Energy Consumption of DIU Buildings: A Study for Future

A Project report is submitted in partial fulfillment of the requirements for the award of Degree of Bachelor of Science in Electrical and Electronic Engineering.

Submitted by

Md. Salauddin (191-33-5109)
Md. Habibur Rahman (191-33-5094)
Md. Minhaz Uddin Seum (191-33-5050)

Supervised by

Dr. Srimanti Roy Choudhury
Associate Professor
Department of Electrical and Electronic Engineering

Department of Electrical and Electronic Engineering
Faculty of Engineering
DAFFODIL INTERNATIONAL UNIVERSITY

JANUARY, 2023

DECLARATION

I hereby certify that the following students worked on the capstone project/thesis " **Energy Consumption of DIU Buildings: A Study for Future**" in the labs of the Department of Electrical and Electronic Engineering within the Faculty of Engineering of Daffodil International University under my direct supervision in order to partially fulfil the requirements for the degree of BSc in Electrical and Electronic Engineering. Starting on August 9, 2022, the capstone project or thesis will be completed. I have sought to identify all of the hazards associated with this research that may develop during the course of this research, received the necessary ethical and/or safety permission (where applicable), and accepted my responsibility as well as the participants' rights.

Signature of the candidates

Salauddin

____

Name: Md. Salauddin

ID: 191-33-5109

____

Name: Md. Habibur Rahman

ID: 191-33-5094

____

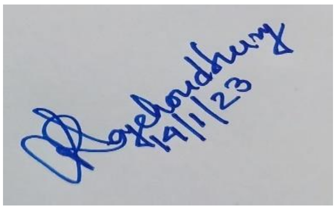
Name: Md. Minhaz Uddin Seum

ID: 191-33-5050

APPROVAL

The project/thesis " **Energy Consumption of DIU Buildings: A Study for Future** " was turned in by **Md. Salauddin (191-33-5109), Md. Habibur Rahman (191-33-5094) & Md. Minhaz Uddin Seum (191-33-5050)** has been done under my supervision and accepted as satisfactory in partial fulfillment of the requirements for the degree of **Bachelor of Science in Electrical and Electronic Engineering** in **January, 2023.**

Signed



Dr. Srimanti Roy Choudhury
Associate Professor
Department of Electrical and Electronic Engineering

Faculty of Engineering

Daffodil International University

Dedicated

To

Our Parents

…..

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

BREB	Bangladesh Rural Electrification Board
DIU	Daffodil International University
R&D	Research and development
YKSG-1	Younus Khan Scholar's Garden
DISS	Daffodil Institute of Social Science
KW	Kilo Watt
KWH	Kilo Watt Hour
LBNL	Last But Not Least.
JYF	Just For You
KVA	Kilo Volt Ampere
PF	Power Factor
ECGs	Electrocardiogram
Ah	Ampere hour
ltr	Liter

LIST OF SYMBOLS

Symbol	*Name of the symbol*

ACKNOWLEDGEMENT

First of all, we want to give thanks to **Almighty Allah**. With his blessing we are able to complete our work with best effort.

This report is the product of efforts by many individuals. We would like to thank in particular our honorable teacher **Professor Dr. M. Shamsul Alam**, **Dean & Professor**, **Faculty of Engineering, DIU** & also Leaders in Field Training, Site Managers and Area Directors at Daffodil International University for making meter deployment and retrieval a reality. At LBNL, we are extremely grateful to the following staff Research Assistants their dedication in preparing meters, downloading meter data and/or entering data into databases: **Dr. Srimanti Roy Choudhury** (SMIEEE, FIETE, MIE(I), LMISTE), **Associate Professor, Department of Electrical & Electronic Engineering, DIU.**

We also want to convey our thankfulness to **Dr. Srimanti Roy Choudhury** (SMIEEE, FIETE, MIE(I), LMISTE), **Associate Professor, Department of Electrical & Electronic Engineering, DIU** for his support and encouragement. Apart from that, we would like to thank our entire class fellows for sharing knowledge; information and helping us in making this project a success. To beloved family, we want to give them our deepest love and gratitude for being very supportive and also for their inspiration and encouragement during our studies in this Institution.

ABSTRACT

In this paper, we propose a framework to characterize the energy consumption of DIU Buildings and their subcomponents (e.g., connected light, fan, air condition (AC), lift, street light, campus light, power socket, water pump, IT accessories, CL light, etc). This framework serves as a key component in describing the environmental impacts of decisions in manufacturing operations design and control, especially at the sub-cellular level. Furthermore, the suggested framework may utilize to investigate the inter-relationship of operational decisions and environmental impacts within a manufacturing plant. The proposed framework for gathering energy data is illustrated in the paper's conclusion.

Keywords: Data Analysis, Energy Benchmarking, Load Curve, Energy Consumption, Energy Monitoring System.

CHAPTER 1
INTRODUCTION

1.1 Introduction

No modern day would be complete without electricity. Day by day its demand increasing. But now in Bangladesh electricity is shortage for fuel are going end. Increasing global energy use has already led to supply difficulties, challenges, depletion of energy supplies, and significant environmental repercussions. It has also assimilated into contemporary life, and it's difficult to imagine existence without it. In our daily lives, electricity serves a variety of purposes. It is utilized for residential purposes such as operating fans, electric stoves, air conditioning, and lighting up rooms. People can find consolation in all of these. Electricity is used in factories to operate massive machinery. Electricity producers of a variety of commodities, including food, clothing, paper, and other necessities.

It has revolution modern modes of transportation and communication. It is quick to travel by electric trains and battery-powered vehicles. The most common types of entertainment, such as radio, television, and movies, are made possible by electricity. Electricity has also facilitated the development of contemporary technology such as computers and robotics. X-rays and ECGs are two medical and surgical procedures that heavily rely on electricity. Every day, more people utilize power.

1.2 Problem Statement and /or Proposed solution(s)

Reasons of the Power Loss in DIU Building

- ❖ When students leave their dorm rooms or hall, they don't turn off the lights or the fans.
- ✓ **Solution:** Have to use sensor switch (physical) of every rooms.
- ❖ As the Generator provide energy long time during the load-shedding its working lifetime reducing day by day.
- ✓ **Solution:** We can use solar system instead of generator.

1.3 Aims/ Objectives

1. To Reduce Loss of energy of DIU buildings.
2. To find out the unusual incident.
3. To gather information on relating events.
4. To sort out specific area.
5. To find out the types of occurrence.
6. To elaborate the process of causing problems.
7. To know energy consumption usually used per day.
8. To compare the connected load and using load.

1.4 Brief Technologies

As our project area is located in a such area where sunlight and its heat produce in a bulk amount so by using a solar technology we can produce an expected amount of electrical energy. So solar technology can be applied in circumstances. Solar technology is cost friendly also ecofriendly. As result it is more efficient for our project area then any kind of technology we assumed.

1.5 Implementation Schedule

Timeframe

- **Started the inspection in field**
- The beginning of the project/field work duration time is from 8.00am to 10.00pm.
- Duration time of field work from 9 august to 15 August 2022.
- Each and every day every hour like 8.00am to 10.00pm,10.00am-11.00am was investigated on project site.
- The time of occurring load-shedding was accurately counted.

Project Timeframe for Solar

Project timeframe or time-life means how many years the project will be working or operated. In this project the life time of the solar has been taken 25 years. For the net metering project in Bangladesh we count the time-life of solar panel is 20 year.

1.6 Organization

While writing the report at first, we started with our introduction Here we described about the electricity and it power demand and using area. Then we described the problem main statement and proposed our solution. Aims and objectives of our project and the technologies that we are going to use is described.

Then we moved forward to our 2nd chapter which is literature review. Here we had a vast discussion about studies of energy consumption across time, energy feedback, revulsion and technologies.

Then we moved to our 3rd chapter which is Conceptual Framework & System Design. Here we showed our system design, system analysis. Then we thoroughly arranged our collected data from YKSG-1 and DISS and the calculation of total energy consumption. Then we showed load curve and load duration curve graph by analyzing those data day by day. Then we summarized the whole chapter.

Then we moved forward to chapter 4 which is result and discussions. This is the most important chapter of our thesis. Here we calculate the cost calculation of YKSG-1 for total generation cost from generator then we showed the price list of solar panels in Bangladesh. And the cost of our requirement of solar panel. Then calculate the cost calculation for DISS for total generation cost from generator then we showed the cost of our requirement of solar panel for DISS. At the end of this chapter we had a discussion.

Now here comes the chapter 5 which is project management. In this chapter we described about the task that we have faced and the milestone that we have achieved. We have described that we faced which kind of problems and how we solved them. And also, we described the resource and cost management. Also, the lesson that we have learnt from this project we described all of them briefly.

Now in chapter 6 we have described about the impact assessment of the project which are economical social and global impact and environmental and ethical issues also described about utilization of existing standards or codes and also described the other concerns of this project.

In the last chapter which is chapter 7 we described the conclusion and our recommendation for future. And lastly all the references have been added.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This study builds a reservoir of energy knowledge using patent data. The impact of new information on energy consumption is then estimated using these stocks in a quadratic formulation of a constrained variable cost function. As a result, it incorporates two types of earlier economic literature. The first are earlier analyses of the impact on energy usage over time. Studies on the productivity of R&D make up the second category of related work. The current study advances prior research by using patent data to more accurately gauge technical advancement. This work can also be improved by using patent data. The next part outlines earlier research in both fields and explains how utilizing patent data enhances each study's findings.

2.2 Studies of Energy Consumption Across Time

Beginning with a series of articles by in the 1970s, studies of energy use through time were writers including David Wood, Ernst Berndt, and Dale Jorgenson. Usually, the expense of a flexible form to create factor demand equations, one would utilize the or production function. Several articles published in these writers used the 1970s to research the need for energy in American companies functions for trans-log costs. Incorporating technological development into these was first done by Jorgenson models. They simply included a temporal trend in the regressions, as did the papers that came after theirs, to model technological development. Using a temporal trend to depict technological advancement, Jorgenson and Fraumeni (1981) discovered that it was energy-consuming, meaning that energy demand per unit output rose with time. But the information in their report was dated 1958. to 1974. The two energy crises of the 1970s spurred a great deal of innovation intended to save energy, as seen in Popp (1998a). The information utilized by Jorgenson and Fraumeni did not incorporate such technical development. It is reasonable to expect that the outcomes may change now as a result. Recent research does confirm that energy is saved by technology advancement. Translog cost functions for the industrial sectors in the US, Canada, and France are estimated by Berndt, Kolstad, and Lee (1993). They discover that technical advancement results in gasoline and power cost reductions. In a related research, Mountain, Stipdonk, and Warren (1989) discover that technical advancement in Ontario's manufacturing sectors uses natural gas and saves oil. The industry had an impact on the power usage results. Technology has the effect of increasing natural gas use because over the time period covered in their article, natural gas prices were continually low. Although the majority of the technical change is contained in new forms of capital, Sterner (1990) shows a positive rate of technological advancement toward fuel-saving in the Mexican cement sector. Berndt (1990) also points out that improvements in energy conservation typically followed changes in energy pricing. In addition to investing in new, less energy-intensive equipment, industry was shifting away from energy as a result of rising prices.

The average quality of energy has improved as well, he adds. Businesses are utilizing more energy-efficient sources, such electricity.

The ability to simulate technological advancement by only include a time trend in their model is a characteristic shared by all of the aforementioned papers. There are two problems with using a time trend. One is that variations in energy prices are connected with advancements in energy-saving technologies rather than happening at random throughout time. The findings of these articles are so dependent on the time period examined. When energy costs are low, technological improvements use energy; when energy prices are high, they save energy. The second issue is that the temporal trend can only depict the total effects of technological advancement. It can only indicate if all of the technical developments that took place throughout the study period resulted in increased or decreased energy demand. For instance, as more energy would be needed to run more machines, technical advancements that result in a higher reliance on capital may result in an increase in energy demand 5 per unit output. The energy might, however, be utilized more effectively than in the past.

The issue with utilizing a temporal trend in both situations is that it is hard to isolate the impact of only those technologies that are connected to energy consumption. For instance, the Mountain, Stipdonk, and Warren research discovers that the use of natural gas throughout the study period was influenced by technical progress. Due to the cheap natural gas costs at the time, this happened. As a result, new technologies have a tendency to use gas more frequently than other energy sources in order to benefit from low natural gas prices. However, technologies could have existed throughout the time period under examination that boosted the efficiency of natural gas usage. However, as Mountain analysis only examines the total impact of technological progress, the impact of these advancements would not be noted there.

These difficulties are avoided by using patents as a sign of technical development, as is done in this study. It is feasible to determine the impact of technology directly connected to energy consumption by identifying those patents that are related to energy efficiency. The use of patent counts also accounts for variations in the rate of technical development across time. Energy costs and technical advancements both significantly influence the direction of technological evolution toward energy conservation. Both of these effects can be found in the patent data. Policy simulations are made feasible by fusing data on the creation of new patents with data on the energy savings brought about by new inventions.

2.3 Studies of the Productivity of R&D

Studies that estimate the productivity of R&D, like those by Zvi Griliches, Frank Scherer, and others in the 1980s, represent the second branch of research that is relevant to this study. These studies employ R&D spending as an input to predict production functions using company or industry data. There are two methods applied. In the first, R&D costs are employed to build a stock of knowledge, often assuming an old R&D depreciation rate of 15%. The approximated equation has the following form:

$$\log Y = a + b(\log X) + g(\log K) + e$$

When K is the stock of knowledge, represented by R&D expenditures, and Y represents output, X are conventional inputs, such as labor and capital. The second strategy makes use of growth rates to get around the issue of building a knowledge stock by utilizing R&D as a gauge of knowledge stock change. These studies provide an estimation for the equation:

$$\frac{\partial \log Y}{\partial t} = \alpha + \beta \frac{\partial \log X}{\partial t} + \gamma \frac{R}{Y} + \varepsilon$$

where R/Y is a measure of the intensity of R&D and R is a measure of R&D expenditures. Griliches provides an overview of both sorts of study (1995).

The findings of these research are conflicting. Between 0.2 and 0.5 is the estimated range of the rate of return on R&D. The common errors in estimating production functions, such as simultaneity, make it difficult to estimate these equations, especially ones like equation (1). For instance, both Griliches and Jacques Mairesse and Philippe Cuneo and Mairesse (1984) establish a link between firm R&D and productivity between businesses, but minimal correlation across time. These models also suffer from the fact that they do a poor job of measuring the effects of R&D spillovers.

Finally, it is challenging to use R&D investment as a gauge of knowledge since we are unsure of its purpose. Process innovations and product innovations are the two basic areas into which R&D spending may be separated. Technological developments that increase manufacturing efficiency are known as process innovations. Other innovations include changes to products.

They either provide new items or raise the caliber of an already-existing product. Process advancements need to have an impact on the company's manufacturing division. Although they shouldn't, product improvements do have an impact on output quality. However, if the price indices used to normalize the value of production do not sufficiently account for increases in the quality of output, the advantages of R&D impacting quality will be understated. Scherer (1993) found that when the computer sector is excluded from his data set, estimates on the return to R&D from 1973–1989 fell from 0.36 to 0.13. This proves his claim. Due to the industry's rapid technical development, the Occupational Labor Statistics develops price indices for the computer industry using hedonic approaches. However, when updating the price indices of other industries, it does not include quality changes.

The measure of knowledge in this research is patent numbers rather than R&D costs. We can avoid some of the problems with R&D expenses by utilizing patent numbers as a measure of the pool of knowledge. To determine the industry of manufacturing and industry of application of patents, utilize the Yale Technology Concordance. We may practically be certain that the patents represent changes to the manufacturing process rather than changes to the output quality by grouping them according to the industry in which they are used. The inventions discussed in this article are process innovations, as confirmed by the use of patents awarded to the industry in which they are applied.

2.4 THE LITERATURE ON ENERGY FEEDBACK

Psychologists dominated the early investigations on energy feedback, which were conducted in the 1970s and 1980s. Most of the time, feedback was viewed as a "intervention," or a disturbance of the regular flow of events. For instance, in a typical early feedback experiment, a letter would be placed on the consumer's kitchen window each morning, letting them know how their intake the day before compared to a predetermined benchmark. Additionally, it was frequently understood in terms of behavior reinforcement, inspiring those who were thought to be comparatively passive and driven by reward and punishment. These experiments proved that, at least temporarily, feedback may change behavior in quantifiable ways.

> Feedback is defined as "information on the result of an action or process that may be utilized to modify or regulate a process or system... especially by noting the difference between an intended and an actual result."
>
> - Oxford English Dictionary

Some studies started to emphasize that feedback is a crucial component of learning, as people actively absorb information to make sense of their environment (Ellis and Gaskell 1978). Another early assessment noted that treatments frequently neglected to evaluate "target behaviors" within a systems context in favor of narrowly focusing on their management (Winkler and Winett 1982). The comprehensive study by Hutton et al. (1986), conducted in three North American cities, advises against stating that any sort of feedback, under any circumstances, delivered at any demographic, would yield beneficial benefits. Context is crucial. Setting limits for a study's focus or developing a theoretical framework for doing so was not always simple. For instance, an evaluation of the efficacy of feedback as shown in experimental settings come the conclusion that "Feedback research is...marked by a combined lack of concern with theory and overemphasis on application." As a result, Katzev and Johnson (1987) state that "our grasp of how feedback does or does not operate remains uncharted or unproven." Learning theory offers one solution to this (Ellis and Gaskell 1978; Darby in press).

More recently, the emphasis has switched to more extensive, "ecological" research that used bigger samples and longer time horizons. These are frequently supported by energy providers, authorities, or the government. In these circumstances, there is less risk of the "Hawthorne effect," which refers to people acting differently because they are aware that they are being watched.

Additionally, the importance of qualitative work has increased in feedback studies. Van Houwelingen and van Raaij, for instance, used interviews in their research on how goal-setting and daily electronic feedback affect gas use (1989). These provide further information about the homeowners' actual use of their input, which was "primarily as a permanent check on the impact of energy conservation initiatives."

It was demonstrated that the consumer's "energy analysis environment" under traditional billing was insufficient for decision-making since it lacked the detail that would make sense of the bill and enable efficient experimentation in its reduction:

Consider purchasing food from a hypothetical supermarket that has no price tags at all and charges you on a monthly statement. With such a billing system in place, how may supermarket buyers save money?

- Kempton and Layne, 1994 attempts

Informed billing initiatives in Norway demonstrated how customers valued increased accuracy and additional information (historical and comparative feedback, a list of the highest consuming end-uses), started to read their bills more frequently and more thoroughly, and started to change their behavior (Wilhite 1997; Wilhite et al, 1999). Numerous qualitative research (such as Egan 1999 and Roberts et al. 2004) go into further depth on how clients react to various charging designs. The latter, which relates to UK billing, demonstrates some scepticism toward comparative input: customers were dubious about the reliability of their comparison group but valued feedback that contrasted their recent consumption with that of earlier billing cycles.

As the body of knowledge on feedback grew, so did that on energy use and strategies for boosting efficiency. I previously discussed five primary forms of feedback with varying levels of immediateness and control by the energy user, from the home energy audit (conducted very seldom, frequently by a professional), to the quick glimpse at a display panel (carried out at any time by the householder). Those that apply to this evaluation are displayed in the box below.

Direct feedback: available on demand. Learning by looking or paying

- Self-meter-reading
- Direct displays
- Interactive feedback via a PC
- Pay-as-you-go/keypad meters
- 'Ambient' devices
- Meter reading with an adviser, as part of energy advice
- Cost plugs or similar devices on appliances

Indirect feedback – raw data processed by the utility and sent out to customers. Learning by reading and reflecting

- More frequent bills
- Frequent bills based on readings plus historical feedback
- Frequent bills based on readings plus comparative/normative feedback
- Frequent bills plus disaggregated feedback.
- Frequent bills plus detailed annual or quarterly energy reports.

Inadvertent feedback – learning by association

- With the advent of microgeneration, the home becomes a site for generation as well as consumption of power.
- Community energy conservation projects such as the Dutch 'Eco-teams'.

Utility-controlled feedback – learning about the customer

- Utility-controlled feedback via smart meters, with a view to better load management. Energy audits – learning about the 'energy capital' of a building Audits may be
- undertaken by a surveyor on the client's initiative
- undertaken as part of a survey for the Home Information Pack
- carried out on an informal basis by the consumer using freely available software, carbon calculators.

Feedback encompasses a variety of behavior, and it is preferable to analyze and comprehend this behavior in their context. The main goal is to examine feedback in terms of how it contributes to the development of a body of "tacit knowledge" or expertise regarding the production and consumption of energy. This involves people learning about their energy usage, acting (changing their behavior in some manner), and then comprehending what happened by analyzing any accessible feedback.

2.5 Compare and Contrast

In this program we're calculate the collecting data from energy meter on Excel sheet. After put the data on the sheet it calculated the data and find out average data in a day used. After we can see the load curve of every hour also see the load duration curve. After that we can see easily hoe much energy consumption in an hour in KW.

2.6 Summary

To summarize this chapter, here is a vast discussion about studies of energy consumption across time. The history of the energy revulsion and technological advancement is described. Various types of research held by the researchers. Those researches mentioned in this chapter. Briefly explained the studies of the productivity of R&D. At the end, energy feedback described with previous history. Also pointed direct feedback, indirect feedback, Inadvertent feedback, Utility-controlled feedback with briefly explaining.

CHAPTER 3

Conceptual Framework & System Design

3.1 Introduction

More than a century ago, solar energy was first used. In the beginning, solar energy was utilized to create steam, which was then used to power machines. However, it wasn't until Edmond Becquerel made his "photovoltaic effect" discovery that sunlight could be converted into electrical energy. Following Becquerel's discovery, Charles Fritts invented the first true solar cell in 1893 by covering sheets of selenium with a thin layer of gold. And from this modest beginning would come the invention that is the solar panel that we know today.

The photovoltaic effect was discovered in 1893 by a French scientist named Edmond Becqerel. Latin's words for "photo" and "voltaic" translate to "light from electricity," or vice versa. Solar panels are collections of solar cells set in frames with glass coverings. The solar panels that use sunlight to create energy are also known as solar PV modules. It has a life expectancy of 25 to 30 years and is a clean and renewable source of energy that lowers carbon emissions, lowers a homeowner's power cost, and lessens environmental impact.

3.2 System Design and Components

A solar panel's primary element is a solar cell, which can produce energy from sunlight. Photovoltaic is another name for a solar cell. Remember that voltaic refers to electricity and photo refers to light. Typically, semiconductor metals like germanium, silicon, carbon silicon carbide, etc. are used to create solar cells. Photovoltaic light energy captures photons from sunlight when solar cells manufactured with them are exposed to it. As a result, a few volts are produced there, and when many of these cells are connected, they may all produce much more volts collectively. As a result, solar panels produce energy using solar cells.

3.3 Design Specifications. Standards and Constraints

We can see in this picture the total solar power system from source to load the sunlight is falling on photovoltaic modules as a result electrical power is being produced. Now this power has to be stored in a battery. The charging rate of this battery is being controlled by a charge controller. And this power is generally a DC power. But in the process of providing power to the load we have to provide AC power. So, in this regard, we have to convert our battery stored DC power to AC power through an inverter.

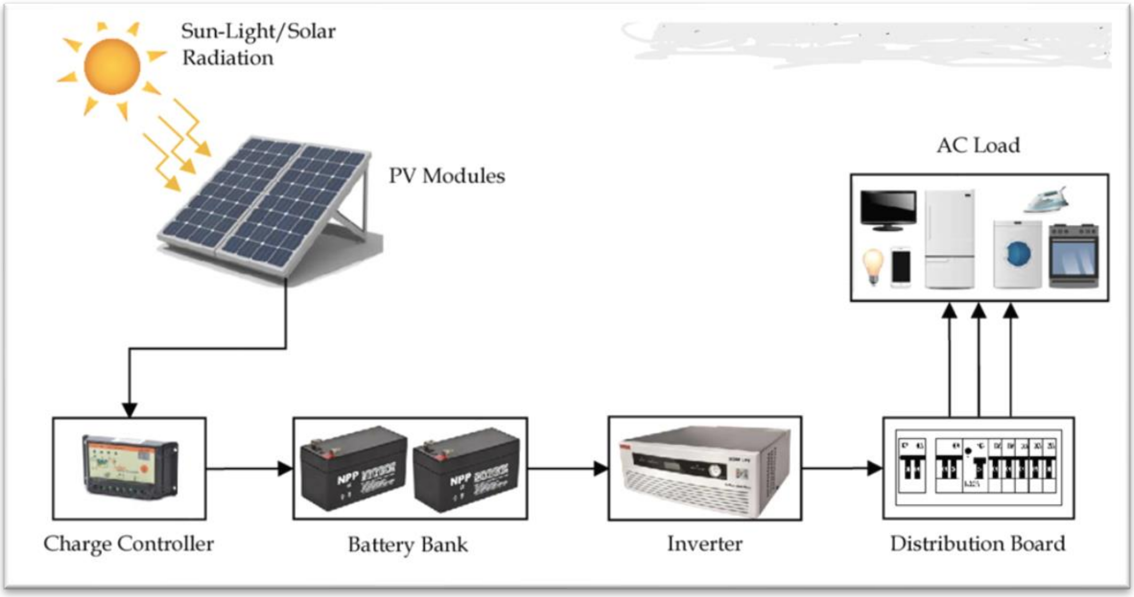


Fig. 3.1 Solar Power Plant System Off Grid

3.4 System Analysis

A Framework for Energy Consumption of Residential of YKSG-1, DISS & Street Light DIU

The characterization of energy consumption of DIU is a six-step process.
These steps are:

1. Initialize
2. Configure the Measuring Device
3. Capture the Total System Power
4. Analyze the Total System Power
5. Determine Subsystems of Primary Focus
6. Capture and Analyze Subsystem Behavior

3.5 Simulation

<u>Field work data collection:</u>

<u>Calculation:</u>

Total using data in hour(kW) = Sum × Constant

Here,
Sum is collecting from the energy meter which is found in **kWh**. Constant is found from BREB which is set for this meter only. **The value of constant is 264.58333**.

We see on energy meter the value of the leading and legging position. We could see in the energy meter Power Factor (PF), Maximum demand, Date, Time, meter number/ID etc.

We measure the value of collecting data per hour in the Load Curve graph and Load duration graph. Where we can easily determine that the energy consumption in an hour maximum level & lower level.

Connected Loads in YKSG-1 Boys Hall Block A

YKSG-1 Block-A								
Floor	Light 20 W	Fan 80 W	Power Socket	AC	Lift	Water Pump	IT Accessories	Total
GF	182	120	238	0	2 X 9500	2 X 2 Hp, 3 X 3 Hp	12 X Rak 2200W	
1st Floor	260	127	253	0				
2nd Floor	285	145	263	0				
3rd Floor	170	140	251	0				
4th Floor	170	141	242	0				
5th Floor	139	172	258	0				
6th Floor	160	80	85	0				
Lift Room	4	2	2	3.5				
Total	1370	927	1592	3.5				
Total	27.4	74.16	382	5.25	19	3.73	2.2	**513.74**

Table 3.5.1 YKSG-1 Block-A Connected Load

Connected Loads in YSKG-1 Boys Hall Block-B

YKSG-1 Block-B								
Floor	Light 20 W	CL Light 12 W	Fan 80 W	Power Socket	Lift	Water Pump	IT Accessories	Total
GF	42	28	42	35	3	1 X 10 Hp, 2 X 2 Hp	12 X Rak 2650 W	
1st Floor	65	37	64	66				
2nd Floor	65	37	64	66				
3rd Floor	65	37	64	66				
4th Floor	65	37	64	66				
5th Floor	65	37	64	66				
6th Floor	65	37	64	66				
7th Floor	65	37	64	66				
8th Floor	65	37	64	66				
9th Floor	65	37	64	66				
10th Floor	65	37	64	66				
11th Floor	65	37	64	66				
Total	757	435	746	761	3	8.95	2.65	
Total	15.15	5.22	59.68	182.64	45	8.95	2.65	**319.29**

Table 3.5.2 YKSG-1 Block-B Connected Load

Now we can see the daily used in YKSG-1 Boys Hall when load connected. We will calculate also the load shedding time also. We're collect data per hour in a day 8am to 10pm & put the values on an excel sheet. We used the equation of total using per hour for the calculation on given table.

Day-1 (09-08-2022):

	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM
Meter 3 Location: YKSG-1	1701.16 * 264.58333 = **450,098.577 kWh**	1701.75 * 264.58333 = **450,254.682 kWh**	1702.29 * 264.58333 = **450397.557 kWh**	1702.92 * 264.58333 = **450564.244 kWh**	1703.51 * 264.58333 = **450720.348 kWh**	**Load Shading Period 12:35 PM to 1:12 PM** 1703.69 * 264.58333 = **450767.973**	1704.11 * 264.58333 = **450879.098 kWh**	1704.71 * 264.58333 = **451037.848 kWh**	**Load Shading Period 03:32 PM to 05:05 PM**	1705.08 * 264.58333 = **451135.744 kWh**	1705.47 * 264.58333 = **451186.015 kWh**	1705.92 * 264.58333 = **451357.994 kWh**	1706.45 * 264.58333 = **451498.223 kWh**	**Load Shading Period 08:06 PM to 09:05 PM**	1707.04 * 264.58333 = **451654.328 kWh**
Remarks (on Hourly Consumption)	Starting Data	156.105 kWh	142.875 kWh	166.687 kWh	156.104 kWh	47.625 kWh	111.125 kWh	158.750 kWh	No Consumption	97.896 kWh	50.271 kWh	171.979 kWh	140.229 kWh	Consumption of 6 minutes	156.105 kWh
	8:00 AM to 9:00 AM	9:00 AM to 10:00 AM	10:00 AM to 11:00 AM	11:00 AM to 12:00 PM	12:00 PM to 1:00 PM	1:00 PM to 2:00 PM	2:00 PM to 3:00 PM	3:00 PM to 4:00 PM	4:00 PM to 5:00 PM	5:00 PM to 6:00 PM	6:00 PM to 7:00 PM	7:00 PM to 8:00 PM	8:00 PM to 9:00 PM	9:00 PM to 10:00 PM	
Average Load in kW over an Hour	156.105 kW	142.875 kW	166.687 kW	156.104 kW	47.625 kW	111.125 kW	158.750 kW	0 kW	97.896 kW	50.271 kW	171.979 kW	140.229 kW	Very Low Consumption for 6 minutes	156.105 kW	

Table 3.5.3 Collected Data (09-08-2022)

In this table you can see that 8 am we got the meter ratting sum is 1701.16 kW. Now calculate the total consumption in a hour

$$1701.16*264.58333 = 450098.577 \text{ kW}$$

Other side 9 am ratting we can see that sum is 1701.29 kW. Now calculate the total consumption in 9 am:

$$1701.29*264.58333 = 450254.682 \text{ kW}$$

We can easily calculate or find the average load in kilowatt (kW) over an hour = New hour consumption - Previous hour consumption

= 450254.682 - 450098.577 kW

= 156.105 kW

Here in an hour 8 to 9 am YSKG-1 Boys hall used 156.105 kw in an hour. In this system we can calculate the per hour consumption. After calculation done if we want to find out how much cost in an hour carrying DIU in an hour just multiply the rate of per unit electricity.

If per unit price is 11tk.

1hour is = 156.105*11 = 1717.155 tk.

When all day has been collected after that we calculate its per day energy consumption. In a day total energy consumption in YKSG-1 Boys Hall DIU is = Sum of full day data = 1555.7246 kW

Total 15 hour comes = 1555.7246*11 = 17,112.97tk

Load Curve & Load Duration Curve Graph:

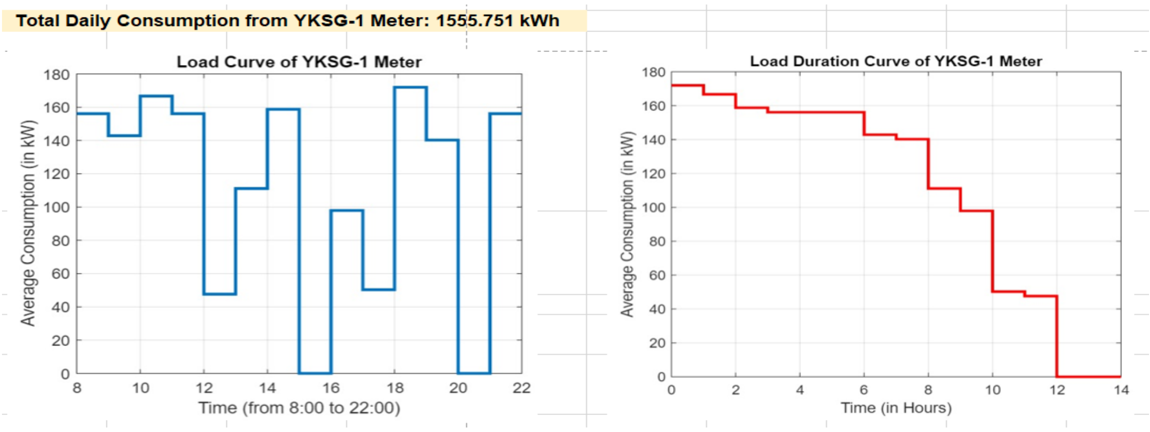


Figure 3.5.1 Load Curve & Load Duration Curve (09-08-2022)

We can see the Load curve of the YKSG-1 meter in left side. The load curve of a power station is a graph that depicts the fluctuation of load on the power station over time. The load on a power station does not remain constant; it fluctuates. It shows us the maximum and minimum energy uses in an hour. We can see on the load curve o to peak value or higher value of the which is named in Average consumption (in KW). Another side ground axis is Time which is from 8.00am-10.00pm.

On the right we can see the Load duration curve of YKSG-1 meter. In electric power production, a load duration curve (LDC) is used to depict the connection between producing capacity requirements and capacity usage. We see here the load curve of maximum to minimum energy uses in 15hour in a day. It gone higher value to lower value in the curve last 15 hour.

Day-2 (10-08-2022):

	ergy Consumption during 10:00 PM to 8:00 AM: 1092.73 kV														
	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM
Meter 3 Location: YKSG-1	1711.17 * 264.58333 = **452,747.057 kWh**	1711.74 * 264.58333 = **452,897.869 kWh**	1712.31 * 264.58333 = **453,048.682 kWh**	1712.96 * 264.58333 = **453,194.203 kWh**	Load Shading Period 11:04 AM to 12:05 PM 1712.87 kWh * 264.58333 = **453,196.848**	1713.35 * 264.58333 = **453,323.848 kWh**	Load Shading Period 01:35 PM to 02:00 PM 1713.84 kWh * 264.58333 = **453,453.494 kWh**	Load Shading Period 02:00 PM to 03:02 PM	1714.26 * 264.58333 = **453,564.619 kWh**	Load Shading Period 04:47 PM to 05:00 PM 1714.70 kWh * 264.58333 = **453,681.036 kWh**	Load Shading Period 05:00 PM to 06:02 PM	1715.12 * 264.58333 = **453,792.161 kWh**	Load Shading Period 07:11 PM to 07:59 PM 1715.26 * 264.58333 = **453,829.203 kWh**	1715.70 * 264.58333 = **453,945.619 kWh**	1716.22 * 264.58333 = **454,083.203 kWh**
Remarks (on Hourly Consumption)	Starting Data	150.812 kWh	150.813 kWh	145.521 kWh	2.645 kWh	127.000 kWh	129.646 kWh	No Consumption	111.125 kWh	116.417 kWh	No Consumption	111.125 kWh	37.042 kWh	116.416 kWh	137.584 kWh

	8:00 AM to 9:00 AM	9:00 AM to 10:00 AM	10:00 AM to 11:00 AM	11:00 AM to 12:00 PM	12:00 PM to 1:00 PM	1:00 PM to 2:00 PM	2:00 PM to 3:00 PM	3:00 PM to 4:00 PM	4:00 PM to 5:00 PM	5:00 PM to 6:00 PM	6:00 PM to 7:00 PM	7:00 PM to 8:00 PM	8:00 PM to 9:00 PM	9:00 PM to 10:00 PM
Average Load in kW over an Hour	150.812 kW	150.813 kW	145.521 kW	2.645 kW	127.000 kW	129.646 kW	0 kW	111.125 kW	116.417 kW	0 kW	111.125 kW	37.042 kW	116.416 kW	137.584 kW

Table 3.5.4 Collected Data (10-08-2022)

Load Curve & Load Duration Curve Graph:

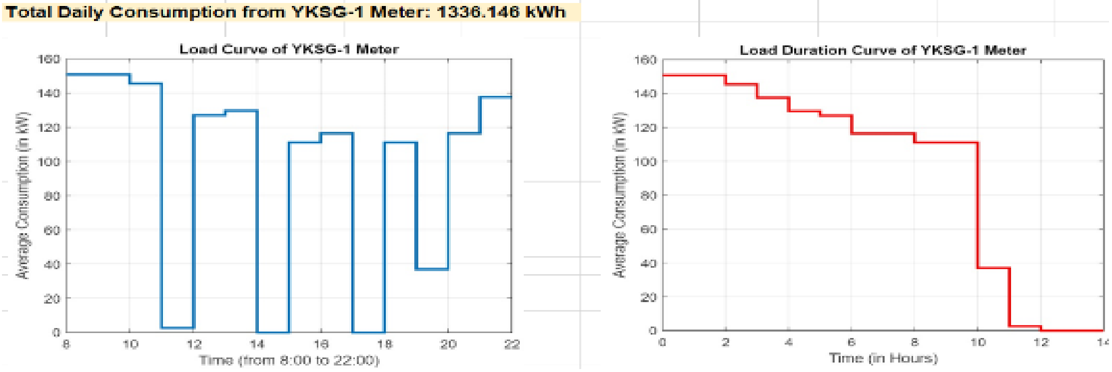


Figure 3.5.2 Load Curve & Load Duration Curve (10-08-2022)

Day-3 (11-08-2022)

	Energy Consumption during 10:00 PM to 8:00 AM: 1140.35 kWh														
	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM
Meter 3 Location: YKSG-1	1720.53 * 264.58333 = 455,223.557 kWh	1721.14 * 264.58333 = 455,384.953 kWh	1721.58 * 264.58333 = 455,501.369 kWh Load Shading Period 10:45 AM to 11:00 PM	Load Shading Period 11:00 AM to 12:00 PM	Load Shading Period 12:00 PM to 12:50 PM	1722.07 * 264.58333 = 455,631.015 kWh	1722.73 * 264.58333 = 455,805.64 kWh	Load Shading Period 02:47 PM to 03:45 PM	1723.35 * 264.58333 = 455,969.68 kWh	Load Shading Period 04:45 PM to 05:40 PM	1723.94 * 264.58333 = 456,125.79 kWh	Load Shading Period 06:23 PM to 07:22 PM	1724.40 * 264.58333 = 456,247.49 kWh	1725.00 * 264.58333 = 456,406.24 kWh	Load Shading Period 09:26 PM to 10:31 PM
Remarks (on Hourly Consumption)	Starting Data	161.396 kWh	116.416 kWh	No Consumption	No Consumption	129.646 kWh	174.625 kWh	Reading Unavailable	164.04 kWh	Reading Unavailable	156.11 kWh	Reading Unavailable	121.70 kWh	158.75 kWh	Reading Unavailable
	8:00 AM to 9:00 AM	9:00 AM to 10:00 AM	10:00 AM to 11:00 AM	11:00 AM to 12:00 PM	12:00 PM to 1:00 PM	1:00 PM to 2:00 PM	2:00 PM to 3:00 PM	3:00 PM to 4:00 PM	4:00 PM to 5:00 PM	5:00 PM to 6:00 PM	6:00 PM to 7:00 PM	7:00 PM to 8:00 PM	8:00 PM to 9:00 PM	9:00 PM to 10:00 PM	
Average Load in kW over an Hour	161.396 kW	116.416 kW	0 kW	0 kW	129.646 kW	174.625 kW	0 kW	164.04 kW	0 kW	156.11 kW	0 kW	121.70 kW	158.75 kW	0 kW	

Table 3.5.5 Collected Data (11-08-2022)

Load Curve & Load Duration Curve Graph:

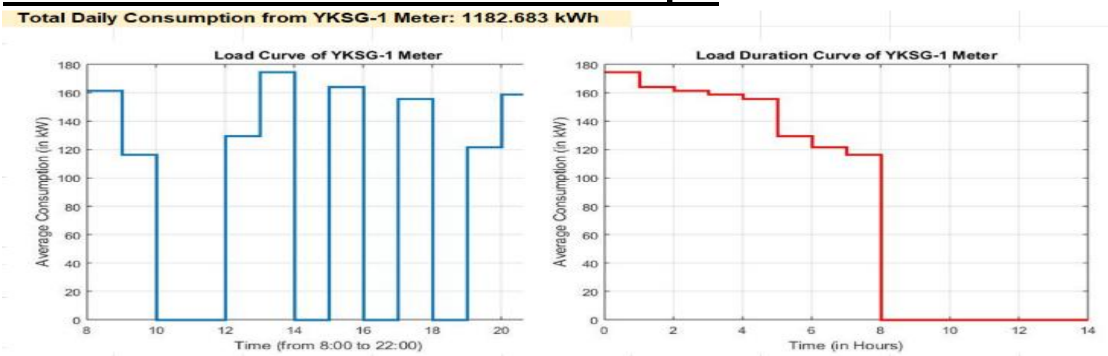


Figure 3.5.3 Load Curve & Load Duration Curve (11-08-2022)

Day-4 (12-08-2022)

	Energy Consumption during 10:00 PM to 8:00 AM: 1111.2														
	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM
Meter 3 Location: YKSG-1	1729.20 * 264.58333 = 457,517.494 kWh	1729.83 * 264.58333 = 457,684.182 kWh	1730.42 * 264.58333 = 457,840.286 kWh	Load Shading Period 10:17 AM to 11:17 AM	1730.95 * 264.58333 = 457,980.515 kWh	Load Shading Period 12:39 PM to 01:33 PM	1731.61 * 264.58333 = 458,155.14 kWh	1732.35 * 264.58333 = 458,350.93 kWh	1733.00 * 264.58333 = 458,522.91 kWh	1733.55 * 264.58333 = 458,668.43 kWh	1733.99 * 264.58333 = 458,784.85 kWh	1734.39 * 264.58333 = 458,890.68 kWh	1734.94 * 264.58333 = 459,036.20 kWh	1735.51 * 264.58333 = 459,187.02 kWh	1736.05 * 264.58333 = 459,329.89 kWh
Remarks (on Hourly Consumption)	Starting Data	166.688 kWh	156.104 kWh	Reading Unavailable	140.229 kWh	Reading Unavailable	174.625 kWh	195.79 kWh	171.98 kWh	145.52 kWh	116.42 kWh	105.83 kWh	145.52 kWh	150.82 kWh	142.87 kWh
	8:00 AM to 9:00 AM	9:00 AM to 10:00 AM	10:00 AM to 11:00 AM	11:00 AM to 12:00 PM	12:00 PM to 1:00 PM	1:00 PM to 2:00 PM	2:00 PM to 3:00 PM	3:00 PM to 4:00 PM	4:00 PM to 5:00 PM	5:00 PM to 6:00 PM	6:00 PM to 7:00 PM	7:00 PM to 8:00 PM	8:00 PM to 9:00 PM	9:00 PM to 10:00 PM	
Average Load in kW over an Hour	166.688 kW	156.104 kW	0 kW	140.229 kW	0 kW	174.625 kW	195.79 kW	171.98 kW	145.52 kW	116.42 kW	105.83 kW	145.52 kW	150.82 kW	142.87 kW	

Table 3.5.6 Collected Data (12-08-2022)

Load Curve & Load Duration Curve Graph:

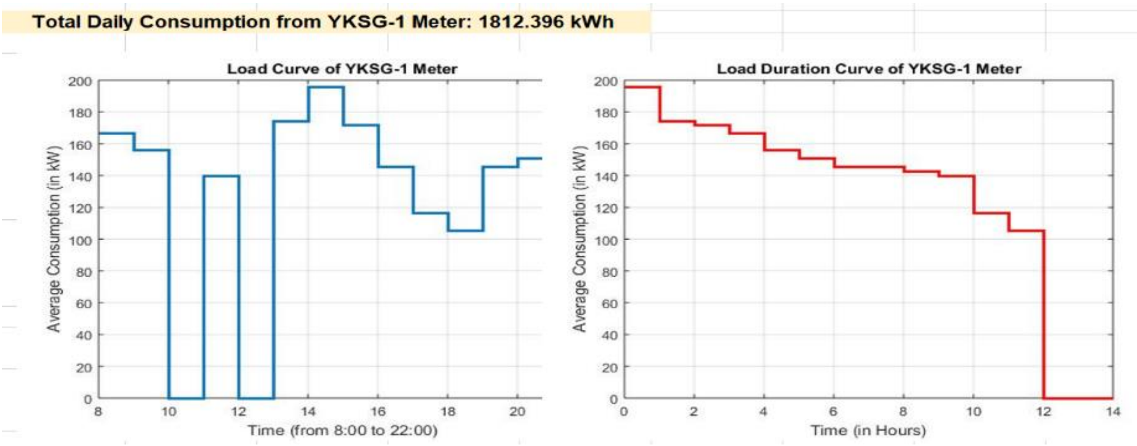


Figure 3.5.4 Load Curve & Load Duration Curve (12-08-2022)

Day-5 (13-08-2022)

	nergy Consumption during 10:00 PM to 8:00 AM: 1386.417 kW														
	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM
Meter 3 Location: YKSG-1	1741.29 * 264.58333 = 460,716.307 kWh	1742.03 * 264.58333 = 460,912.098 kWh	1742.81 * 264.58333 = 461,118.473 kWh	Load Shading Period 10:45 AM to 11:00 AM	Load Shading Period 11:00 AM to 12:00 PM	Load Shading Period 12:00 PM to 01:10 PM 1743.31 * 264.58333 = 461,250.765	1743.81 * 264.58333 = 461,383.062 kWh	Load Shading Period 02:21 PM to 03:33 PM	Load Shading Period 03:41 PM to 04:45 PM	1744.26 * 264.58333 = 461,502.119 kWh	1744.42 * 264.58333 = 461,544.453 kWh	Load Shading Period 06:21 PM to 07:20 PM	1744.98 * 264.58333 = 461,692.619 kWh	1745.49 * 264.58333 = 461,827.557 kWh	1746.06 * 264.58333 = 461,978.369 kWh
Remarks (on Hourly Consumption)	Starting Data	195.791 kWh	206.375 kWh	Reading Unavailable	Reading Unavailable	132.292 kWh	132.297 kWh	Reading Unavailable	Reading Unavailable	119.057 kWh	42.334 kWh	Reading Unavailable	148.166 kWh	134.938 kWh	150.812 kWh
	8:00 AM to 9:00 AM	9:00 AM to 10:00 AM	10:00 AM to 11:00 AM	11:00 AM to 12:00 PM	12:00 PM to 1:00 PM	1:00 PM to 2:00 PM	2:00 PM to 3:00 PM	3:00 PM to 4:00 PM	4:00 PM to 5:00 PM	5:00 PM to 6:00 PM	6:00 PM to 7:00 PM	7:00 PM to 8:00 PM	8:00 PM to 9:00 PM	9:00 PM to 10:00 PM	
Average Load in kW over an Hour	195.791 kW	206.375 kW	0 kW	0 kW	132.292 kW	132.297 kW	0 kW	0 kW	119.057 kW	42.334 kW	0 kW	148.166 kW	134.938 kW	150.812 kW	

Table 3.5.7 Collected Data (13-08-2022)

Curve Load & Load Duration Curve Graph:

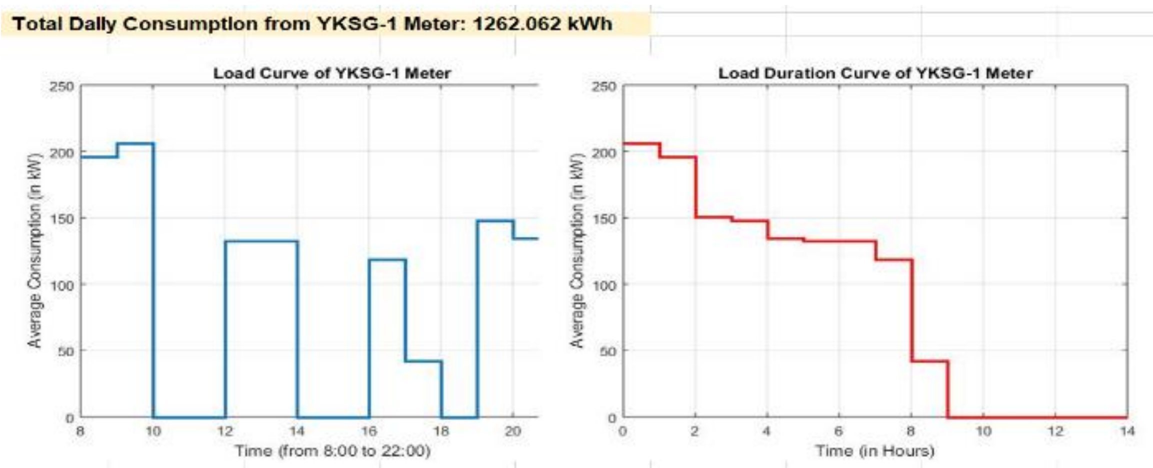


Figure 3.5.5 Load Curve & Load Duration Curve (13-08-2022)

Day-6 (14-08-2022)

	Energy Consumption during 10:00 PM to 8:00 AM: 1235.604 k													
	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM
Meter 3 Location: YKSG-1	1750.73 * 264.58333 = 463,213.973 kWh	1751.40 * 264.58333 = 463,391.244 kWh	Load Shading Period 09:45 AM to 10:55 PM	1751.84 * 264.58333 = 463,507.661 kWh	1752.37 * 264.58333 = 463,647.889 kWh	Load Shading Period 12:20 PM to 01:17 PM and 01:51 PM to 01:58 PM	1753.04 * 264.58333 = 463,825.161 kWh	1753.61 * 264.58333 = 463,975.973 kWh	Load Shading Period 03:56 PM to 04:00 PM	Load Shading Period 04:00 PM to 05:26 PM	1754.42 * 264.58333 = 464,190.286 kWh	1754.96 * 264.58333 = 464,333.161 kWh	1755.31 * 264.58333 = 464,425.765 kWh	1755.78 * 264.58333 = 464,550.119 kWh	1756.23 * 264.58333 = 464,669.182 kWh
Remarks (on Hourly Consumption)	Starting Data	177.271 kWh	Reading Unavailable	116.417 kWh	140.228 kWh	Reading Unavailable	177.272 kWh	150.812 kWh	Reading Unavailable	Reading Unavailable	214.313 kWh	142.875 kWh	92.604 kWh	124.354 kWh	119.063 kWh
	8:00 AM to 9:00 AM	9:00 AM to 10:00 AM	10:00 AM to 11:00 AM	11:00 AM to 12:00 PM	12:00 PM to 1:00 PM	1:00 PM to 2:00 PM	2:00 PM to 3:00 PM	3:00 PM to 4:00 PM	4:00 PM to 5:00 PM	5:00 PM to 6:00 PM	6:00 PM to 7:00 PM	7:00 PM to 8:00 PM	8:00 PM to 9:00 PM	9:00 PM to 10:00 PM	
Average Load in kW over an Hour	177.271 kW	0 kW	116.417 kW	140.228 kW	0 kW	177.272 kW	150.812 kW	0 kW	0 kW	214.313 kW	142.875 kW	92.604 kW	124.354 kW	119.063 kW	

Table 3.5.8 Collected Data (14-08-2022)

Load Curve & Load Duration Curve Graph:

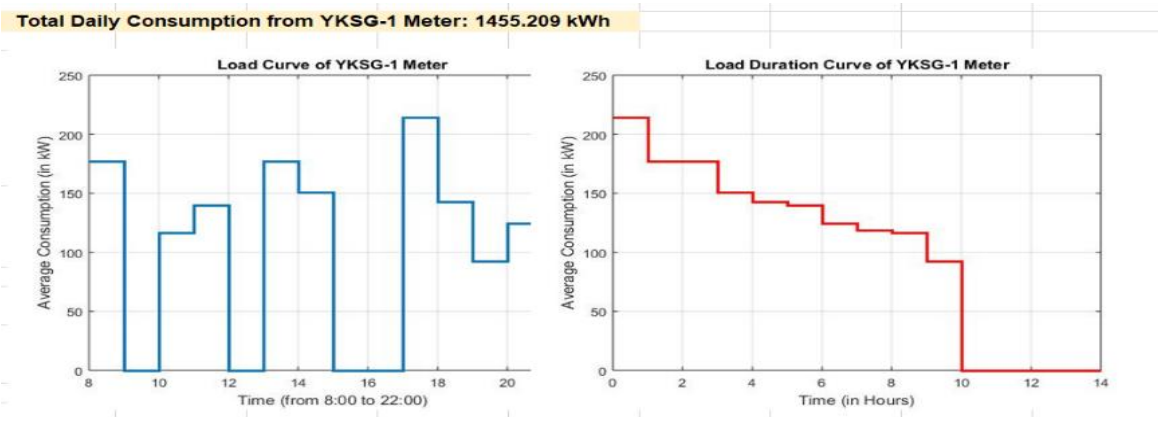


Figure 3.5.6 Load Curve & Load Duration Curve (14-08-2022)

Day-7 (15-08-2022)

	Energy Consumption during 10:00 PM to 8:00 AM: 1346.729 k													
	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM
Meter 3 Location: YKSG-1	1761.32 * 264.58333 = 466,015.911 kWh	1761.83 * 264.58333 = 466,150.848 kWh	1762.30 * 264.58333 = 466,275.202 kWh	1762.82 * 264.58333 = 466,412.786 kWh	1763.42 * 264.58333 = 466,571.536 kWh	1764.02 * 264.58333 = 466,730.286 kWh	1764.57 * 264.58333 = 466,875.807 kWh	1765.25 * 264.58333 = 467,055.723 kWh	1766.07 * 264.58333 = 467,272.682 kWh	1766.75 * 264.58333 = 467,452.598 kWh	1767.03 * 264.58333 = 467,526.682 kWh	1767.43 * 264.58333 = 467,632.515 kWh	1767.95 * 264.58333 = 467,770.098 kWh	1768.58 * 264.58333 = 467,936.786 kWh	1769.26 * 264.58333 = 468,116.702 kWh
Remarks (on Hourly Consumption)	Starting Data	134.937 kWh	124.354 kWh	137.584 kWh	158.75 kWh	158.75 kWh	145.521 kWh	179.916 kWh	216.959 kWh	179.916 kWh	74.084 kWh	105.833 kWh	137.583 kWh	166.688 kWh	179.916 kWh
	8:00 AM to 9:00 AM	9:00 AM to 10:00 AM	10:00 AM to 11:00 AM	11:00 AM to 12:00 PM	12:00 PM to 1:00 PM	1:00 PM to 2:00 PM	2:00 PM to 3:00 PM	3:00 PM to 4:00 PM	4:00 PM to 5:00 PM	5:00 PM to 6:00 PM	6:00 PM to 7:00 PM	7:00 PM to 8:00 PM	8:00 PM to 9:00 PM	9:00 PM to 10:00 PM	
Average Load in kW over an Hour	134.937 kW	124.354 kW	137.584 kW	158.75 kW	158.75 kW	145.521 kW	179.916 kW	216.959 kW	179.916 kW	74.084 kW	105.833 kW	137.583 kW	166.688 kW	179.916 kW	

Table 3.5.9 Collected Data (15-08-2022)

Load Curve & Load Duration Curve Graph:

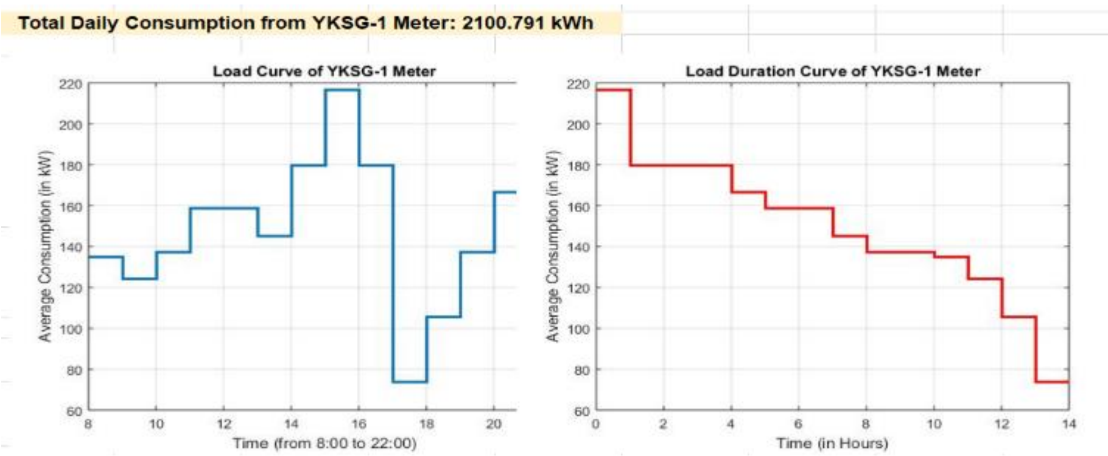


Figure 3.5.7 Load Curve & Load Duration Curve (15-08-2022)

DISS Data Collection:

DISS										
Floor	Light 20 W	CL Light 12 W	Fan 80 W	Power Socket	AC	Users (AC)	Lift	Water Pump	IT Accessories	Total
Basement	57	18	10	8						
Ground Floor	31	0	12	9						
1st Floor	56	30	40	32	1.5 Ton	Deputy Director, DISS				
2nd Floor	56	30	40	32						
3rd Floor	56	30	40	32						
4th Floor	56	30	40	32			2 X 11000	1 X 5.5 Hp 1 X 2 Hp	2 X Rak, 2200 W	
5th Floor	56	30	40	32						
6th Floor	56	30	40	32						
7th Floor	56	30	40	32						
8th Floor	56	30	40	32						
9th Floor	56	30	40	32						
10th floor	64	0	20	42						
Total	656	288	402	347	1.5					
Total KW	13.12	3.46	32.16	83.28	2.25		22	5.6	2.2	164.07

Table 3.5.17 DISS Connected Loads

DISS uses energy meter shows us the direct current. We just take the reading after 1 hour. When we take reading & calculate the value & find the average value of DISS is 16.306 KW.

DISS connected load is less than YKSG-1. Normally we can tell from this DISS energy consumption is very lower than YSKG-1. We see that in a day YKSG-1 an hour maximum energy used 216KW. Another way we can see that DISS energy consumption is very lower than YKSG-1. Its maximum average Load is 16.07. We can see the data in a day maximum energy used 39KW.

When we will see the load curve then understood easily from curve chart.

Day-1 (09-08-2022):

	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM
Meter 4 Location: DISS	338,031 kWh	338,056 kWh	338,081 kWh	338,102 kWh	338,121 kWh	Load Shading Period 12:35 PM to 1:12 PM 338,127 kWh	338,141 kWh	338,163 kWh	Load Shading Period 03:30 PM to 05:05 PM	338,176 kWh	338,188 kWh	338,204 kWh	338,229 kWh	Load Shading Period 08:06 PM to 09:05 PM	338,261 kWh
Remarks (on Hourly Consumption)	Starting Data	25 kWh	25 kWh	21 kWh	19 kWh	6 kWh	14 kWh	22 kWh	No Consumption	13 kWh	12 kWh	16 kWh	25 kWh	Consumption of 6 minutes	32 kWh
	8:00 AM to 9:00 AM	9:00 AM to 10:00 AM	10:00 AM to 11:00 AM	11:00 AM to 12:00 PM	12:00 PM to 1:00 PM	1:00 PM to 2:00 PM	2:00 PM to 3:00 PM	3:00 PM to 4:00 PM	4:00 PM to 5:00 PM	5:00 PM to 6:00 PM	6:00 PM to 7:00 PM	7:00 PM to 8:00 PM	8:00 PM to 9:00 PM	9:00 PM to 10:00 PM	
Average Load in kW over an Hour	25 kW	25 kW	21 kW	19 kW	6 kW	14 kW	22 kW	0 kW	13 kW	12 kW	16 kW	25 kW	Very Low Consumption for 6 minutes	32 kW	

Table 3.5.10 Collected Data (09-08-2022)

Load Curve & Load Duration Curve Graph:

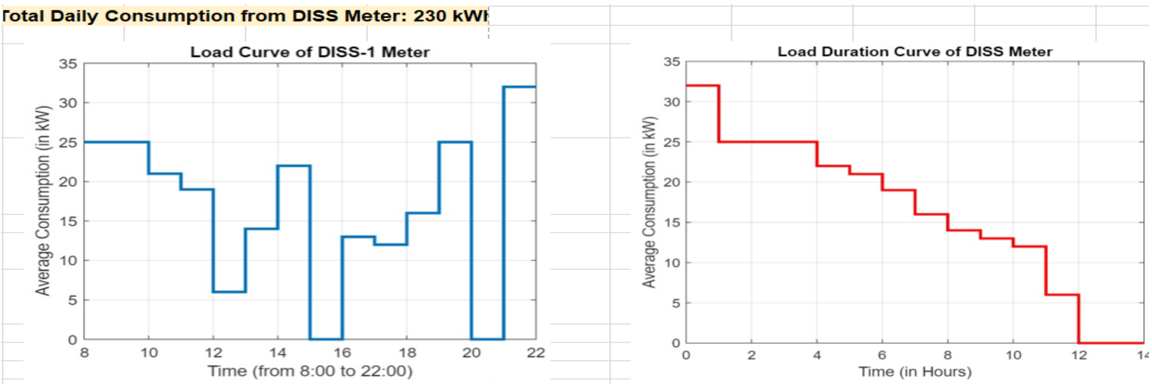


Figure 3.5.8 Load Curve & Load Duration Curve (15-08-2022)

Day-02 (10-08-2022):

	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM
	Energy Consumption during 10:00 PM to 8:00 AM: 226 kWh														
Meter 4 Location: DISS	338,487 kWh	338,506 kWh	338,526 kWh	338,541 kWh	Load Shading Period 11:02 AM to 12:05 PM	338,554 kWh	Load Shading Period 01:35 PM to 02:00 PM 338,563 kWh	Load Shading Period 02:00 PM to 03:02 PM	338,583 kWh	Load Shading Period 04:47 PM to 05:00 PM 338,600 kWh	Load Shading Period 05:00 PM to 06:03 PM	338,617 kWh	Load Shading Period 07:11 PM to 07:59 PM 338,621 kWh	338,652 kWh	338,677 kWh
Remarks (on Hourly Consumption)	Starting Data	19 kWh	20 kWh	15 kWh	No Consumption	13 kWh	9 kWh	No Consumption	20 kWh	17 kWh	No Consumption	17 kWh	4 kWh	31 kWh	25 kWh
	8:00 AM to 9:00 AM	9:00 AM to 10:00 AM	10:00 AM to 11:00 AM	11:00 AM to 12:00 PM	12:00 PM to 1:00 PM	1:00 PM to 2:00 PM	2:00 PM to 3:00 PM	3:00 PM to 4:00 PM	4:00 PM to 5:00 PM	5:00 PM to 6:00 PM	6:00 PM to 7:00 PM	7:00 PM to 8:00 PM	8:00 PM to 9:00 PM	9:00 PM to 10:00 PM	
Average Load in kW over an Hour	19 kW	20 kW	15 kW	0 kW	13 kW	9 kW	0 kW	20 kW	17 kW	0 kW	17 kW	4 kW	31 kW	25 kW	

Table 3.5.11 Collected Data (10-08-2022)

Load Curve & Load Duration Curve Graph:

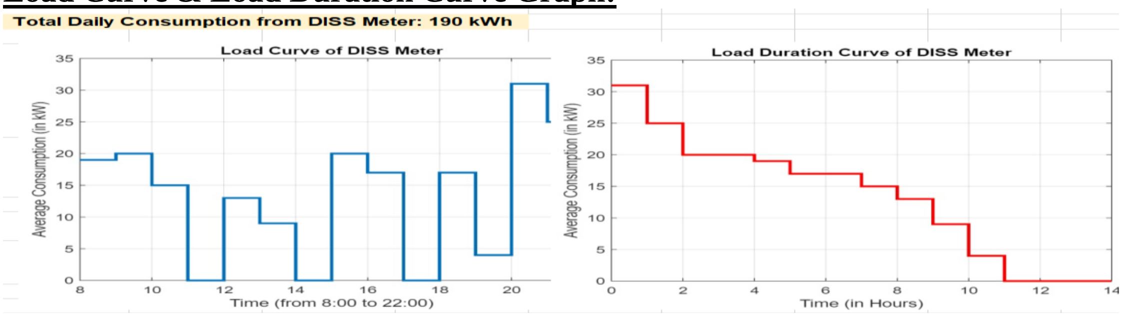


Figure 3.5.9 Load Curve & Load Duration Curve (15-08-2022)

Day-03 (11-08-2022):

	Energy Consumption during 10:00 PM to 8:00 AM: 192 kWh														
	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM
Meter 4 Location: DISS	338,859 kWh	338,874 kWh	338,892 kWh Load Shading Period 10:45 AM to 11:00	Load Shading Period 11:00 AM to 12:00 PM	Load Shading Period 12:00 PM to 12:47 PM	338,912 kWh	338,930 kWh	Load Shading Period 02:47 PM to 03:45 PM	338,955 kWh	Load Shading Period 04:45 PM to 05:44 PM	338,972 kWh	Load Shading Period 06:23 PM to 07:22 PM	338,991 kWh	339,024 kWh	Load Shading Period 09:26 PM to 10:31 PM
Remarks (on Hourly Consumption)	Starting Data	15 kWh	18 kWh	No Consumption	No Consumption	20 kWh	18 kWh	Reading Unavailable	25 kWh	Reading Unavailable	17 kWh	5 kWh	14 kWh	33 kWh	Reading Unavailable
	8:00 AM to 9:00 AM	9:00 AM to 10:00 AM	10:00 AM to 11:00 AM	11:00 AM to 12:00 PM	12:00 PM to 1:00 PM	1:00 PM to 2:00 PM	2:00 PM to 3:00 PM	3:00 PM to 4:00 PM	4:00 PM to 5:00 PM	5:00 PM to 6:00 PM	6:00 PM to 7:00 PM	7:00 PM to 8:00 PM	8:00 PM to 9:00 PM	9:00 PM to 10:00 PM	
Average Load in kW over an Hour	15 kW	18 kW	0 kW	0 kW	20 kW	18 kW	0 kW	25 kW	0 kW	17 kW	5 kW	14 kW	33 kW	0 kW	

TABLE 3.5.12 COLLECTED DATA (11-08-2022)

LOAD CURVE & LOAD DURATION CURVE GRAPH:

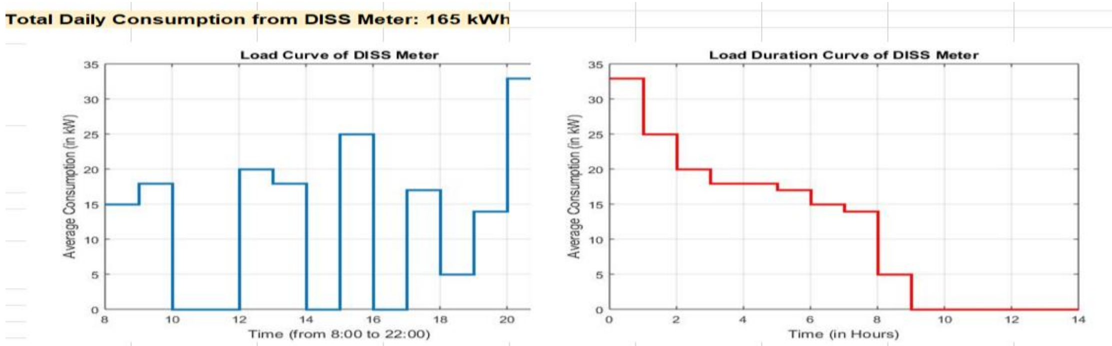


Figure 3.5.10 Load Curve & Load Duration Curve (15-08-2022)

Day-04 (12-08-2022):

	Energy Consumption during 10:00 PM to 8:00 AM: 181 kWh														
	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM
Meter 4 Location: DISS	339,205 kWh	339,225 kWh	339,258 kWh	Load Shading Period 10:17 AM to 11:17 AM	339,273 kWh	Load Shading Period 12:40 PM to 01:35 PM	339,291 kWh	339,314 kWh	339,342 kWh	339,364 kWh	339,382 kWh	339,405 kWh	339,436 kWh	339,462 kWh	339,501 kWh
Remarks (on Hourly Consumption)	Starting Data	20 kWh	33 kWh	Reading Unavailable	15 kWh	Reading Unavailable	18 kWh	23 kWh	28 kWh	22 kWh	18 kWh	23 kWh	31 kWh	26 kWh	39 kWh
	8:00 AM to 9:00 AM	9:00 AM to 10:00 AM	10:00 AM to 11:00 AM	11:00 AM to 12:00 PM	12:00 PM to 1:00 PM	1:00 PM to 2:00 PM	2:00 PM to 3:00 PM	3:00 PM to 4:00 PM	4:00 PM to 5:00 PM	5:00 PM to 6:00 PM	6:00 PM to 7:00 PM	7:00 PM to 8:00 PM	8:00 PM to 9:00 PM	9:00 PM to 10:00 PM	
Average Load in kW over an Hour	20 kW	33 kW	0 kW	15 kW	0 kW	18 kW	23 kW	28 kW	22 kW	18 kW	23 kW	31 kW	26 kW	39 kW	

Table 3.5.13 Collected Data (12-08-2022)

LOAD CURVE & LOAD DURATION CURVE GRAPH

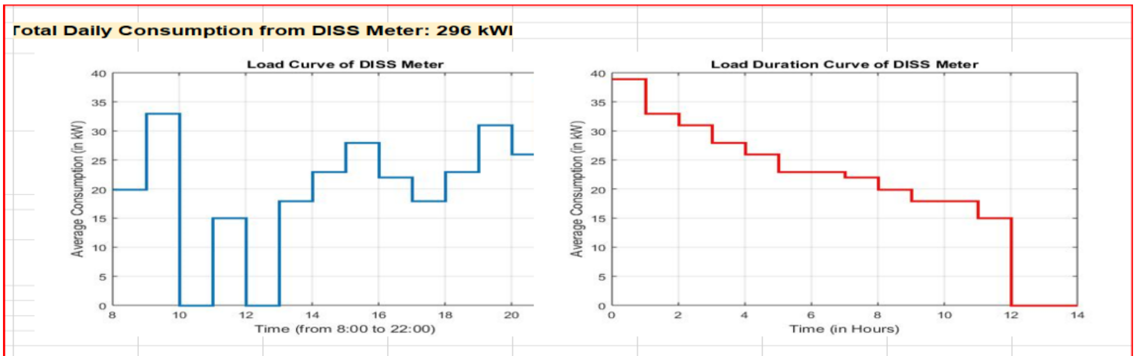


Figure 3.5.11 Load Curve & Load Duration Curve (15-08-2022)

Day-05 (13-08-2022):

Energy Consumption during 10:00 PM to 8:00 AM: 228 kWh

	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM
Meter 4 Location: DISS	339,729 kWh	339,752 kWh	339,779 kWh	Load Shading Period 10:45 AM to 11:00 AM	Load Shading Period 11:00 AM to 12:00 PM	Load Shading Period 12:00 PM to 01:10 PM [illegible]	339,813 kWh	Load Shading Period 02:21 PM to 03:33 PM	Load Shading Period 03:41 PM to 04:45 PM	Load Shading Period 05:00 PM to 05:54 PM	339,835 kWh	Load Shading Period 06:21 PM to 07:20 PM	339,860 kWh	339,890 kWh	339,919 kWh
Remarks (on Hourly Consumption)	Starting Data	23 kWh	27 kWh	Reading Unavailable	Reading Unavailable	16 kWh	18 kWh	Reading Unavailable	Reading Unavailable	Reading Unavailable	22 kWh	Reading Unavailable	25 kWh	30 kWh	29 kWh
	8:00 AM to 9:00 AM	9:00 AM to 10:00 AM	10:00 AM to 11:00 AM	11:00 AM to 12:00 PM	12:00 PM to 1:00 PM	1:00 PM to 2:00 PM	2:00 PM to 3:00 PM	3:00 PM to 4:00 PM	4:00 PM to 5:00 PM	5:00 PM to 6:00 PM	6:00 PM to 7:00 PM	7:00 PM to 8:00 PM	8:00 PM to 9:00 PM	9:00 PM to 10:00 PM	
Average Load in kW over an Hour	23 kW	27 kW	0 kW	0 kW	16 kW	18 kW	0 kW	0 kW	1 kW	22 kW	0 kW	25 kW	30 kW	29 kW	

Table 3.5.14 Collected Data (13-08-2022)

LOAD CURVE & LOAD DURATION CURVE GRAPH

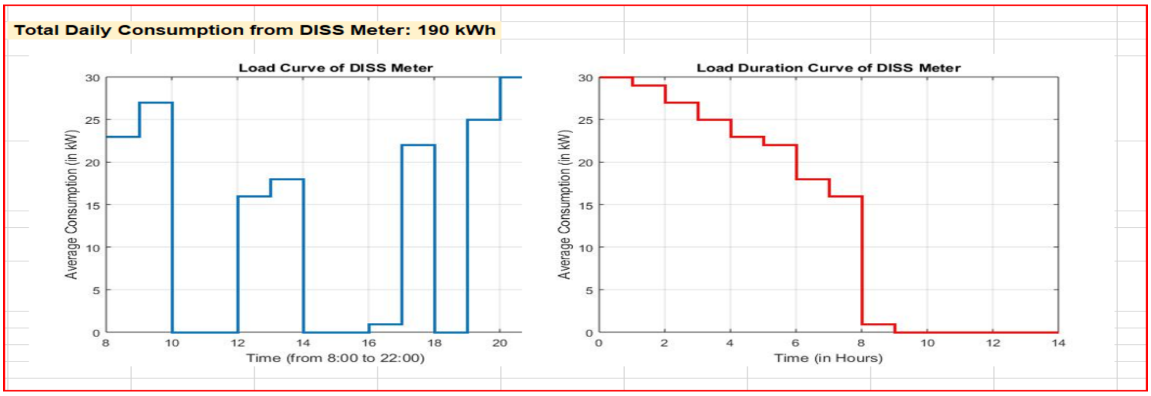


Figure 3.5.12 Load Curve & Load Duration Curve (15-08-2022)

Day-06 (14-08-2022):

Energy Consumption during 10:00 PM to 8:00 AM: 195 kWh

	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM
Meter 4 Location: DISS	340,114 kWh	340,133 kWh	Load Shading Period 09:45 AM to 10:55 PM	340,146 kWh	340,158 kWh	Load Shading Period 12:20 PM to 01:17 PM and 01:51 PM to 01:58 PM	340,176 kWh	340,192 kWh	Load Shading Period 03:56 PM to 04:00 PM	Load Shading Period 04:00 PM to 05:26 PM	340,227 kWh	340,252 kWh	340,274 kWh	340,294 kWh	340,326 kWh
Remarks (on Hourly Consumption)	Starting Data	19 kWh	Reading Unavailable	13 kWh	12 kWh	Reading Unavailable	18 kWh	16 kWh	Reading Unavailable	Reading Unavailable	35 kWh	25 kWh	22 kWh	20 kWh	32 kWh
	8:00 AM to 9:00 AM	9:00 AM to 10:00 AM	10:00 AM to 11:00 AM	11:00 AM to 12:00 PM	12:00 PM to 1:00 PM	1:00 PM to 2:00 PM	2:00 PM to 3:00 PM	3:00 PM to 4:00 PM	4:00 PM to 5:00 PM	5:00 PM to 6:00 PM	6:00 PM to 7:00 PM	7:00 PM to 8:00 PM	8:00 PM to 9:00 PM	9:00 PM to 10:00 PM	
Average Load in kW over an Hour	19 kW	0 kW	13 kW	12 kW	0 kW	18 kW	16 kW	0 kW	0 kW	35 kW	25 kW	22 kW	20 kW	32 kW	

Table 3.5.15 Collected Data (14-08-2022)

LOAD CURVE & LOAD DURATION CURVE GRAPH

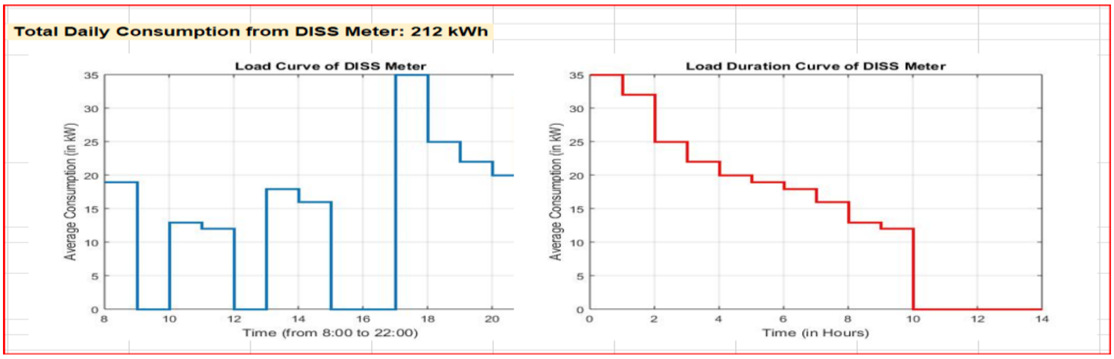


Figure 3.5.13 Load Curve & Load Duration Curve (15-08-2022)

Day-07(15-08-2022):

	Energy Consumption during 10:00 PM to 8:00 AM: 218 kWh														
	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM	6:00 PM	7:00 PM	8:00 PM	9:00 PM	10:00 PM
Meter 4 Location: DISS	340,544 kWh	340,554 kWh	340,581 kWh	340,602 kWh	340,624 kWh	340,642 kWh	340,664 kWh	340,691 kWh	340,713 kWh	340,731 kWh	340,746 kWh	340,769 kWh	340,796 kWh	340,831 kWh	340,858 kWh
Remarks (on Hourly Consumption)	Starting Data	10 kWh	27 kWh	21 kWh	22 kWh	18 kWh	22 kWh	27 kWh	22 kWh	18 kWh	15 kWh	23 kWh	27 kWh	35 kWh	27 kWh

	8:00 AM to 9:00 AM	9:00 AM to 10:00 AM	10:00 AM to 11:00 AM	11:00 AM to 12:00 PM	12:00 PM to 1:00 PM	1:00 PM to 2:00 PM	2:00 PM to 3:00 PM	3:00 PM to 4:00 PM	4:00 PM to 5:00 PM	5:00 PM to 6:00 PM	6:00 PM to 7:00 PM	7:00 PM to 8:00 PM	8:00 PM to 9:00 PM	9:00 PM to 10:00 PM
Average Load in kW over an Hour	10 kW	27 kW	21 kW	22 kW	18 kW	22 kW	27 kW	22 kW	18 kW	15 kW	23 kW	27 kW	35 kW	27 kW

Table 3.5.16 Collected Data (15-08-2022)

LOAD CURVE & LOAD DURATION CURVE GRAPH

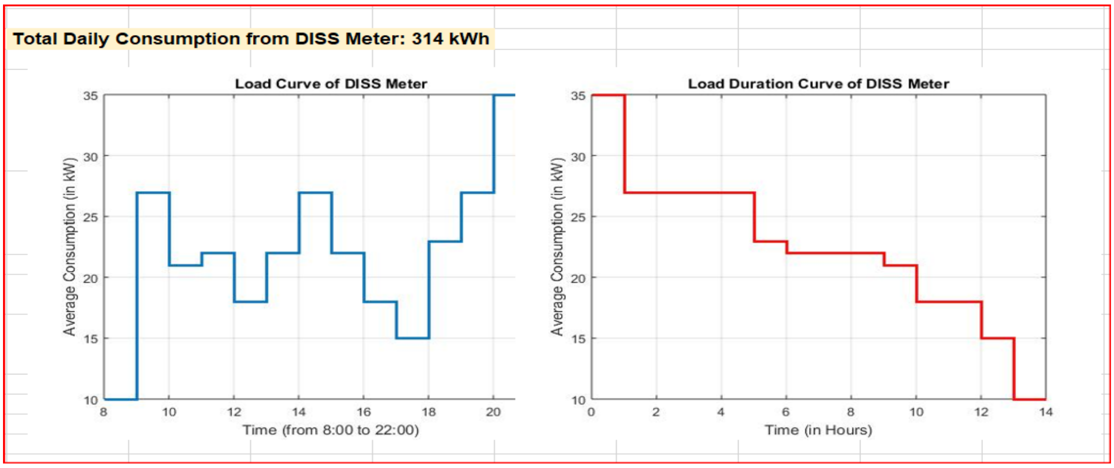


Figure 3.5.14 Load Curve & Load Duration Curve (15-08-2022)

3.6 SUMMARY

We present the data gathered from the energy meters of the DIU buildings YKSG-1 & DISS in this chapter. To show the average usage for each hour, we gather the data and input it onto an excel data sheet. Additionally, the load curve and load duration curve make it easy to see what hour or what time consumption is the highest. The length of the load curve demonstrates that the regular basis decreases in magnitude as consumption increases. This is a simple method for determining how much energy is consumed daily and how much of a bill to send to the provider of the power. Discuss the use of solar power plants as a backup generator during load shedding here as well. In Bangladesh, there is now an urgent need for electrical service due to the country's high demand. In that situation, we would like to install or utilize a generator to save money. Also, talk about the parts of the solar power plant's system.

CHAPTER 4
RESULTS AND DISCUSSIONS

4.1 Results

What is the Solar Panel Cost?

In Bangladesh, a solar panel costs about 8,000 Taka and has a 300watt power output. The cost of the panel typically depends on the panel's overall strength, quality, and resilience to natural calamities.

Best Solar Panel Price List in Bangladesh (BD) for January, 2023:

Solar Panel Model	Price in BDT
Commercial 2KW On-Grid Solar Power Plant	159,000 TK
Sunland 300 Watt Solar Panel	16,500 TK
Commercial 5KW Solar Power Plant	400,000 TK
Commercial 6KW Solar Power Plant	480,000 TK
Commercial 3KW On-Grid Solar Power System	240,000 TK
Commercial 1KW Solar Power Plant	100,000 TK
Commercial 4KW Solar Power System	300,000 TK
Commercial 7KW Solar Power System	560,000 TK
Commercial 8KW Solar Power Plant	640,000 TK
Solar Power System 1KW	100,000 TK
Industrial 20KW On-Grid/Off-Grid Solar Power System	1,355,000 TK

Table 4.1.1 Solar Panel Price in January 2023

Installment Cost for Generator:

Generator needs to repair or need to change after 2-5 year. Its warranty for 2 years. After some of years generator efficiency decreases or damaged different parts

Included Equipment with Solar Power System:

8KW on-grid solar power system, solar panel, wiring cable, energy meter, structure, JFY (Just For You) inverter China, distribution board ide Spain, MCB ABB Italy.

4.1.1 YKSG-1 Cost Calculation

Generator Cost:

Rating of generator 330 KVA. Maximum Demand 250KWh. Connected load 833.03KW. Average load-shedding per day 6 hours in summer season & winter season 2 hours.
Here uses diesel engine generator. In summer needs about 45liter oil in an hour & for the winter 17liter oil in hours. Because generator consumption the oil depends on the loads. The rate of

diesel oil in Bangladesh January 2023 is 109tk per liter. Now, calculate how much oil consume to generate power.

In summer season	**In winter season:**
Per day needs, 45*6 = 270liter	Per day needs, 17*2 = 34liter
Per month needs, 270*30 = 8,100liter	Per month needs, 34*30 =1,020liter
Per 8 month needs, 8,100*8 = 64,800liter	Per 4 month needs, 1,020*4 = 4,080liter

Table 4.1.2 YKSG-1 Summer & Winter Generator Cost

Installment Cost:

The cost of generator of 330KVA is 38,00,000.

Running Cost of Generator Oil:

In Summer season	**In winter season**
Per day = 270*109 = 29,430 TK	Per day = 34*109 = 3,706 TK
Per month = 8,100*109 = 8,82,900 TK	Per month = 1,020*109 = 1,11,180 TK
Per 8 month = 64,800*109 = 70,63,200 TK	Per 4 months = 4,080*109 = 4,44,720 TK

Table 4.1.3 YKSG-1 Summer and Winter Running Cost

Total yearly cost of oil is = (summer + winter) = (70,63,200+4,44,720) = 75,07,920 TK.

20 years cost of oil is = 20*75,07,920 = 15,01,58,400 TK.

Servicing Cost of Generator:

Servicing cost per month is 15,000 Tk.
Servicing cost per year is = 12*15,000 = 1,80,000 TK
Servicing cost for 20 years is = 20*1,80,000 = 36,00,000 TK

Mobil/Engine oil/Lubricants Cost:

Cost per 3 months is 25liter. Per year cost is 100liter.
Engine oil price approximately 500 Tk. Per year its cost is 50,000 TK.
Cost for 20 years is = 20*50,000 = 10,00,000 Tk

Total Cost of Generator:

Total cost = Oil cost + Servicing cost + Engine oil cost + Installment Cost

1st Year Cost= (75,07,920 + 1,80,000 + 50,000 + 38,00,000) TK
= 1,15,37,920 TK
After 5 Years Cost = (5*(75,07,920 + 1,80,000 + 50,000) + 38,00,000) TK
= 4,24,89,600 TK
Per 10 Year’s Cost = (10*(75,07,920 + 1,80,000 + 50,000) + (38,00,000*2)) TK

= 8,49,79,200TK

Per 20 Year's Cost = (20*(75,07,920 + 1,80,000 + 50,000) + (38,00,000*2)) TK

= 16,23,58,400TK

Cost of Solar Power Plant (off grid):

Maximum demand for YKSG-1 per hour is 250 KW.

Industrial 20KW On-Grid/Off-Grid Solar Power Plant Cost = 13,55,000 TK.

Commercial 5KW Solar Power Plant Cost = 4,00,000 TK.

We need 12 unit of 20KW & 2 unit of 5KW of solar power system to found 250 KW.
The Price of solar panel is given on the chart.
If we take 20 KW solar power plant cost for this project is = (12*13,55,000) TK
= 1,62,60,000 TK.
If we take 5 KW panel cost for this project is = (2*4,00,000) TK
= 8,00,000 TK.
Total Initial/ 1st year Cost of the power plant is = (1,62,60,000+ 8,00,000) TK
= 1,95,18,000 TK.
We need total lead acid industrial battery (Rating 200 Ah) for 6 hours are 625 pcs

(N.B Battery Size = ((Total load *Back up time) / Battery Voltage)
= ((250KW*6hr)/12Volts)
= 1,25,000 Ah
Now, Number of Battery = (1,25,000 Ah/200 Ah)
= 625 pcs)

The total cost of 625 pcs battery are = (625* 20,000) TK
= 1,25,00,000 TK
We know, normally every 5 years need to exchange the batteries.
So,
Yearly cost = Initial cost + Battery exchange cost

After 5 Year Cost = (1,95,18,000+ 1,25,00,000) TK
= 3,20,18,000 TK
After 10 years cost = 1,95,18,000+ (2*1,25,00,000) TK
= 4,45,18,000 TK
After 20 years cost = 1,95,18,000+ (3*1,25,00,000) TK
= 5,70,18,000 TK

4.1.2 Cost Calculation for DISS:

Generator Cost:

Rating of generator 220 KVA. Maximum Demand 50KWh. Connected load 164.07 KW.
Average load-shedding per day 6 hours in summer season & winter season 2 hours.
Here uses diesel engine generator. In summer needs about 7liter oil in an hour & for the winter 3liter oil in hours. Because generator consumption the oil depends on the loads. The rate of

diesel oil in Bangladesh January 2023 is 109tk per liter. Now, calculate how much oil consume to generate power.

In summer season:	**In winter season:**
Per day needs, 7*6 = 42ltr.	Per day needs, 3*2 = 6ltr
Per month needs, 42*30 = 1,260ltr.	Per month needs, 6*30 = 180ltr
Per 8 month needs, 1260*8 = 10,080ltr.	Per 4 month needs, 180*8 = 1,440ltr

Table 4.2.1 DISS Summer & Winter Generator Cost

Installment Cost:

The cost of generator of 220KVA is 35,00,000TK.

Running cost of generator oil:

In Summer season:	**In winter season:**
Per day = 42*109 = 4,578 TK	Per day = 6*109 = 654 TK
Per month = 1,260*109 = 1,37,340 TK	Per month = 180*109 = 19,620TK
Per 8 month = 10,080*109 = 10,98,720 TK	Per 4 months = 1,440*109 =1,56,960 TK

Table 4.2.2 DISS Summer and Winter Running Cost

Total yearly cost of oil is = (summer + winter) = (10,98,720 + 1,56,960) = 12,55,680 TK.
20 years cost of oil is = 20*12,55,680 = 2,51,13,600 TK.

Servicing cost of generator:

Servicing cost per month is 8,000 Tk.
Servicing cost per year is = 12*8,000 = 96,000 TK
Servicing cost for 20 years is = 20*96,000 = 19,20,000 TK

Mobil/Engine oil/Lubricants Cost:

Cost per 3 months is 4liter. Per year cost is 16liter.
Engine oil price approximately 500 Tk. Per year its cost is 8,000 TK.
Cost for 20 years is = 20*8,000 = 1,60,000 Tk

Total Cost of Generator:

Total cost = Oil cost + Servicing cost + Engine oil cost + Installment Cost

1st Year Cost= (12,55,680 + 96,000 + 8,000 + 35,00,000) TK
= 48,59,680 TK
5th Year Cost = (5*(12,55,680 + 96,000 + 8,000) + 35,00,000)
= 1,02,98,400 TK
10th Year Cost = (10*(12,55,680 + 96,000 + 8,000) + (35,00,00*2))

= 2,05,96,800 TK
Per 20 Year’s Cost = (20*(5*(12,55,680 + 96,000 + 8,000) + (35,00,00*2)))
= 3,41,93,600 TK

Cost of Solar Power Plant (off grid):

Maximum demand for YKSG-1 per hour is 50 KW.
Industrial 20KW On-Grid/Off-Grid Solar Power Plant Cost = 13,55,000 TK.
Commercial 5KW Solar Power Plant Cost = 4,00,000 TK.

We need 2 unit of 20KW & 2 unit of 5KW of solar power system to found 50 KW.
The Price of solar panel is given on the chart.
If we take 20 KW solar power plant cost for this project is = (2*13,55,000) TK
= 27,10,000 TK.
If we take 5 KW panel cost for this project is = (2*4,00,000) TK
= 8,00,000 TK.
Total Initial/ 1st year Cost of the power plant is = (27,10,000 + 8,00,000) TK
= 35,10,000 TK.
We need total lead acid industrial battery (Rating 200 Ah) for 6 hours are 125 pcs

(N.B Battery Size = ((Total load *Back up time) / Battery Voltage)
= ((50KW*6hr)/12Volts)
= 25,000 Ah
Now, Number of Battery = (25,000 Ah/200 Ah)
= 125 pcs)

The total cost of 125 pcs battery are = (125* 20,000) TK (Battery price 20,000 TK)
= 25,00,000 TK
We know, normally every 5 years need to exchange the batteries.
So,
Yearly cost = Initial cost + Battery exchange cost

After 5 Year Cost = (35,10,000 + 25,00,000) TK
= 60,10,000 TK
After 10 years cost = 35,10,000 + (2*25,00,000) TK
= 85,10,000 TK
After 20 years cost = 35,10,000 + (3*25,00,000) TK
= 1,10,10,000 TK

4.2 Discussions

This chapter is jam-packed with details about several calculations, costs, and financial outlays. First, we determined the YKSG-1 generator's cost, taking account both the summer and winter seasons' fuel costs. Initial investment costs as well as operation and maintenance costs for the generator have been calculated.

We make assumption and computed the overall cost of using the YKSG-1 generator. Then we displayed a chart showing the prices of various solar power systems. Now that the cost has been determined with great accuracy, it is time to determine how many solar panels we actually need.

Now that the generator cost for DISS has been carefully evaluated, it includes installation costs, fuel costs for summer and winter, running costs, and maintenance costs.

Next, the specifications and price of the DISS solar panel were revealed. The magic part of this article is now here. We have analyzed the cost estimates for solar and generator power systems. We have observed significant cost savings from adopting solar electricity for such properties.

Therefore, given these conditions, a solar power system should be put in place.

Final Result of the Cost Calculation YKSG-1

Year	Cost of Generator (Taka)	Cost of Solar plant (Taka)	Savings Amount (Taka)
1st	1,15,37,920	1,95,18,000	-79,80,080
5th	4,24,89,600	3,20,18,000	1,04,71,600
10th	8,49,79,200	4,45,18,000	4,04,61,200
20th	16,23,58,400	5,70,18,000	10,53,40,400

Table 4.2(a) Final Cost Calculation of YKSG-1

If we use off grid solar power plant instead of Generator. After 20 years total cost saving is 10,53,49,400 Tk.

Final Result of the Cost Calculation DISS

Year	Cost of Generator (Taka)	Cost of Solar plant (Taka)	Savings Amount (Taka)
1st	48,59,680	35,10,000	13,49,000
5th	1,02,98,400	60,10,000	42,88,400
10th	2,05,96,800	85,10,000	1,20,86,800
20th	3,41,93,600	1,10,10,000	2,31,83,600

Table 4.2(b) Final Cost Calculation DISS

If we use off grid solar power plant instead of generator. After 20 years total cost saving is 2,32,83,600 TK.

- **For on grid solar power plant we just less the battery cost. Then we will get the on grid solar power plant cost.**

Area Estimation for Solar Panel in YKSG-1 Buildings

YKSG-1 Buildings required 250KW is maximum demand. In this case, need 12 unit of 20KW solar panel and 2 unit of 5KW solar panel.

Area required 20KW solar panel is 1,725 square feet.

Now, required total area 20KW is 12*1,725 = 20,700 square feet.

Area required 5KW solar panel is 350 square feet.

Now, required total area 5KW is 2*350 = 700 square feet.

Area Estimation for Solar Panel in DISS Buildings

DISS Buildings required 50KW is maximum demand. In this case, need 2 unit of 20KW solar panel and 2 unit of 5KW solar panel.

Area required 20KW solar panel is 1,725 square feet.

Now, required total area 20KW is 2*1,725 = 3,450 square feet.

Area required 5KW solar panel is 350 square feet.

Now, required total area 5KW is 2*350 = 700 square feet.

CHAPTER 5
PROJECT MANAGEMENT

5.1 Task, Schedule and Milestones

Here is some task and milestone that we have faced and achieved from the very beginning to the end of this project.

1. To find out how the load is connected from the bus bar and which energy meter is providing the reading of those Lords.

2. How to take the reading accurately in accurate time also note in excel sheet.

3. Making the load curve and duration curve from those data.

4. Gathering information about all the connected loads and calculate them.

5. Find out the requirements and how to full fill them.

6. Calculation of energy coming from generator with their cost and maintenance.

7. Finding out the efficient way to solve the energy requirement, their cost and maintenance.

8. Comparison of current situation and proposed power plant system in this project.

9. To briefly explain the final result, aims and benefits.

10. Finally to prove that our project is efficient and worthwhile.

5.2 Resources and Cost Management

In the term of resource and cost management, as a manager we have calculated all of our cost requirement and installation very accurately. We have collected information about the connected load and their power requirement also their maintenance from our electrical engineer and technician who ware working in this project site. We have examined how the power is being wasting and if there any kind of leakage or error occurs. After that we calculated our requirement load our requirement power with their cost. We have calculated the cost of generator, maintenance cost, fuel cost and requirement and estimated the overall cost for around 20 years. Then we thoroughly collect information about solar power system their maintenance and cost. We have calculated them very accurately.
Then compared both of the power system depending on their installation, life cycle, cost and maintenance. Then we have able to find a result after all of those calculations that solar power system is efficient in our project.

5.3 Lesson Learned

First of all, we have learnt about the time management also learnt how to complete our field work with great efficiency. By doing this project we faced lots of problems and solved those problems. We have gained the ability to face the problem and how to solve them. At first in the time of working in field we learn to calculate and take the data from the energy meter. We rearranged all of those data in right way in a chart and learn to make load curve and duration curve from them. Will learn about the load management of a property how the power system works also about generator and its power system and maintenance. We learnt a lot about how solar power system works their cost, their efficiency, maintenance and installation cost. Now we can compare which power system is cost friendly, ecofriendly and efficient.

After learning about all those fields. We have able to make a conclusion which is suitable for our project. Thus, we proved and offered our outcome.

CHAPTER 6

IMPACT ASSESSMENT OF THE PROJECT

6.1 Economical, Societal and Global Impact

- This project is very efficient and applicable for our regular life in this current situation of power lacking.

- During the period of load shedding this project will provide continuous power supply to the loads which is completely renewable energy.

- This project is cost friendly then other power plants and can save a considerable amount of money while generating electrical energy.

- This project also a great impact in global energy consumption. Instead of using fuel we will use solar energy which is completely renewable and this will reduce the consumption of our Limited fuel energy. Thus, the global limited storage energy consumption will reduce.

6.2 Environmental and Ethical Issues

The quantity of environmental effect is also affected by the system scale, which can range from tiny, dispersed rooftop PV arrays to enormous utility-scale PV and CSP installations.

The potential environmental impacts associated with solar power

- Land use and habitat loss
- Water use
- Depending on the technology—which falls into one of two major categories: photovoltaic (PV) solar cells or concentrating solar thermal plants—the usage of hazardous compounds in manufacture might vary significantly (CSP).

The system scale, which can range from small, dispersed rooftop PV arrays to massive utility-scale PV and CSP projects, also has an influence on the amount of environmental impact.

6.3 Utilization of Existing Standards

The timely establishment of the fundamental norms and standards regulating solar deployment is necessary for the installation of photovoltaic (PV) solar energy systems in a safe and reliable manner and for their integration with the country's electric grid. The demand for current connectivity and interoperability standards that assure cross-technology compatibility of regulatory requirements is driven by technological advancements, new commercial prospects, and statutory and regulatory obligations.

Safety issues of solar panels.

- Falls from high rooftops.
- Electrocution or other electric hazards.
- Repetitive stress injuries.
- Cuts or sprains.

6.4 Other Concerns

- Associated with the emission of greenhouse gases.
- There are also some toxic materials and hazardous products used during the manufacturing process of solar photovoltaic systems.
- Uses a lot of Space.
- Weather Dependent.

CHAPTER 7
CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

At now, there is no universally accepted method for gathering and analyzing data in the field of energy monitoring using existing platforms. To aid in energy profiling, benchmarking, and diagnostics, a standardizing data model describing the hierarchy of energy end uses in buildings is essential. Credible information is the backbone of studies examining building energy efficiency. All the problems with data collecting, sharing, retrieval, identifying of data points, and dealing with missing and low-quality data call for more effective and standardized approaches to solving these problems. Detailed data analysis and benchmarking of the hall buildings at daffodil international university showed that buildings operated considerably differently, had substantial potential for energy savings, but required various efficiency strategies.

7.2 New Skills and Experiences Learned

In this thesis work we are learned about many things. It will help us in future in our workplace. We learned about **Meter Reading** which is help in our future job place. We also learn about how to collect data and how to calculate the energy and how to calculate the average load in buildings. Find out how much unit required in building. What will be the monthly electricity bill we can measure it now easily. We also known about the solar panel and its working principle.

7.3 Future Recommendations

Wind Power Plant:

For wind turbine cut-in speed of wind is needed - 5 km/h to 10 km/h.
Power generation speed is – 15 km/h to 50 km/h.

Here cut-in speed is the speed which is mandatory for moving a wind turbine. That means the turbine will not generate energy until the cut-in speed of wind is not achieved. Power generation speed is that speed of wind when power is being produced. So here it is 15 km/h to 50 km/h depending to the size of the turbine.

We assumed we will use the small turbine but the wind speed rate of our installation area is not achieving the “cut-in” speed all time. Overall wind rate is below then the cut-in speed of wind. Though the gusts wind speed is comparatively okay for power generation but this will not be efficient for our load. So, it will not be a good idea to install a wind power plan in this property.

REFERENCES

1.EIA. 2009. Residential Energy Consumption Survey 2009. U.S. Energy Information Administration. Washington, DC.

2.Lanzisera, S. B. Nordman, R.E. Brown. 2012. Data network equipment energy use and savings potential in buildings. Energy Efficiency.

3.Bartelsman, Eric and Wayne Gray (1994), "NBER Manufacturing Productivity Database," NBER Technical Working Paper, available on-line.

4. Berndt, Ernst (1990), "Energy Use, Technical Progress and Productivity Growth: A Survey of Economic Issues," The Journal of Productivity Analysis.

5. Bernstein, Jeffrey I. and M. Ishaq Nadiri (1989), "Research and Development and Intra-industry Spillovers: An Empirical Application of Dynamic Duality," Review of Economic Studies.

6. Attan J (1985) Metering Survey. Carried out for the Electricity Consumers' Council.
Arvola A, Uutela A and Anttila U (1994) Billing feedback as a means of encouraging conservation of electricity in households: a field experiment in Helsinki. Energy and the consumer, Finnish Ministry of Trade and Industry

7.Barbose G, Goldman C and Neenan B (2005) A survey of utility experience with real time pricing; implications for policymakers seeking price responsive demand. Proceedings, European Council for an Energy-Efficient Economy.

8.Benders RMJ, Kok R, Moll HC, Wiersma G and Noorman KJ (in press) New approaches for household energy conservation. In search of personal household energy budgets and energy reduction options. Energy Policy

9.https://www.bdstall.com/solar-panel/