

A survey on Grid Solar Roof Top System in Bangladesh

**A dissertation submitted to the Department of EEE, Faculty of Engineering Sciences,
Daffodil International University. In the partial fulfilment of the requirement for the
degree of BSc Engineering.**

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Certification

This is to certify that this thesis entitled “Performance of on Grid Solar Roof-tof System Under DPDC” is done by the following students under my direct supervision and this work has been carried out by them in laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfilment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on

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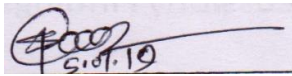
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DECLARATION

I hereby declare that, this project report is done by me under the supervision of **Dr. M. Shamsul Alam**, Professor, Dean Department of EEE, Faculty of Engineering, Daffodil International University, impartial fulfilment of the requirement for the degree of Bachelor of EEE. I am declaring that this project is my original work. I am also declaring that neither this project nor any part thereof has been submitted elsewhere for the award of Bachelor or any degree.

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Acknowledgements

At the end of our thesis, we would like to thank the Almighty GOD who bestowed us with knowledge to make this thesis possible and unforgettable experience for us. First of all, we would like to express our deepest sense of Gratitude to our supervisor **Professor Dr. M. Shamsul Alam** who offered his continuous advice and encouragement throughout the course of this thesis. We thank him for the systematic guidance and great effort he put into training us in the research field. We also want to thank all of our respected faculties of the department who rendered their immense knowledge to enhance our potential throughout our graduation. We want to show our humble respect to all the owners of inspected houses. Without their permission and assistance, we could not have completed our thesis. Finally, we take this opportunity to express the profound gratitude from our deep heart to our beloved parents for their love and continuous support both spiritually and materially.

Shahadat Hossain

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Dedicated to
MY BELOVED FAMILY

Abstract

Solar rooftop system is the simplest way to reduce the waste of electricity and to keep the environment green. In this study and survey period, this was the initial basis to research whether the users of the system are taking it in a positive way or not. The study mainly focuses on the importance of the solar system, benefits and prospect. Solar energy has been the most favorable resource of renewable energy to improve the continuing unavailability of electricity. In this context, the composition of Solar Rooftop system related works is reviewed and later on, the methods and measures of the collected data from various fields of Narayanganj are described elaborately. About 20 solar rooftop systems formed in Fatullah, Woaparpul, Esha Kha Road, Chashara in Narayanganj area have been randomly surveyed. The entire study is mainly based on the data collected from these surveys. After the long process of collecting data and bringing them together, the survey has managed to find out some important outcomes.

Initially, the primary aim of the study was to find out the Consumer information, operation details, in which purpose they use the system, and afterwards, they're asked whether they are satisfied with the system or not. It is found that a majority of the people are completely dissatisfied with the system. After all, the effectiveness of the system was discussed in brief to influence them to come to know about the appropriateness of the system and the proper way to maintain the system. It is seen that a few among them find the system useful and want to increase its capacity. The operating condition and maintenance of the SRS was evaluated as well. Most of the interviewed people do not either maintain the system or want to repair it. It is very unfortunate that most of the systems were found inactive or not connected in a proper way. Although urban people are more likely to know the efficient use of solar energy, they still prefer fossil fuels for their power generation. In this manner, they are indirectly contributing to environmental hazards and wasting a lot of money too. From the reading of an installed solar system, the cost per unit is calculated later as an example. However, the appropriateness of the system to the consumer is very limited due to having a lack of knowledge and training to operate the system productively.

List of Abbreviation

SRS = Solar Roof Top System

USA = United State of America

PVA = Photovoltaic

CSP = Concentrated Solar Power

GW = Giga Watt

MW = Mega Watt

BRAC = Bangladesh Rural Advancement Committee

NGO = Non-Government Organization

KW = Kilo Watt

AC = Alternating Current

RERC = Renewable Energy Research Centre

SQ-FT = Square Fit

DC = Direct Current

SHS = Solar Home System

DPDC = Dhaka Power Distribution Company

DESCO = Dhaka Electric Supply Company

BDT = Bangladesh Taka

List of figure:

Figure No	Figure name	Page no
2.1	Non-Renewable Energy	8
2.2	Hydro power plant	10
2.3	Wind power plant	11
2.4	Biomass power plant	12
2.5	world solar status	14
2.6	SHS installation statistics	16
2.7	10kw solar electrification systems at Barkal,Rangamati	17
2.8	Monthly average solar profile in Bangladesh	18
2.9	Solar technical diagram	18
2.10	Solar panel diagram	19
2.11	Solar charge controller	20
2.12	Solar inverter	21
2.13	solar Battery	22
3.1	Survey area Chsara, Narayanganj	25
4.1	Area and Survey House	27
4.2	Installment cost of various consume	28
4.3	SRS Cleaning time some sector	29
4.4	SRS training	30
4.5	Grid Connection	31
4.6	Panel Condition	32
4.7	SRS instrument Arrangement	32
4.8	Customer Satisfaction	33
4.9	Waste of money	34
4.10	Increasing Capacity	35
4.11	SRS useful	35

Contents:

INDEX	PAGE NO
List of Table	26
List of Figure	viii
List of Abbreviations	vii
Acknowledgment	iv
Abstract	vi
1 Introduction:	1-6
1.1 Introduction	1
1.2 Problem statement	2
1.3 Objective	4
1.4 Scope of the research	4
1.5 Thesis Outline	5
2 Literature Review:	6-22
2.1 Introduction	6
2.2 Energy	7
2.3 Renewable Energy	9
• Hydro Energy	9
• Wind Energy	10
• Biomass Energy	11
2.4 Solar	12
2.4.1 World solar status	13
2.4.2 Bangladesh solar system	15

2.4.3 Technical diagram of solar system	18
2.5 Working Principle of Solar Energy	19
3 Methodology:	23-26
3.1 Introduction	23
3.2 Flow Chart	24
3.3 Site selection	24
3.4 Table of content	26
4 Result:	27-37
4.1 Introduction	27
4.2 Customer information	27
4.3 Cost analysis	28
4.4 Maintenance of SRS	29
4.5 Installation information	30
4.6 Customer satisfaction	33
4.7 Cost calculation	36
4.8 Result Finding	37
5 Conclusion:	38-40
6 Reference:	41

Chapter One

Introduction

1.1 Introduction

One of the greatest energy sources (our sun) is readily available for the taking. We just need to be able to harness its power. For those interested, below is a brief history of how solar power came to be.

The history of photovoltaic energy started way back in 1876. William Grylls Adams along with a student of his, Richard Day, discovered that when selenium was exposed to light, it produced electricity. An electricity expert, Werner von Siemens, stated that the discovery was “scientifically of the most far-reaching importance”. The selenium cells were not efficient, but it was proved that light, without heat or moving parts, could be converted into electricity.

In 1953, Calvin Fuller, Gerald Pearson, and Daryl Chapin, discovered the silicon solar cell. This cell actually produced enough electricity and was efficient enough to run small electrical devices. The New York Times stated that this discovery was “the beginning of a new era, leading eventually to the realization of harnessing the almost limitless energy of the sun for the uses of civilization.”

The year is 1956, and the first solar cells are available commercially. The cost however is far from the reach of everyday people. At \$300 for a 1 watt solar cell, the expense was far beyond anyone’s means. 1956 started showing us the first solar cells used in toys and radios. These novelty items were the first item to have solar cells available to consumers.

In the late 1950’s and early 1960’s satellites in the USA’s and Soviet’s space program were powered by solar cells and in the late 1960’s solar power was basically the standard for powering space bound satellites.

In the early 1970’s a way to lower to cost of solar cells was discovered. This brought the price down from \$100 per watt to around \$20 per watt. This research was spearheaded by Exxon. Most off-shore oil rigs used the solar cells to power the waning lights on the top of the rigs.

The period from the 1970's to the 1990's saw quite a change in the usage of solar cells. They began showing up on railroad crossings, in remote places to power homes, Australia used solar cells in their microwave towers to expand their telecommunication capabilities. Even desert regions saw solar power bring water to the soil where line fed power was not an option!

Today we see solar cells in a wide variety of places. You may see solar powered cars. There is even a solar powered aircraft that has flown higher than any other aircraft with the exception of the Blackbird. With the cost of solar cells well within everyone's budget, solar power has never looked so tempting.

Recently new technology has given us screen printed solar cells, and a solar fabric that can be used to side a house, even solar shingles that install on our roofs. International markets have opened up and solar panel manufacturers are now playing a key role in the solar power industry. [1]

1.2 Problem Statement

Electricity crisis is the burning question in Bangladesh now. Our main source of electricity product is the natural gas which is shortage and is going to run out. Some power stations are furnace controlled and some others are oil dependent. This sort of power stations is more expensive and they are not atmospheric friendly. They produce greenhouse gas which destroys the Ozone layer and causes the global warming. There are some power stations which run by renewable energy source, namely Hydroelectric power Scheme, Tidal power Scheme, Wind mill, Nuclear reactor and Solar Cell.

Hydroelectric power Scheme needs large area. They are costly to build and they are not granted in all time. This power station has low efficiency.

Tidal power Scheme also needs large area to store water. Their building cost is very high and they are not granted in all time because its output depends on the tides comes in or goes out. This power station has low efficiency.

Wind mill power scheme also needs large area to build and their initial building cost is very high. Their output depends on the wind flow which is not constant in all time, i.e. they are not granted in all time. This power station has low efficiency.

Nuclear power station is very efficient but their initial building cost is very high and their fuel is not available in Bangladesh. The fuel of this power station has to import from abroad. The most concerning of this power station is the safety. That is, before building this power station we have to ensure 100% safety because if any accident occurs, its effect exists for long time. Radioactive dust is very harmful for human being and also for other animals.

Solar Cells are cheap to install. Bangladesh is a county where 13 hours Sun light is available within 24 hours. They are environment friendly because they do not produce any harmful gas. The most common solar cells are silicon solar panel. Some private

9 institutions install solar cells in various districts in Bangladesh which are working well. Silicon Solar cells are expensive. Recently few countries, namely Switzerland, Netherlands, Newzeland, U.S.A. Discovered Polymer solar cells which are more efficient and cheap. Various researches are going on about Polymer solar Cells in Bangladesh. Fibers are available in Bangladesh. So, it is easy to produce Polymer Solar cell. In Silicon, the cost per unit electricity production is almost Tk. 12 but in Polymer Solar cells its cost might be Tk. 4. So, we can produce energy (mainly electricity) as long as the Sun exists. All energy sources might be run out but Sun light never run out. If we can install Polymer Solar Cells in everywhere in Bangladesh, we will get rid of electricity crisis in all respect. As electricity can be used to produce other source of energy, i.e. electrical energy can be converted into any other form, so we can remove our energy crisis problem and we can develop our country in all respects. [2]

Approximately 75% of the total population lives in the rural area and only 42% of them have direct access to the grid electricity connection. It is not possible to connect them to the existing grid connection neither economically nor technically because it is already overloaded with the existing connection. So, rural electrification must have to rely on renewable energy source considering economically and also as most available option.

Transport is an important part of Bangladesh's economy. Since the liberation of the country, the development of infrastructure has progressed rapidly and a number of land, water and air transport modes exist. However, significant progress must be made to ensure uniform access to all available transport. A major constraint with developing and maintaining rural roads is the fact that they are, unfortunately, rural. The areas where they are needed are often difficult to access, logistics become complicated, local contracting capability is limited, engineers are few and far between, and

younger engineers especially, are not keen to leave the urban environment. Another problem in our rural area is manpower. Most of the peoples are unexperienced. There is no proper sub-station in rural area.

1.3 Objective

The objectives of the study are as follows:

- To assess the role of SRS on socio-economic development in Bangladesh.
- To develop some practical recommendations for improving access to SRS in areas where adequate power supply is constrained.
- Emphasis people for using SRS.
- To know the present condition of SRS in Bangladesh and the opinion of the consumers about it.
- Calculate per unit cost of solar electricity.
- Try to make concern consumers about the usefulness of using SRS system.
- Find out the problems that consumers are facing when they are using SRS.

1.4 Scope of the research

We get various benefit from solar system. Solar energy is obtained from the sun's radiation and it can be converted to electricity or heat. It is freely available and thanks to advances in technology, we can now harness even more of the solar energy that is continuously available to us. Here are 7 benefits related to this renewable source of energy.

Solar energy has the least negative impact on the environment compared to any other energy source. It does not produce greenhouse gases and does not pollute the water. It also requires very little water for its maintenance, unlike nuclear power plants for example, needing 20 times more water. Solar energy production does not create any noise, which is major benefit, since a lot of solar installations are in urban areas.

Generating your own electricity means that you will be using less from the utility supplier. This will immediately translate to savings on your energy bill. Plus, you can also make money by selling the unused electricity, which you have generated, back to the grid. The more energy you produce, the less you will need from the supplier which will increase your energy self-reliance.

Energy needs tend to be higher in the **11:00-16:00** time frame and then early in the evening. Naturally, this is the period when the price of the electricity peaks. Solar energy happens to reach its maximum production capacity during those hours. Electricity produced at that time has higher value than if it was generated at night. With the additional electricity input of solar energy, prices in those time frames could be driven down to a level close to those of night hours.

As long as there is sunshine, solar energy can be deployed anywhere. This is particularly useful for remote regions with no access to any other source of electricity. There is a vast amount of people around the world with no access to electricity. Independent solar systems could be deployed in those regions and improve the lives of millions of people. Moreover, solar energy is also used to power up spacecraft's and boats. Some of the energy, around **3-5%**, is lost during transportation and distribution. The longer the distances between the production and the supply points, the more energy is lost. Those losses might not seem significant but they can influence the performance of the installation in regions with high population density. Having solar panels on the roof or in the yard significantly reduces this distance, therefore increasing the efficiency of the electrical system. The grid is less vulnerable to blackouts if there are many power plants which are spread out. A grid with high penetration of solar energy has thousands of energy production centers which are widely spread out. This improves the security of the grid in case of overload, natural or human-caused disasters. Large part of the cost associated with solar systems comes from the installation of the panels. This contributes to local job creation. Using solar systems boosts the economy and positively affects the local community. [3]

1.5 Thesis Outline

- In chapter one which is introduction where we discuss about the electricity problem in rural area of our country and its solution. We also discuss about the benefits of SRS.

- In chapter two which is literature review where we discuss about various types of energy source.
- In chapter three which is mythology where we discuss about our survey work.
- In chapter four which is result where we discuss about our result which we collect from our survey.
- In chapter five which is conclusion where we discuss about our country electricity generation capacity and some steps to improving our electricity generation which has been taken from our government.

Chapter Two

Literature Review

2.1 Introduction

Solar energy is radiant light and heat from the Sun that is harnessed using a range of ever-evolving technologies such as solar heating, photovoltaic, solar thermal energy, solar architecture, molten salt power plants and artificial photosynthesis.^{[9][10]}

It is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on how they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light-dispersing properties, and designing spaces that naturally circulate air.

The large magnitude of solar energy available makes it a highly appealing source of electricity. The United Nations Development Programmed in its 2000 World Energy Assessment found that the annual potential of solar energy was 1,575–49,837 exajoules (EJ). This is several times larger than the total world energy consumption, which was 559.8 EJ in 2012.^{[4][5]}

2.2 Energy

In our any physical activity in this world, whether carried out by human beings or by nature, is cause due to flow of energy in one form or the other. The word 'energy' itself is derived from the Greek word 'en-ergo', which means 'in-work' or 'work content'. The work output depends on the energy input. Energy is one of the major inputs for the economic development of any country. In the case of the developing countries, the energy sector assumes a critical importance in view of the ever increasing energy needs requiring huge investments to meet them.

Energy can be classified into several types based on the following criteria:

- Primary and Secondary energy
- Commercial and Non commercial energy
- Renewable and Non-Renewable energy
- Conventional and Non-conventional energy

Primary and Secondary energy:

Primary energy sources are those that are either found or stored in nature. So primary energy sources are coal, oil, natural gas, and biomass (such as wood). Other primary energy sources available include nuclear energy from radioactive substances, thermal energy stored in earth's interior, and potential energy due to earth's gravity. Primary energy sources are costly converted in industrial utilities into secondary energy sources; for example coal, oil or gas converted into steam and electricity. Primary energy can also be used directly. Some energy sources have non energy uses, for example coal or natural gas can be used as a feedstock in fertilizer plants.

Commercial and Non commercial Energy

Commercial Energy:

The energy sources that are available in the market for a definite price are known as commercial energy. By far the most important forms of commercial energy are electricity, coal and refined petroleum products. Commercial energy forms the basis of industrial, agricultural, transport and commercial development in the modern world. In the industrialized countries, commercialized fuels are predominant source not only for economic production, but also for many household tasks of general population. Examples: Electricity, lignite, coal, oil, natural gas etc.

Non-Commercial Energy:

The energy sources that are not available in the commercial market for a price are classified as non-commercial energy. Non-commercial energy sources include fuels such as firewood, cattle dung and agricultural wastes, which are traditionally gathered, and not bought at a price used especially in rural households. These are also called traditional fuels. Non-commercial energy is often ignored in energy accounting.

Example: Firewood, agro waste in rural areas; solar energy for water heating, electricity generation, for drying grain, fish and fruits; animal power for transport, threshing, lifting water for irrigation, crushing sugarcane; wind energy for lifting water and electricity generation.

Renewable and Non-Renewable energy

Non-Renewable energy:

A nonrenewable resource is a natural resource that cannot be re-made or re-grown at a scale comparable to its consumption.



Figure 2.1: Non-Renewable Energy

2.3 Renewable Energy:

Renewable energy is energy that is collected from **renewable resources**, which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat.

Conventional and Non-conventional energy

The sources of energy used for mass generation of power called conventional sources. Examples: Thermal, Hydro-power, Nuclear power

The non-conventional sources of energy used for less generation. Examples: Solar energy, Wind power, Tidal power, Biogas, Geo-thermal energy.

Renewable Energy

There are various types of renewable energy such as:-

- Hydro
- Wind
- Biomass
- Solar

Hydro

Hydropower plant from of renewable power plant. Hydropower or water power is power derived from the energy of falling water or fast running water, which may be harnessed for useful purposes. This type of renewable energy use for mass generation of energy. This type power plan required large area. Hydro power plant is expensive to built, but it's operate is very inexpensive. There are three types of hydro hydropower facilities those are impoundment, diversion, and pumped. Some hydro power plants use dams and some do not. Hydro power plant requires various components for generating electricity. Some components of hydro power plant are Dam, Trash Rack, Surge Tank, Penstock, Spillway, Prime Mover and Generator.



Figure 2.2: Hydro power plant

Micro hydro and mini hydro have limited potential in Bangladesh, with the exception of Chittagong and the Chittagong Hill tracts. Hydropower assessments have identified some possible sites from 10 kW to 5 MW but no appreciable capacity has yet been installed. There is one hydro power plant at Kaptai established in the 1960s with present installed capacity of 230 MW.

Wind

Wind Energy is from of solar energy. A wind farm can also located offshore. A wind turbine captures the wind to produce energy. Wind Energy has also made some inroads but its potential is mainly in coastal areas, and offshore islands with strong wind regimes. These coastal settings offer good opportunities for wind-powered pumping and electricity generation. A generator convert mechanical power into electricity. Wind energy doesn't pollute the air like other power plants because in wind power plant fossil fuels doesn't need such like coal, natural gas etc. Like other countries Bangladesh also has wind power plant. Presently there are 2 MW of installed wind turbines at Feni and Kutubdia.



Figure 2.3: Wind power plant

Biomass

Biomass is a direct combustion System. Biomass burned in a combustor to generate hot gas, which is fed into a boiler to generate steam, which expanded by a steam turbine or steam engine to produce mechanical to electricla. Bangladesh has strong potential for biomass gasification based electricity. More common biomass resources available in the country are rice husk, crop residue, wood, jute stick, animal waste, municipal waste, sugarcane bagasse etc. This technology can be disseminated on a larger scale for electricity generation.



Figure 2.4: Biomass power plant

2.4 Solar

History of solar energy:

In recent condition energy cost is uprising so people use many kind of alternative energy source. One of the most energy source is sun. Our country and many country use solar energy for fulfill their energy demand. For those interested, below is a brief history of how solar power came to be. The history of photovoltaic energy launched in 1876. William Grylls Adams along with a student of his, Richard Day, discovered that when selenium was exposed to light, it generated electricity. An electricity expert, Werner von Siemens, stated that the discovery was “scientifically of the most far-reaching importance”. The selenium cells are not efficient, but it was proved that light, without heat or moving parts, could be converted into electricity. In 1953, Calvin Fuller, Gerald Pearson, and Daryl Chapin, discovered the silicon solar cell. This cell generally produced enough electricity and was efficient enough to run small electrical devices. The New York Times says that this discovery was opening new era, leading actually to the realization of harnessing the almost limitless energy of the sun for the uses of civilization.”

In 1956, first solar cell are available in market commercially. But the cost is far from the reach of regular people. At \$300 for a 1 watt solar cell, the expense was far beyond anyone's means. 1956 started showing us the first solar cells used in toys and radios. These items were the first item to have solar cells available to consumers. In the late 1950's and early 1960's satellites in the USA's and Soviet's space program were powered by solar cells and in the late 1960's solar power was basically the standard for powering space bound satellites. In the early 1970's a way to lower to cost of solar cells was first discovered. This brought the price down from \$100 per watt to around \$20 per watt. Most off-shore oil rigs used the solar cells to power the warning lights on the top of the rigs. The period from the 1970's to the 1990's saw quite a change in the usage of solar cells. They began showing up on railroad crossings, in remote places to power homes, Australia recently used solar cells in their microwave towers to expand their telecommunication capabilities. Even desert regions using solar system bring water for the soil where link power fed is not possible. Today we see solar cells in a wide variety of places are available. You may see solar powered cars. Many solar powered aircraft that has flown higher than any other aircraft with the exception of the Blackbird. The cost of solar cells well within everyone's budget, solar power has never looked so tempting. Recently the technology has given us screen printed solar cells, and a solar fabric that can be used to side a house, even solar shingles that install many house roofs. Now International markets have opened up and solar panel manufacturers are now playing a key role in the solar power industry. [6]

2.4.1 World solar status

According to the renewables global status report roughly a fifth of electrical production comes from renewable sources. In 2013 renewable energy accounted for 22% of the global energy mix, up from 21% in 2012 and 18% in 2007. The U.S. set a new renewable energy milestone in March. There are now 1.3 million solar installed across the United States. It is five to eleven times more expensive to produce electricity from the sun than it is from coal, hydro or nuclear resources. First problem is the cost of technology. Solar panels are made by expensive semiconductor material to produce electricity directly from the sunlight. In 2000, the United Nations Development Programme, UN Department of Economic and Social Affairs, and World Energy Council published an estimate of the potential solar energy that could be used by humans each year that

took into account factors such as insolation, cloud cover, and the land that is usable by humans. In addition, land availability is a big effect on the available solar energy because solar panels can only be set up on land that is otherwise unused and suitable for solar panels. Roofs have been found to be a suitable place for solar cells, as many people have discovered that they can collect energy directly from their homes this way. Other areas that are suitable for solar cells are lands that are not being used for businesses where solar plants can be established. Solar energy has a part to play in reducing future carbon emissions and ensuring a sustainable energy future. It can be used for heating, cooling, lighting, electrical power, transportation and even environmental clean-up. Global installed capacity for solar-powered electricity has seen an exponential growth, reaching around 227 GWe at the end of 2015. It generated 1% of all electricity used globally. Germany has led PV capacity installations over last decade and continues as a leader followed by China, Japan, Italy and the United States. Concentrated Solar Power (CSP) remains with very limited capacity at 4 GW today.

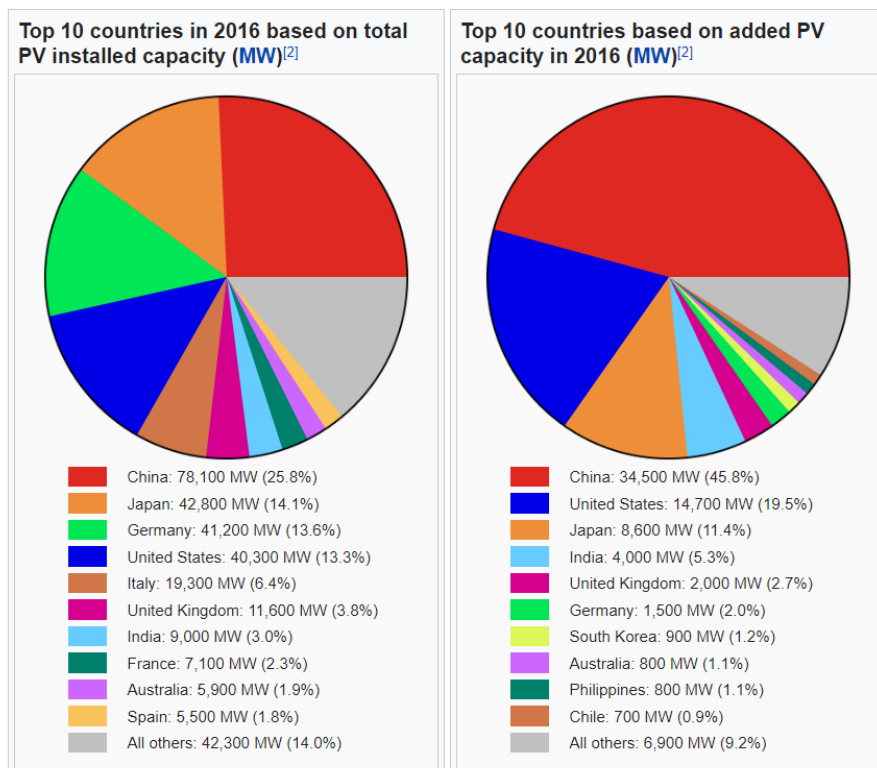


Figure: 2.5: world solar status

2.4.2 Bangladesh solar system

Bangladesh is an over populated developing country, electricity supply in many remote areas of the country are not enough. Bangladesh is one of the most densely populated countries with 79% people living in rural areas. Again the electricity coverage is only 42% at per capita electricity consumption is about 140 kWh which is one of the lowest in the world. So we can say, though we are most densely populated country but maximum of our people do not have the advantages of electricity. For a developing country like Bangladesh it is economically very much thorny to electrify residences through the extension of the distribution grids. So here renewable energy can be an effective solution. The core energy sources of Bangladesh are biomass and natural gas. Over 80% of people depend on conventional energy sources such as firewood, cow dung and agricultural residues for their energy needs. Excessive use of firewood's threatens the remaining forest cover, which is only 10% of the total land area. So solar energy is most environments saving project for us. According to the recent data Bangladesh economy is growing up and poverty rate is falling gradually. If we figure out numerical data that indicates, economy has grown at around 6% or more and poverty has fallen substantially from 45% in 2005 to around 30 by 2010. The general lack of access to electricity imposes limits on the prospects of growth and increased welfare. This lack of electricity is also opposing our process of digitalize the nation. To increase such condition and generation of electricity we can realize the importance of solar home system (SHS). Actually solar home system is basically designed to fulfill demand of electricity to single household. SHS always consist of one or more photovoltaic modules, a battery, a charge regulator, a load consisting of lights and one or more sockets of radio, television or other applications.

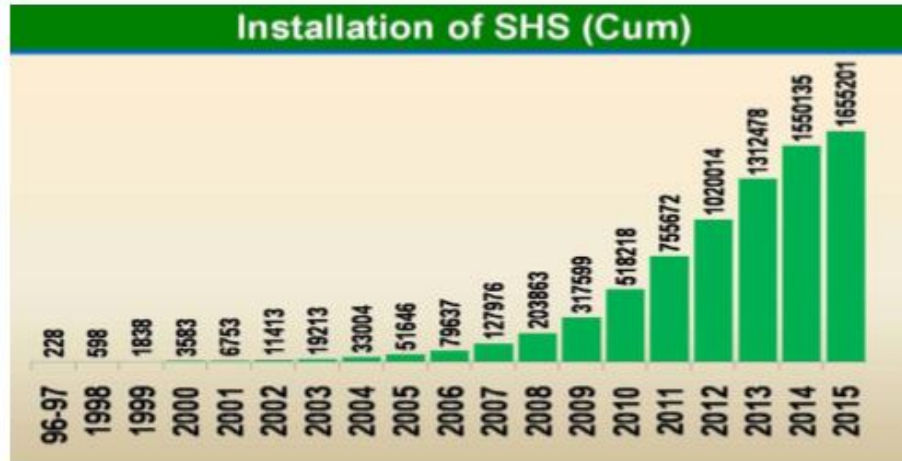


Figure 2.6: SHS installation statistics

Bangladesh has a success story in developing off-grid rooftop solar power known as solar home system (SHS) which has given electricity to a large number of people living in rather remote off-grid areas and who would not have electricity otherwise. More than four million SHS installed domestically have uplifted the lifestyle of these impoverished people by providing small-scale power at their homes. But in the context of national power demand and generation, the contribution of SMS is tiny, a mere 250 megawatt, which is only two percent of the total power generation capacity in the country. In fact, in the solar industry worldwide, large-scale solar power generation essentially means on-grid solar (grid-connected). According to the government plan, renewable sources should provide about 10 percent of the total power generation capacity by 2021, meaning 2400MW power generation from renewable sources. The prospect of wind power (presently total installed capacity is 2MW), bio-energy (present installed capacity 1MW) or new hydro-power have been limited in Bangladesh and therefore, growth of renewable energy in Bangladesh will rely mainly on the development of on-grid solar power.



Figure 2.7: 10kw solar electrification systems at Barkal,Rangamati

As per the government rule, no agricultural land can be used for solar power project. Bangladesh is a densely populated fertile agricultural land and non-agricultural unused land is not easily available. A 100MW solar park for example would require about 300 acres of land. It is expected that the efficiency of the solar panel will increase in future through new technological advances thus requiring lesser area for generating per unit of power. But until that happens, acquiring land will be a major problem for rapid expansion of on-grid solar in Bangladesh. Another drawback in developing on grid solar in Bangladesh is lack of governmental incentive. The companies which are engaged in negotiations and implementation of solar park opine that solar industry in Bangladesh is still in an immature and infant stage and requires incentives.

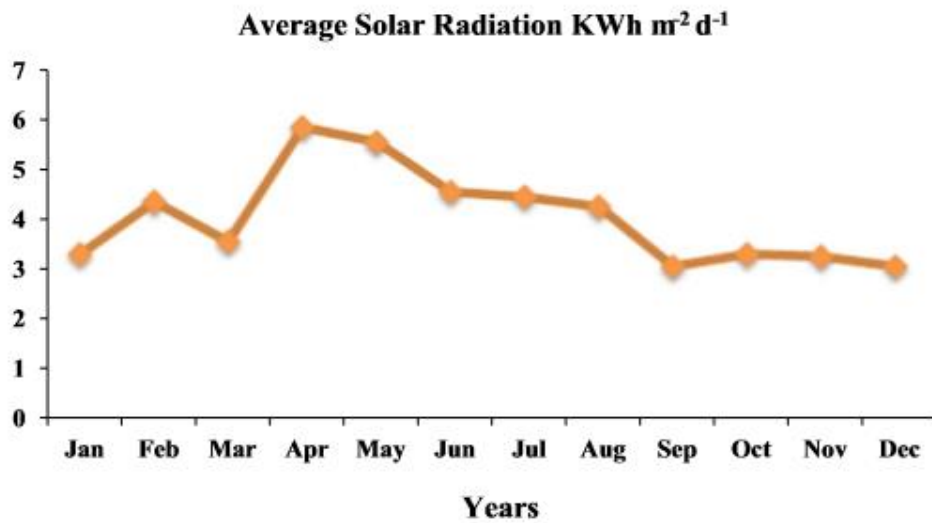


Figure 2.8: Monthly average solar profile in Bangladesh

2.4.3 Technical diagram of solar system

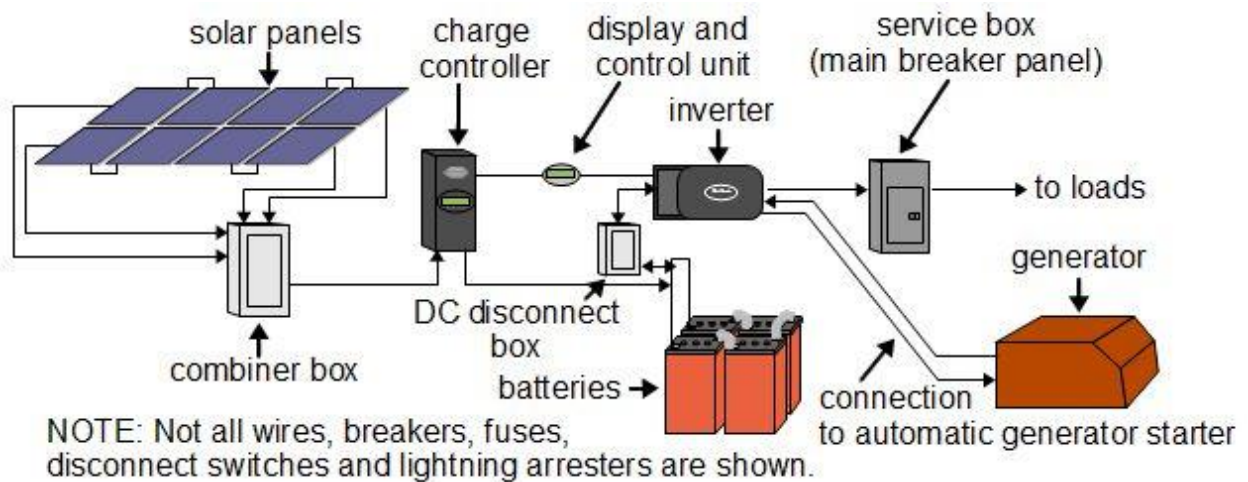


Figure 2.9: Solar technical diagram

2.5 Working principle of solar energy

Solar energy operate to the following steps:-

1. Step 1: Solar panels collect sunlight. Every solar panel contains something called photovoltaic, or PV, cells.
2. Step 2: Inverters convert the solar power to usable electricity. On the back of each solar panel is an inverter.
3. Step 3: Electricity flows into net meter.
4. Step 4: Fire up the toaster.

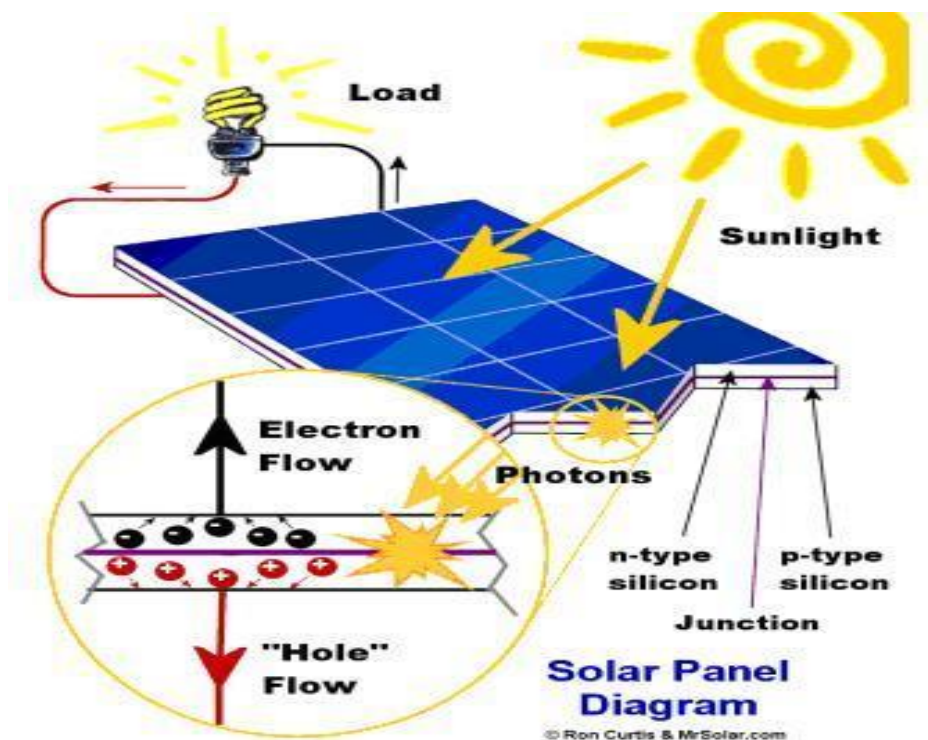


Figure 2.10: Solar panel diagram

Charge controller:

A solar charge controller is fundamentally a voltage or current controller to charge the battery and keep electric cells from overcharging. It directs the voltage and current hailing from the solar panels setting off to the electric cell. A solar regulator is a small box consisting of solid state circuitry that is placed between a solar panel and a battery. Its function is to regulate the amount of charge coming from the panel that flows into the deep cycle battery bank in order to avoid the batteries being overcharge.



Figure 2.11: Solar charge controller

Solar inverter:

A solar inverter or PV inverter, is a type of electrical converter which converts the variable direct current (DC) output of a photovoltaic (PV) solar panel into a utility frequency alternating current (AC) that can be fed into a commercial electrical grid or used by a local, off-grid electrical network.



Figure 2.12: Solar inverter

Solar battery:

The characteristics of battery is it store electricity and supply electricity to the system. Solar batteries work by converting the DC energy being produced by your solar panels and storing it as AC power for later use. When you install a solar battery as part of your solar panel system, you are able to store excess solar electricity at your home instead of sending it back to the grid. Battery quantity depends on the solar panel if the system panels are large then need big quantity of battery for that system.



Figure 2.13: solar Battery

So, we can easily say that the operation of solar system is very simple and we can easily generate power. During generate energy solar system does not produce smoke or ashes so it is not pollute our environment and it beneficiary and economical.

Conclusion:

The share of world energy consumption for electricity generation by source was coal at 40.8%, natural gas at 21.6%, nuclear at 10.6%, hydro at 16.4%, other sources (solar, wind, geothermal, biomass, etc.) at 6.3% and oil at 4.3%. Coal and natural gas were the most used energy fuels for generating electricity. Natural gas and electricity are the most-consumed energy sources in BD homes, followed by heating oil, and propane. Natural gas and heating oil (fuel oil) are used mainly for home/space heating. Space heating accounts for the largest share of the energy used in BD homes. 80 percent of the world's energy comes from fossil fuels. Fossil fuels, such as brown coal, are finite and therefore they are unsustainable resources. A new analysis by Bloomberg New Energy Finance says that 50 percent of the world's energy will come from solar and wind by 2050. In 2015, wind and solar made up only 7 percent of global electricity generation. There are several possible sources including geothermal, solar, wind, hydroelectricity and biomass. Biomass has the biggest contribution with 50%, followed by hydroelectricity at 26% and wind power at 18%. Geothermal energy is generated by harnessing the Earth's natural heat.

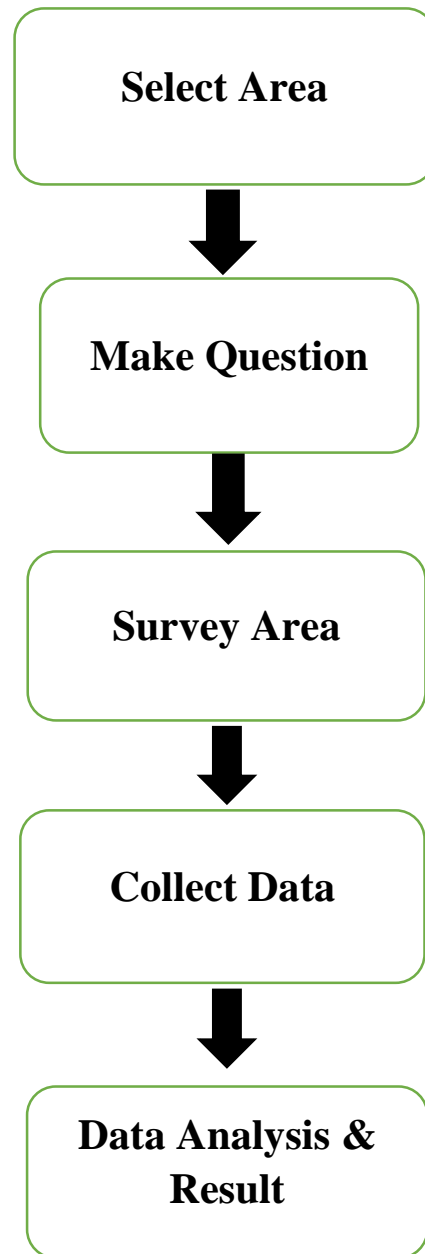
Chapter Three

Methodology

3.1 Introduction

For create about solar profile index firstly we select an area for survey then we select those building has solar panel. We create all list of consumer and create a question pattern for asking question to the consumer. We ask various question and collect their various comments about solar panel. This audit was meant to analysis the socio-economic effects of star roof system and realize the answers regarding what do the users accept its appropriateness. This study is applied to the business and industrial areas of Asian country. Because the survey at first supported social analysis, some qualitative and quantitative method approaches area unit applied. At first the overall info regarding the impacts of star electricity and its effectiveness area unit Collected through an intensive unit survey technique victimization type. Primary data of the survey is truly collected from the users of star roof system. A scientific try was thrown to search out the opinions regarding the appropriateness of the system and therefore the method folk's area unit taking the service. Opinions area unit taken by the house owners or the users of this technique. The survey type is meant as gift and before SHS installation to measure role of SHS in socio-economic development of geographical region.

3.2 Flow Chart:



3.3 Site selection

The survey is especially coated in one amongst the busiest cities of the country, Narayonganj relating to a twenty four kilometers far-off from Dhaka. Regarding forty fields relating to industries and buildings are occasionally visited for the analysis of the thesis.

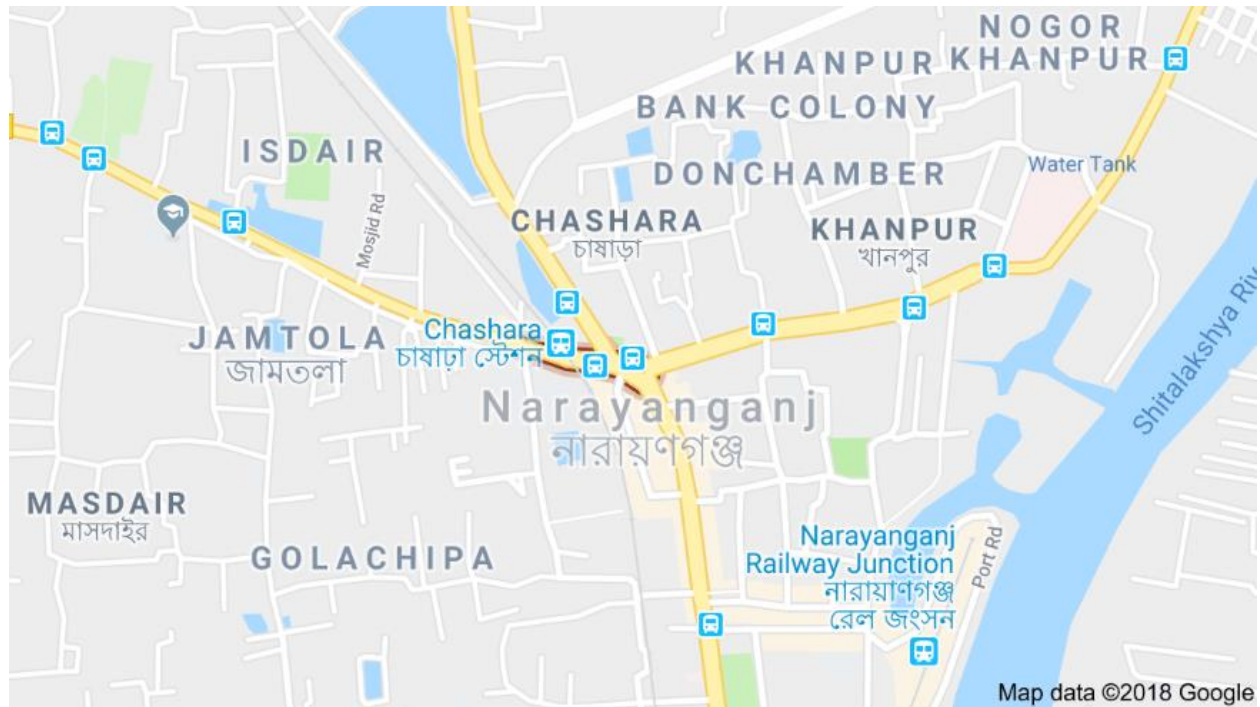


Figure 3.1 : Survey area Chsara, Narayanganj

These fields are circulated below the help of DPDC. Some areas relating to New chasara, Allama Iqbal Road, north chasara, Chandpura Adarsha Chasara, Nag road ar given for the survey. Quite forty SRS-owned home information are collected from the areas. Survey places are haphazardly chosen as there are plenty of SRS-owned buildings and industries. For secondary sources of data journal, reports, operative paper and documents regarding

Solar energy is consulted. Moreover, personal experiences and informal interview technique are also used to have some plenty of information regarding the matter. The standard length of interviews was regarding twenty minutes and it's found that the interviewed unit members showed terribly keen interest to the survey activity. The queries are asked in Bengali for well understanding and it had been taken as straightforward because it is feasible as nobody gets hesitated.

3.4 Table of content:

Serial No.	Indicators	Questions	Comment
01	Consumer Information	<ul style="list-style-type: none"> • Name • Address • Contact number • zone 	Here we are trying to collect consumer details.
02	Cost analysis	<ul style="list-style-type: none"> • Installment cost • Repairing cost • Per unit cost 	We asked about his whole SRS cost.
03	Maintenance	<ul style="list-style-type: none"> • Do you ever clean your SRS? • Do you get any training for SRS operation? • Do you test regular basis? 	How to consumer maintenance their SRS?
04	Installation of Information	<ul style="list-style-type: none"> • Why do you install this SRS? • From where you bought SRS? • Is your SRS in operation? 	We asked why you interested to install SRS?
05	Consumer Satisfaction	<ul style="list-style-type: none"> • Do you think it is waste of money? • Do you want to increase the capacity of your SRS? 	We collect various comment about SRS.

Chapter Four

RESULT

4.1 Introduction:

We survey many areas of Narayanganj district and collect many data from consumer. We audit chasara, killarpol, Bk road, fatulla and collect various comment of consumer. We saw some solar panel are active and most of the solar panel are inactive because of improper maintenance. Maximum solar panel are on grid and some of are off grid. In this chapter we plot various analyzed data by graphically.

4.2 Customer Information

Area:

We survey chasara, killarpol, Bk road, fatulla. we collect most of data from chasara because it is central point of narayanganj and here many commercial building and market and bk road has many flower mills. killarpol and fatulla are housing societies.

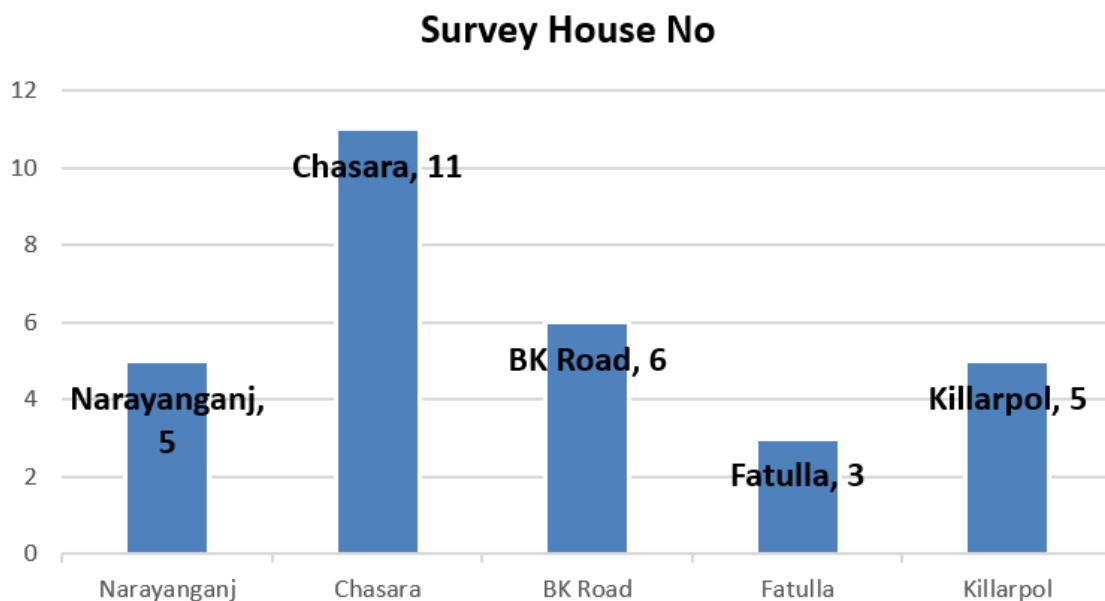


Figure 4.1: Area and Survey House

4.3 Cost Analysis

Installment Cost

After complete our survey we recognize this point that big amount of installment cost need in industrial sector then domestic sector and others. Some consumers installment cost are given below which collect from our survey at narayanganj and jhigatola :-

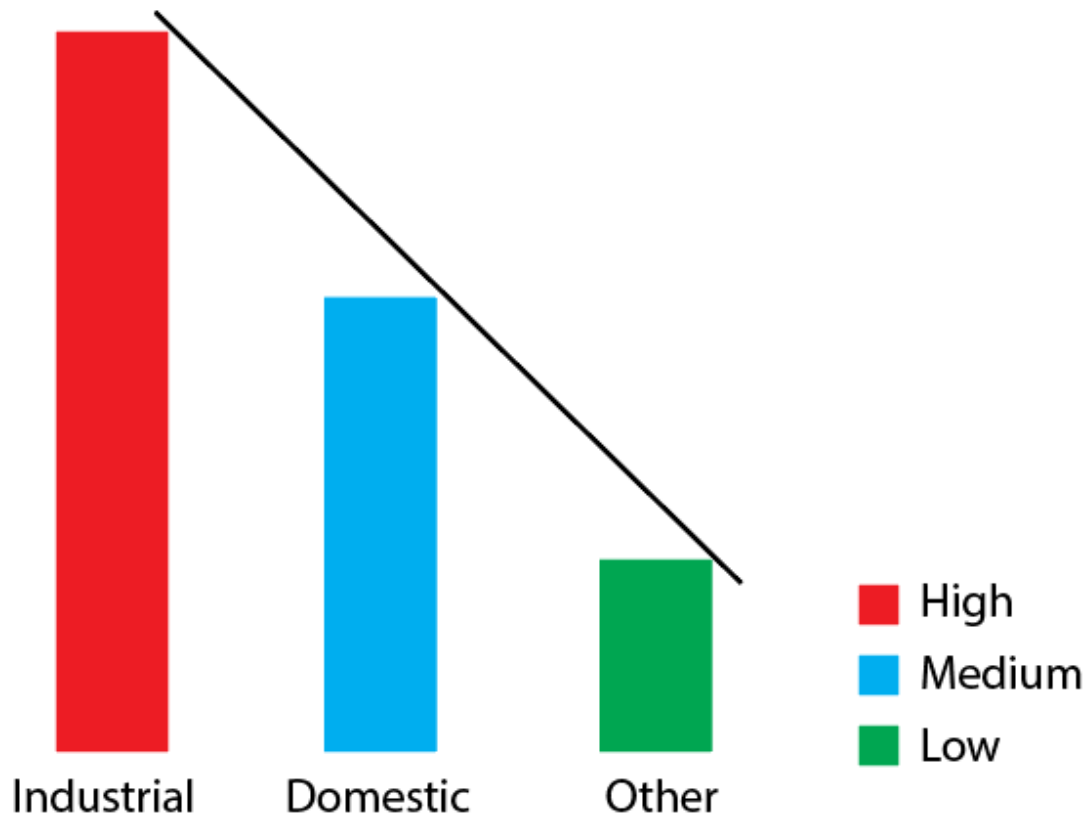


Figure 4.2: Installment cost of various consume

4.4 Maintenance of SRS

SRS Cleaning

Solar panels are typically self-cleaning, however in notably dry areas or wherever panel tilt is smallest, mud and different substances like bird ordure will build up over time and impact on the quantity electricity generated by a module. Grime and bird poop does not must cowl a whole panel to own a control. However in our survey we saw maximum consumer clean their solar panel regularly but they do not have proper concept how to clean solar panel and what need to do for getting high generation of electricity.

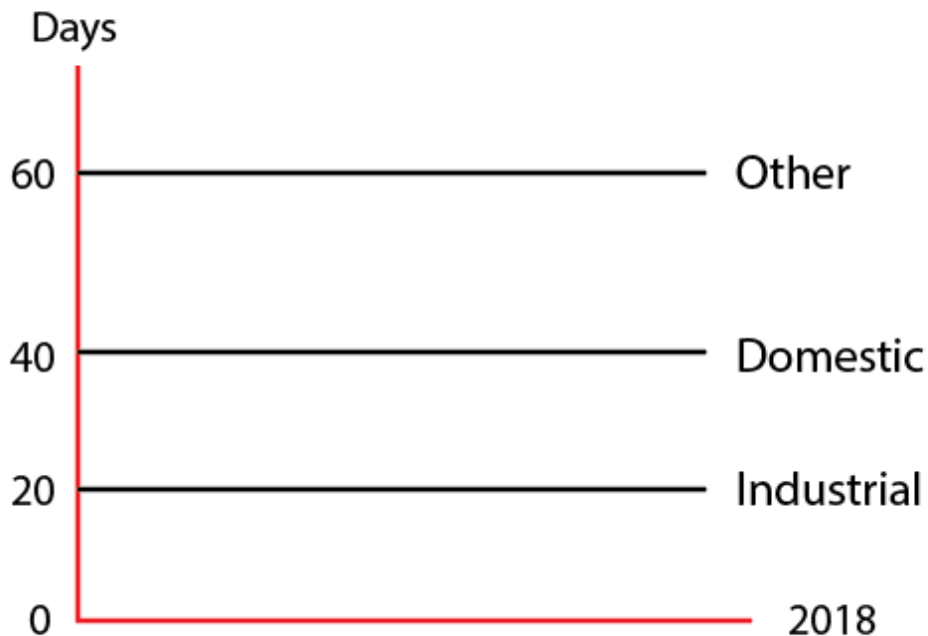


Figure: 4.3 : SRS Cleaning time some sector

SRS Training:

Almost all consumers are not take training from any NGO or organization. Because they are think this is priceless. 99% consumers are untrained which is showing in figure below:-



Figure 4.4: SRS training

4.5 Installation Information

SRS Grid Connection:

Almost 98% consumers solar connection are on grid and only 2% connection are off grid. Consumers connect their solar panels for their personal uses because they get low amount of electricity from their solar system.

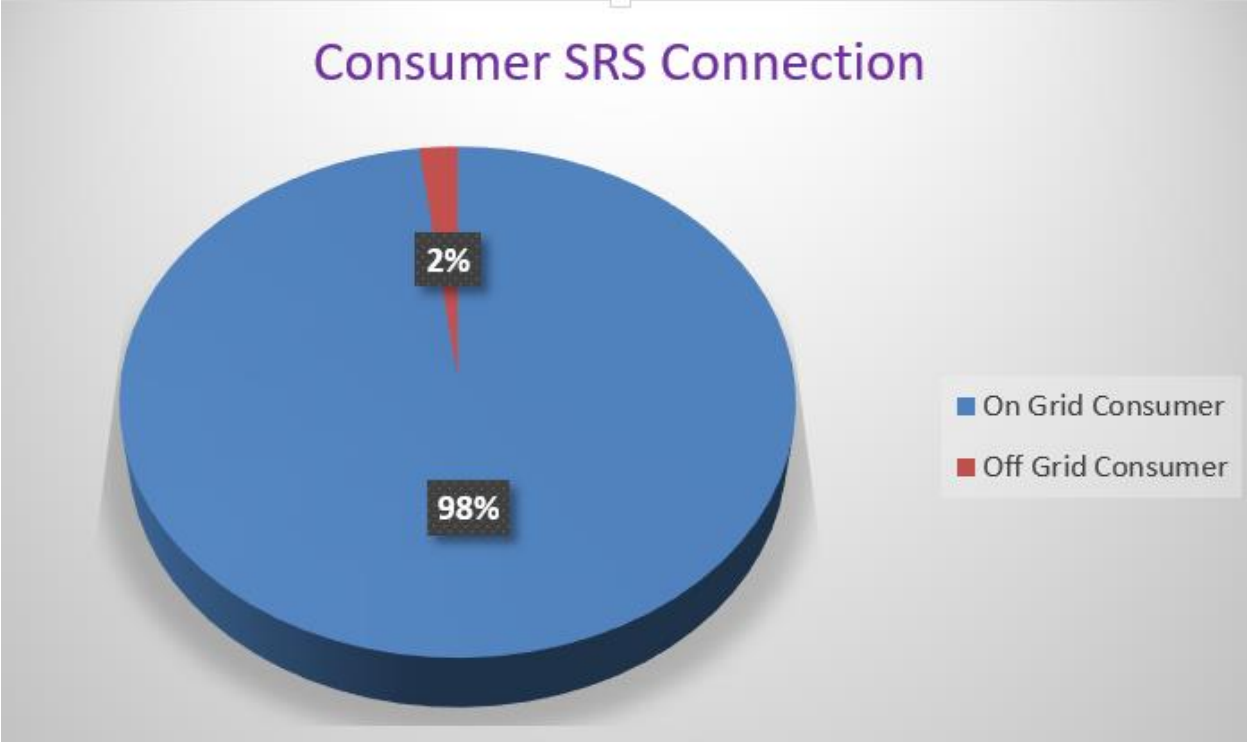


Figure 4.5 Grid Connection

Panel Condition:

In our survey we noticed that average 50% panel are in good condition and 35% panel are damage after installment because of improper maintenance and some are damaged by storm and natural disaster and 25% panel are fully deactivate. The main reasons for this problems are they don't clean their solar panel regularly and don't maintenance.

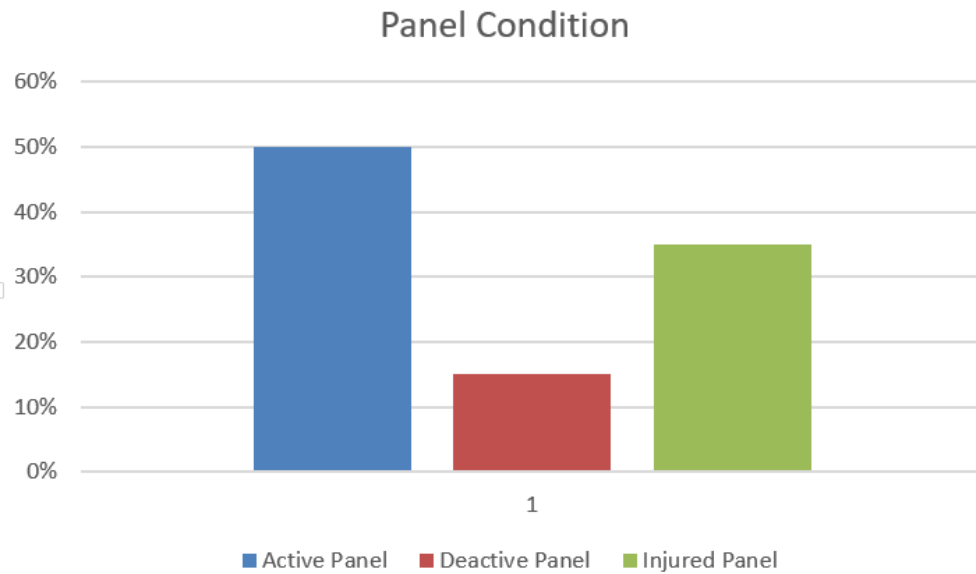


Figure 4.6: Panel Condition

SRS Instrument Arrangement

We saw in our survey most of the consumer bought their solar panel in different market place someone bought from DPDC, DESCO and government organization. It is noted that maximum peoples bought their instrument from market. Which is cleared by following figure:-

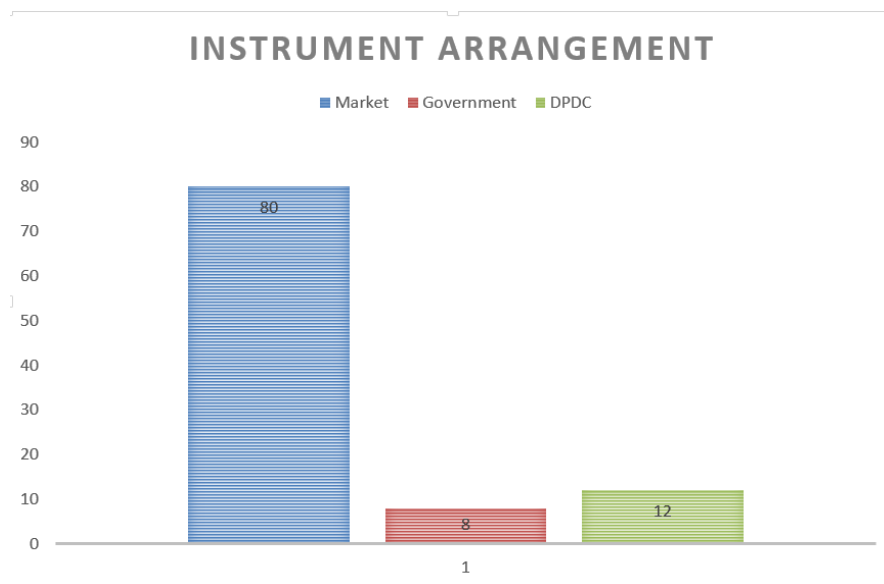


Figure 4.7: SRS instrument Arrangement

4.6 Customer Satisfaction

Percentage of customer satiation

Here is cleared that 90% consumers are not satisfied because of they think this system is costly. They do not get proper training about SRS from government sector and private sector also they do not get their expectation electricity from this system. That's why they are not satisfied.



Figure 4.8: Customer Satisfaction

Waste of Money

Low economical star panels are a waste of cash. The reason is that residents can have star on their roof in future years and cannot solely be able to generate electricity however additionally to charge the battery system for his or her home electricity consumption at midnight, and to get electricity for his or her electric cars.

waste of money

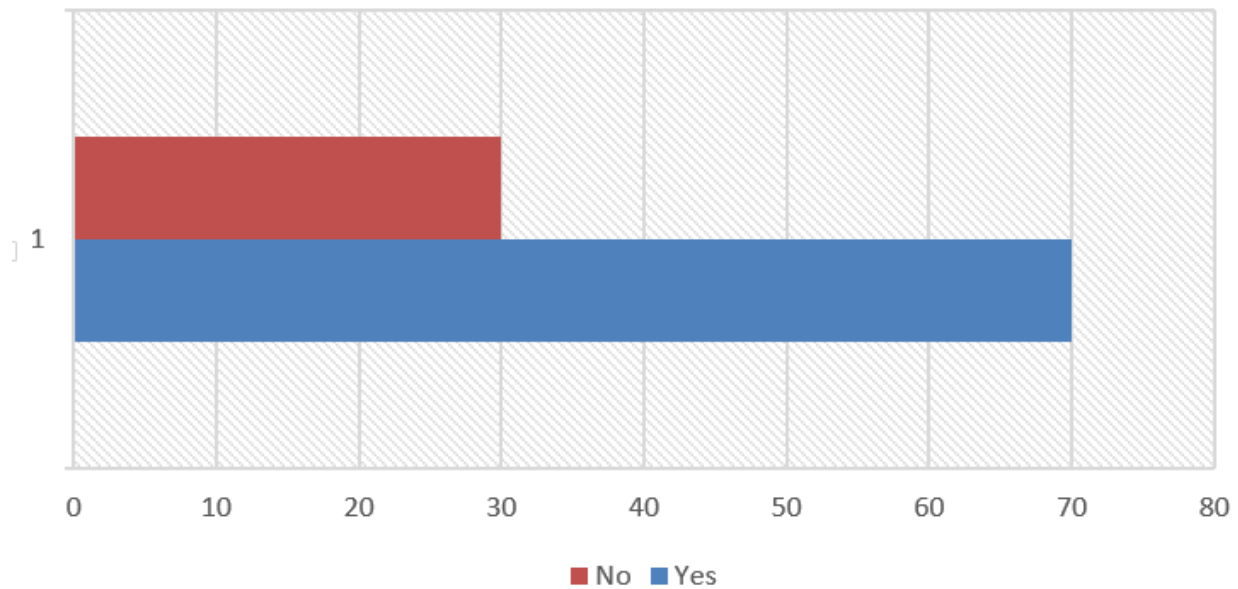


Figure 4.9: Waste of money

Increasing Capacity Yes/No:

In present condition solar system instrument are not reasonable price in our country and its maintenance cost is high for that reasons consumers won't to increase their capacity. The another reason is that for large amount of electricity need to install big size panel but it's costly so that they won't increase capacity.

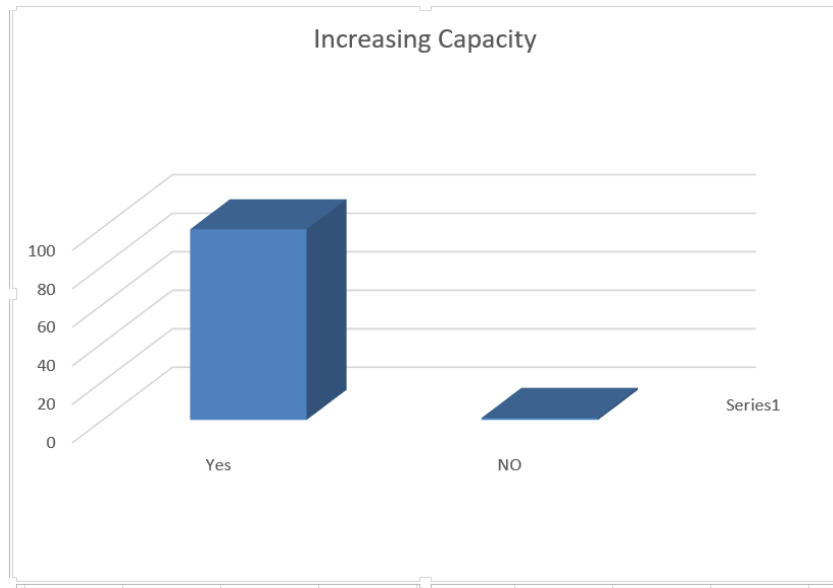


Figure 4.10: Increasing Capacity

SRS Useful:

While in use, solar panels produce completely no waste or emissions. Not like fuel power plants, they manufacture clean, renewable energy from a fuel supply that needs no locating, excavation, transportation, or combustion. This system is without risky and easier also good for our environment.

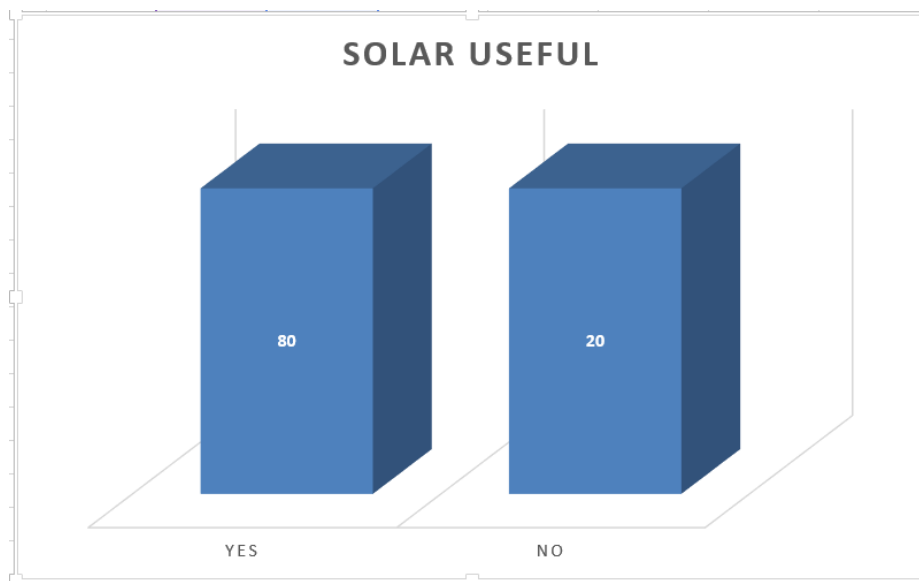


Figure 4.11: SRS useful

4.7 Cost Calculation:

Here showing a cost calculation for 500 watt solar capacity panel.

Date of installation 1st January 2018

Installation cost 100,000

Capacity- 500 watt

Total life time 15 years

Date of reading -20th November

Total produced in 11 month= 2.46kwh

So, produced in 11 month= 2.46kwh

Then after 1 month produced= $2.46/11$

So, after 12 month produced= $(2.46*12)/11 = 2.6836\text{kwh}$

Now we can say after 15 years will produce 40.245kwh

Per unit cost= 2484.78TK

4.8 Result Finding

- After finished our survey by the direction of supervisor and analyzing our result we noted some specific points. Those point are below:-
- Most of the consumer are not concern about the SRS because they are not used to it .So we need to counsel consumer before provide the SRS.
- Consumers has lack of knowledge how to clean it and maintenance it.
- So all provider should trained the consumer so that they clean and maintenance it properly.
- Majority of consumer do not know about the net metering system so government should inform the consumer about those system how to get profit by net metering system.
- Almost 98% consumer think that SRS system is waste of money, they do not get much energy from SRS but its initial cost is very high. And most of the consumer says that they set up this SRS by government forced, and they also said the instrument of SRS are costly and unavailable so provider or Government should reduce the market price of instrument for the SRS system.
- From above analysis it can be roughly estimated the data in the respective areas.

To find out actual data we need time series data. Further studies are required in this line for better understanding of SRS in various area of Bangladesh.

Chapter Five

Conclusion

This paper discusses totally concerning star roof system with its quality and significance to the trendy society. Because the technology itself is growing days once days, person is obtaining accustomed this and victimization all of it for the betterment of future. The benefits and downsides, varied limitations of star upside system are mentioned here. Among all the benefits of star panels, the foremost necessary issue is that alternative energy may well be truly renewable energy offer. It typically controlled in all areas of the world and is on the market daily. We've got an inclination to run out of alternative energy, in distinction to variety of opposite sources of energy. Alternative energy goes to be accessible as long as we have got the sun.

Since you will be meeting variety of your energy needs with the electricity your system has generated, your energy bills will drop. What proportion you save on your bill goes to be captivated with the scale of the system and your electricity or heat usage. Moreover, not entirely are you able to be saving on the electricity bill, but if you generate further electricity than you use, the surplus ar progressing to be exported back to the grid and you may receive bonus payments for that amount (considering that your device system is connected to the grid). Savings can any grow if you sell excess electricity at high rates throughout the day then acquire electricity from the grid throughout the evening once the rates unit of measurement lower. To justify the statistics of the appropriateness of any project, gathering the people's thought is that the best thanks to do the duty. At the tip of the time, public demand matters. Star upside system is that the easiest method to scale back the waste of electricity. During this study and survey amount, this was the initial basis to analysis whether or not the users of the system are taking it at intervals a positive approach or not. Within the analysis, it's found that majority of individuals don't apprehend either the importance or the quality of the star upside system. Being a developing country, the govt. ought to clearly agonize to the present system concerning however the system will be developed to the trendy society. Some steps are to be taken as individual's gets question and are available to understand concerning the system. If this happens orderly, individuals will certainly be influenced to extend

the capability of the system. The amount of energy we tend to receive from the sun is enormous. At the outer atmosphere of the world we tend to receive regarding 1300 watts value of power per hour per meter a day. Around half-hour of this power is reflected back that still leads to a staggering four.2 Kilowatt-hours of energy per meter day by day. Thus it can be safely aforementioned that every cent are collects the approximate energy equivalent of just about a barrel of oil annually. The quantity of alternative energy reaching the surface of the world is therefore immense that in one year it is regarding doubly the maximum amount as can ever be obtained from all of the Earth's non-renewable resources of coal, oil, natural gas, and metallic element combined. Most of the generated power in Asian nation comes from coal, diesel and gas driven power stations. However the reserve of such natural resources (natural gas) square measure being depleted at Associate in Nursing appalling rate, with current estimates showing that it'll last a number of decades some at the present consumption rate. This together with the actual fact that over seventieth of Asian nation lies outside the national grid ought to be of grave concern. Even then the square measures that are inside the grid have inconsistent and sometimes unreliable power supply. The country includes a total demand of 7000 MW per day in response to that solely 4500~4600 MW can be created, despite having the potential of producing 6700MW per day. This is often principally as a result of the out-of-date and drained instrumentality within the countries eighty one stations. Bangladesh may be a semi-tropical region lying in northeastern a part of South Asia gets extensive sunlight year spherical. The common bright sunshine duration in Asian nation within the dry season is concerning seven.6 hours each day, which within the monsoon season is concerning four.7 hours. The best sunlight hours received is in Khulna with readings ranging from two.86 to 9.04hours and in Barisal with readings starting from two.65 to 8.75 hours. These are very good statistics when put next to the eight hours of day light in Spain which produced 4 GW of energy covering 2.7% of national demand by the end of 2010. Moreover Germany produces 18 GW of energy which is 2% of their national demand with only half the solar radiation received by Bangladesh. Thus solar Power could be used in Bangladesh if possible not as a direct generation scheme but in conjunction with technology has experienced a revival in its use lately with countries around the world using it as basis to build new power plants. This technology uses lenses or mirrors and tracking systems to focus a large area of sunlight onto a small area. The concentrated sunlight is focused onto either high efficiency photovoltaic chips or onto a heat transfer medium as in a conventional thermal

power plant. The steam produced is in turn used to rotate a turbine coupled to an electric power generator. CSP systems work best at about 5.5KWH/square meter/day. Currently the cost of generating power using CSP technology is around 15 to 23 BDT per watt. Concentrating technology exists mainly in four forms, each having different levels of efficiency due to the differences in the way they track and focus sunlight. Some of them even offer storage facilities since normal operation at night time is not possible.

Finally, we can say that people of our country should be aware of the use of solar energy and also should be aware of the benefits of solar energy so that everyone is interested in using solar energy.

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