased in personal use in the campus (air-conditioning, water pumping generator, cooking stoves, refrigerators). For the energy consumption reduction in the university campus, the energy consumption reduction analysis of the current situation has to be executed. Therefore, the survey was made in 2018 by the Environmental Studies specialized students at the grass-root level. The main aim of this survey study is to know the minimum energy consumption in the University campus and to find out the potentiality of the replacement of renewable energy. According to the survey results, the average daily energy consumption of the University of Mandalay was 14.9 MWHour. The teaching departments (including the laboratories) consumed about 31% of that average amount and the remaining 69% was used by the supporting offices and residents.

Introduction

Myanmar generates electric energy from the water resources since the time of the British. To date, the main access for power consumption throughout the country is the national gridline. All government offices and public universities, institutes have to rely on the national grid. Therefore, the individual power consumption (at the household and family level) has to be electrified by the grid. For the tax of electricity consumption by government offices, institutes, hospitals are used to be paid by concerned institutions (i.e. government budget). That is the main reason to reduce the power consumption at each institution. In Mandalay University (Map 1), the students can stay at the students' hostels, both teaching and supporting staff can be allotted on the campus (Staff's Apartment and Residents). They can access water and electricity free of charge before 2020. As a result, the monthly average charge for the electricity of the university was about 45m. MMK (about US $ 329358.15) and the monthly average power unit was about 15MGWhour. Almost every each house and apartment by the staff use as much electronic material as possible including electric stove, air conditioner, refrigerator, washing machine, and television and video sets. After fixing the sub-meter for each house of the staff (after October 2019), the tariff has been decreased (about 35m MMK or US$ 256167.45) per month. A very high amount of power charges was due to the increase in electricity tariff by the central government for the entire country. Therefore, the survey was made in 2019 to collect the average estimation of the electrical device and appliances from the teaching departments and staff's apartments.

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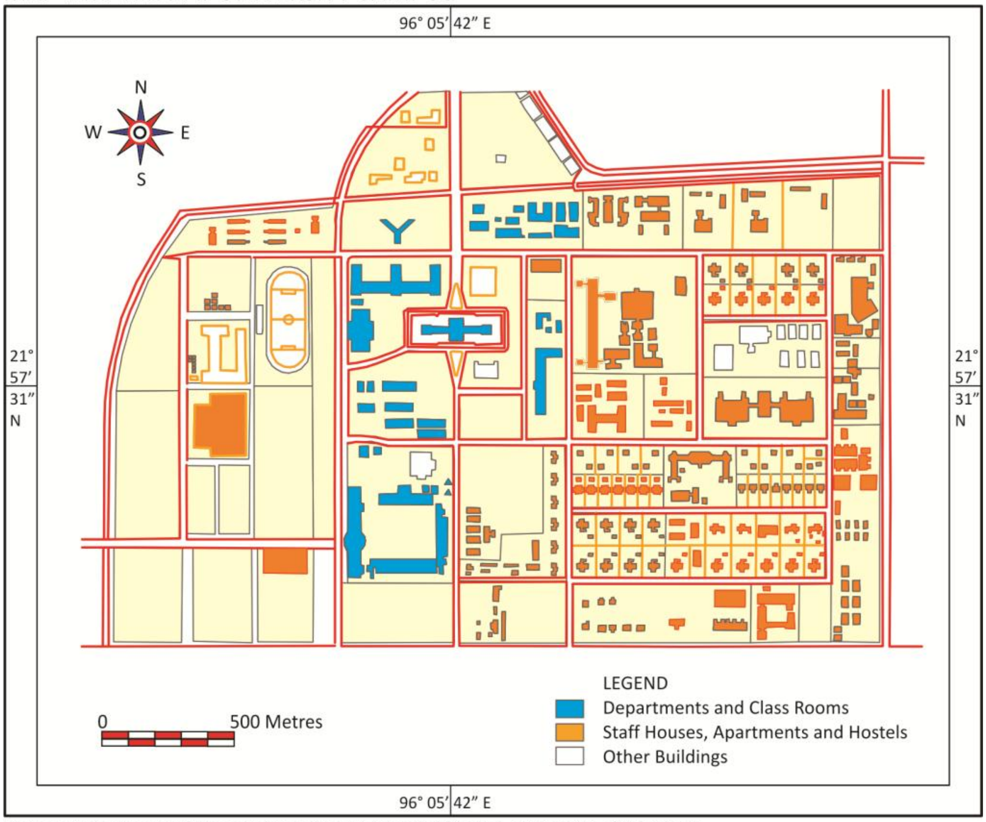
MAP 1 MANDALAY UNIVERSITY CAMPUS



Source: Department of Geography and Environmental Studies, University of Mandalay.

Literature Review

The ADB Report (2016) for Power Consumption by the Households in Myanmar provided detailed data and information at the household level for 11 regions and States in the country. There was not a separate description of the power consumption by the public university or government office. Tim Dobermann (2016) explained why the study of power consumption by the university campus is essential and the author focused the power consumption by the air-conditioning systems of the campus. Regarding Myanmar Electricity consumption was analyzed by the different scholars. The potentiality and development of electricity production in Myanmar was examined by the ASH Centre in 2012. The report was mentioned about the power consumption of the household level and some consideration on the future development. In 2013, Vikas Sharma overviewed the electricity industry in Myanmar. It was mainly focused on the electricity production. The household level power consumption was considered by Win Win Kyu and Dr. Boonrod Sajjakulnkit in 2014. As a part of the ADB report in 2015, Kee-Yung Nam, Maria Rowena Cham and Paulo Rodelio Halili presented the power sector development in Myanmar. The Ministry of Electricity and Energy, The Republiuc of the Union of Myanmar published that the power consumption in the country was shared by hydro-electricity for 59%, Gas for 4% and Coal for less tha 1 % (2016). The official announcement said that there are 5 stations of solar power (which produces about 1510 MWatt per hour) to date. The scholars from Mandalay Institute of Technology (Maw Maw Tun, Myo Min Win, Aung Myat Thu) jointly published with Dagnar Juchelkom, Tomas Puctor (2019) the efficiency and the challenges of the power produced from biomass. The number of the research results regarding the power production and consumption in Myanmar are still left out. It is distinct that there was very rare researching and finding about the reducing of power consumption by an institute or a community, replace of the renewable energy in Myanmar. Therefore, this paper may fill this blank of the micro-level observation in power consumption and of introducing the renewable energy at a small area or a place.

Aim and Objectives

The main aim is to find out the potentiality of the use of renewable energy (solar panel) which will be the very first Green University Campus ever in Myanmar. To meet this aim, it is important to collect the data of power consumption and electricity tariff of the campus at a monthly average rate. Moreover, it is necessary to calculate the minimum requirement for the implementation of green energy. But, this study can be able to examine the ground level of power consumption by the departments, hostels, and apartments.

Data and Methodology

The University of Mandalay is located in Mandalay City, Mandalay region, Central Dry Zone of Myanmar. It is the second-largest university in Myanmar and is the public university. The tariffs for power, water, sanitation, waste dumping for the entire campus is paid by the budget of the Central Government. If the University would be the first Green University ever in the Country and it also helps to save the Government budget.

The offices from the University provided the secondary data of the number of the departments, the total population who reside on the campus, the number of apartments where the staff is allowed to stay. The work of the solar panel task will be applied to define the electrical device and appliances which are used by an individual. The amount of watts that are consumed by the devices will be computed to acquire the minimum consumption amount of power. This is of course an average variable value. For example, the power that is consumed by the computer depends on the power value of its inbuilt elements (power block, processor, video camera, etc.) The simple graph methods will be applied to show the comparison of the power consumption by the different departments/ apartment.

The common various devices with an average consumed watts setting up in the buildings of the University campus are as follows:

1. Electrical cooking stove-1.5 Kwatt
2. Air conditioner- 0.5 Kwatt
3. Electric oven -2.3 Kwatt
4. Hair drier -1.5 Kwatt
5. Heater - 1.5 Kwatt
6. Microwave oven - 1.5 Kwatt
7. Iron - 1.1 Kwatt
8. Water heater -479 watt
9. TV -150 watt
10. Blender -300 watt
11. Fridge -188 watt
12. Monitor -150 watt
13. Computer -120 watt
14. Portable fan - 100 watt
15. Ceiling fan - 75 watt
16. Printer -45 watt
17. Cable box- 20 watt
18. Satellite antenna - 15 watt
19. Wireless wifi router -7 watt
20. Mobile charger - 4 watt
21. Wireless phone - 3 watt
22. Electric Water Pump - 500 watt

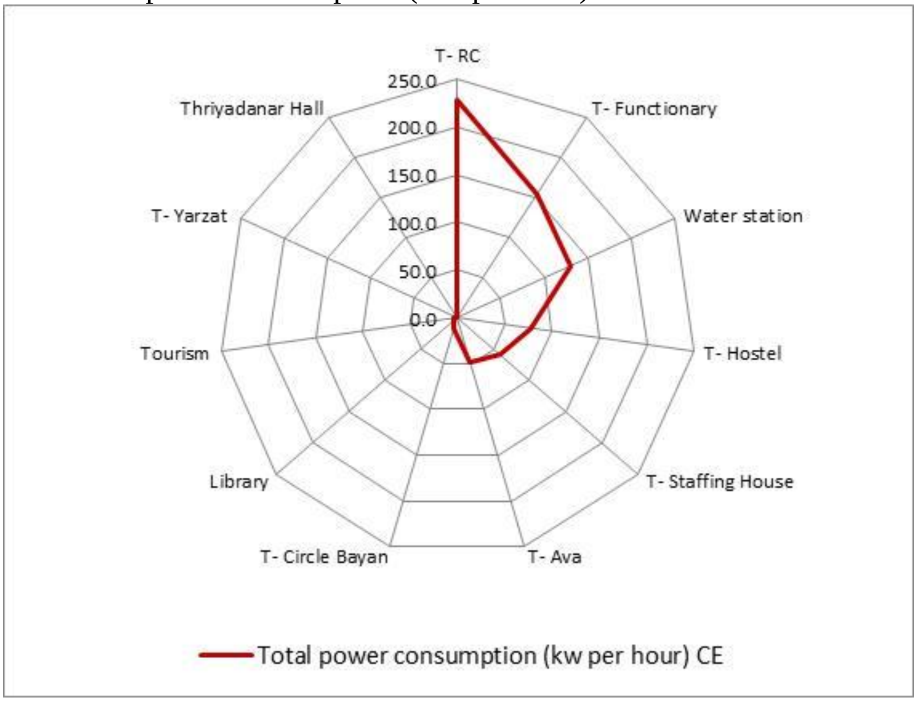
After collecting the number and type of devices from the different buildings and rooms are multiplied by the average consumed power as mentioned above. Then, the results will be explained according to the buildings.

Results and findings

Required consumption power is estimated by the amount of consumed electricity by electric devices. When calculating it is necessary to take into account the losses for the conversion of DC voltage to AC, charge-discharge of batteries, and losses in conductors.

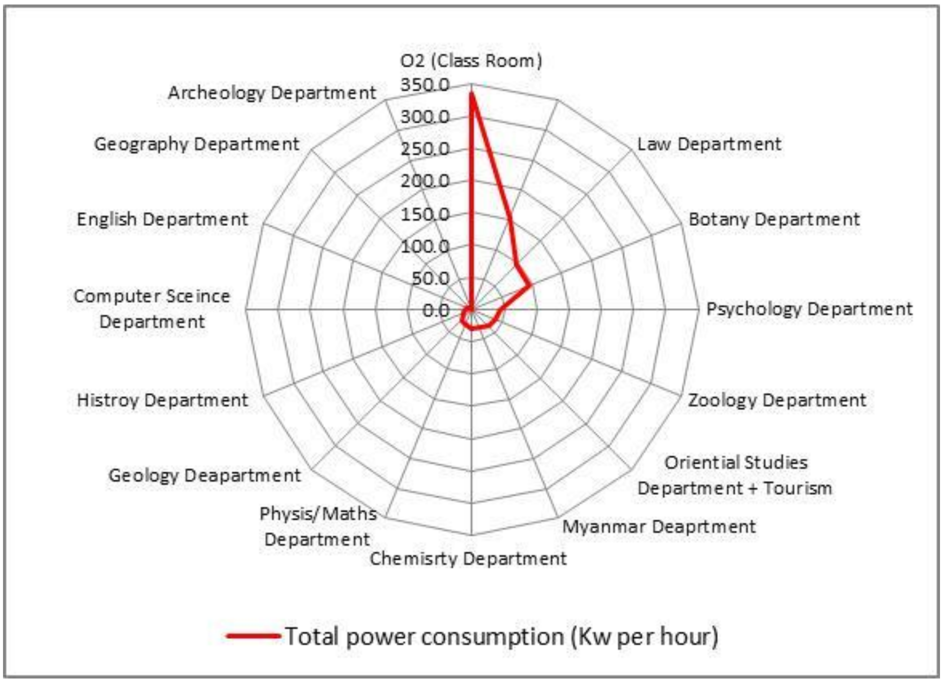
Total power consumption per hour according to the devices used of the buildings on the campus of the University of Mandalay showed in the table (1), (2), and in figure (1), (2). The tables and the figures showed the minimum total power consumption by the departments and other buildings (students' hostels, staff's houses and apartments, library, water pumping stations). The period was considered for an hour. This consumption amount was calculated based on the number and types of electric devices at each building. It was difficult to define exactly for some departments or buildings. For instance, the Chemistry department is located at the same building of Administrative departments (students' affairs, students' hostel, sports, examination and graduation, etc.). Therefore, a very high amount of power consumption under the Chemistry Department and that of power by the Main Building are not able to separate. The same situation can be observed in the departments of Physics and Mathematics because both departments are located in the same building. Moreover, department wise power consumption amounts are included by that of nearby classrooms. The power consumption according to the programs is also added to the concerned departments. A good example is the Economic Department and the MBA/ MPA programs. As shown in the table and figure, the Economic department is the topmost department in power consumption. During the survey period, it was noted that various types of electric devices were used in the department (including electric stove, air conditioner and fridge).

Figure 1 Total power consumption (Kw per hour) CE in the different buildings



Source: Based on the primary data from survey works in 2018

Total power consumption (Kw per hour) CE in the departments and classrooms



Source: Based on the primary data from survey works in 2018

Moving beyond the grid

Grid electricity will not solve all problems. It is a technically efficient solution for many areas, but not for all. The process of expansion and connection also takes many years (once the grid reaches a township, it can take anywhere between one to four years for households to complete their connections). There exist immediate opportunities for electrifying villages without relying on or waiting for the grid. Two promising technologies to achieve this are solar power and micro hydropower. Currently, largely as a result of charitable or non-governmental and private individual efforts, there has been an emergence of small solar devices used for basic lighting and charging of mobile phones. Another technology being used is diesel generators, with individuals in a village paying a fee to access its electricity as a community owned. Current per capita electricity consumption is very low in Myanmar, around 150-160kWh. As a reference, it takes 130kWh to use a standard 60-watt light bulb for six hours per day for a full year. Electricity comes relatively cheap for those who can access it in Myanmar. An examination of the electricity tariff the structure across various ASEAN countries reveals that Myanmar has some of the lowest rates in the region. Determining the correct electricity price or tariff is a key policy objective. First, the facts: the existing rates are not financially sustainable over the long term. Recent reforms have allowed private (and international) companies to assist in the generation of electricity. However, all electricity is still sold to state-economic enterprises, which then transmit and distribute the electricity to consumers at established rates. The revenues from sales of electricity must at least offset the costs. Myanmar has tremendous potential to develop renewable energy beyond hydropower. Its central dry zone has an estimated potential of around 52,000 terawatt-hours per year (52 x 10^{15} watt hour/ year). (Solar Panels Task)

When calculating the power of solar panels, it is essential to know the required power consumption, the time of the year and the geographical location even in Myanmar. Required power consumption is already worked as shown in above and in the tables and the figures for the Mandalay University Campus. The following formula was applied to achieve the minimum required energy produced by solar batteries by the departments/ apartments/ houses.

PSP = CE*k*IPES/ MAR

Where, PSP – power of solar panels, W or KW

CE –Consumed energy, Wh/ day

MAR – Monthly average radiation, $KWh/m^2/day$

IPES – insolation power on the earth's surface per square meter (1000 W/ m^2)

k- the coefficient of charge loss- the discharge of batteries, the conversion of DC to AC, is usually taken to be 1.2.

The formula (2) for calculating the energy produced by solar batteries is:

EP = MAR*PSP/ IPES*k

Where, EP – energy produced by solar batteries, Wh/day or kWh/ day

PSP – power of solar panels, W or kW

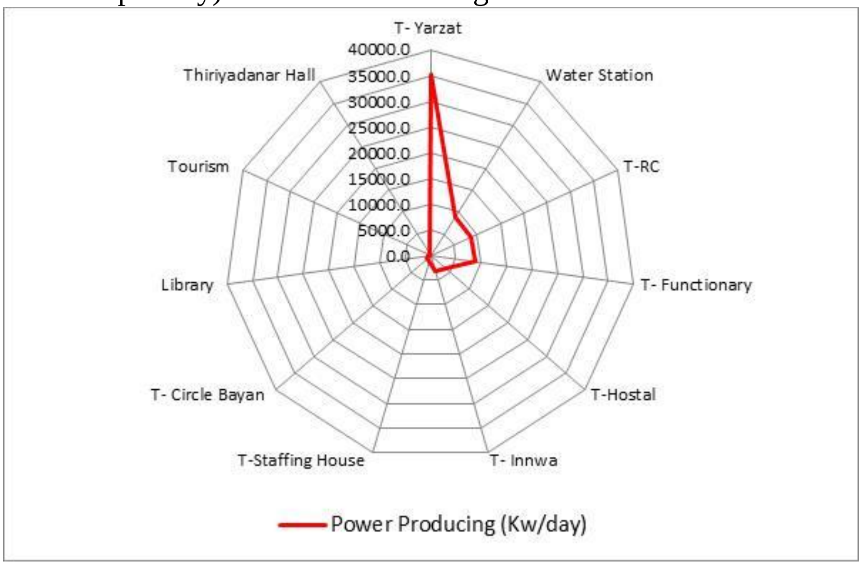
MAR – monthly average radiation $kWh/m^2/day$

IPES – insolation power on the earth's surface per square meter ($1000W/m^2$)

k- the coefficient of charge loss- the discharge of batteries, the conversion of DC to AC, is usually taken to be 1.2.

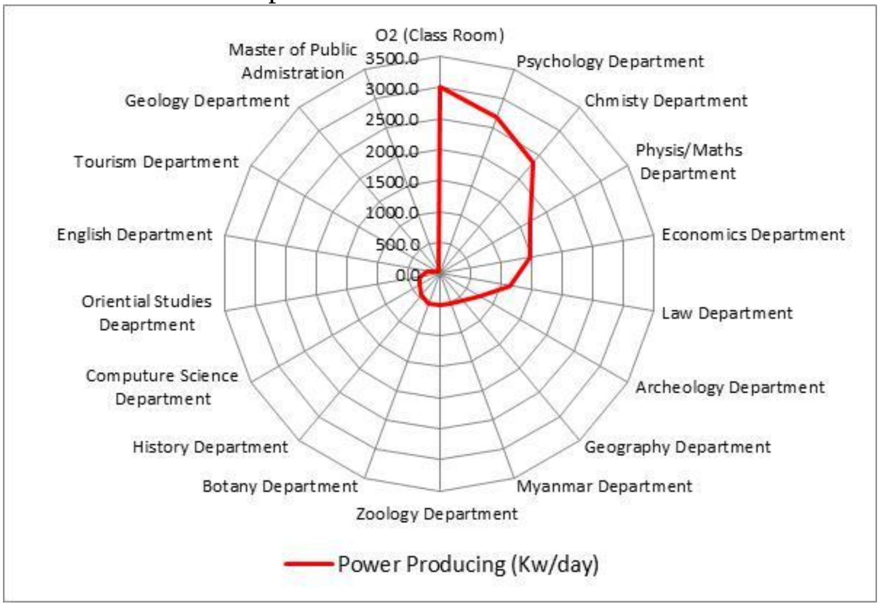
Solar radiation is not a constant value and depends on many factors- time of the year, time of day, weather conditions, etc. These factors should also be taken into account when calculating the amount of required solar panel power. Table 3 and 4, Figure 3 and 4 showed that amount of required solar panel power by the departments and the staff house, apartment in Mandalay University by using formula (2).

Figure 3 Required Energy produced by solar batteries (EP) (Kw per day) in different buildings



Source: Based on the primary data from survey works in 2018

Figure 4 Required energy produced by solar batteries (Kw per day) for each department



Source: Based on the primary data from survey works in 2018

Conclusion

After conducting this mini research, it is realized that the replacement of the renewable energy on the university campus is possible. Due to the lack of technology and shortage of the financial aid, we can initiate from a very small area or the much consumed building on the campus like URC. There will be many obstacles to replace the renewable energy in Myanmar. The first and foremost challenge is what policies will support in establishing the new energy. Moreover, it is important to take into account on the question of how can tariffs be reformed to improve the financial health of existing utilities and state enterprises? What is the right price given to social, economic, and environmental objectives? What financial incentives can the government provide for the adoption of off-grid technologies, like small-scale hydro and solar?

Moreover, the flux of energy produced from the solar panels will be finding difficult to store. How can the government assist in large-scale renewable electricity generation, and which technologies require more research and development to be efficient?

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