

# **PERFORMANCE ON SOLAR ROOFTOP SYSTEM UNDER DPDC**

**A Project and Thesis submitted in partial fulfillment of the requirements for the Award of  
Degree of Bachelor of Science in Electrical and Electronic Engineering.**

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## Certification

This is to certify that this project and thesis entitled "performance on solar rooftop system under DPDC" is done by the following students under my direct supervision and this work has been carried out by them in the laboratories of the Department of Electrical and Electronic Engineering under the Faculty of Engineering of Daffodil International University in partial fulfillment of the requirements for the degree of Bachelor of Science in Electrical and Electronic Engineering. The presentation of the work was held on December 2018.

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# ABSTRACT

This research is an attempt to find out the appropriateness of Solar Rooftop system (SRS). 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 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 25 solar rooftop systems formed in Fatullah, killarpool, Chashara, Nitaigonj 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.

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**Dedicated to**

**Our parents**

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## LIST OF ABBREVIATIONS

SRS:	SOLAR ROOFTOP SYSTEM.
DPDC:	DHAKA POWER DISTRIBUTION COMPANY.
UNFCC:	UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE.
CDM:	CLEAN DEVELOPMENT MECHANISM.
MW:	MEGA WATT.
CSP:	CONCENTRATING SOLAR THERMAL PLANTS.
GHG:	GREEN-HOUSE GAS.
GW:	GIGA-WATT.
REB:	RURAL ELECTRIFICATION BOARD
BPDP:	BANGLADESH POWER DEVELOPMENT BOARD.
PV:	PHOTOVOLTAIC.
KWH:	KILOWATT HOUR.
DC:	DIRECT CURRENT.
USA:	UNITED STATES OF AMERICA.
LGED:	LOCAL GOVERNMENT ENGINEERING DIRECTORATE.
SPV:	SOLAR PHOTOVOLTAIC.
STC:	STANDARD TESTING CONDITION.
BDT:	BANGLADESH TAKA.
WP:	WATT POWER.
VMP:	VOLTS AT MOST POWER.



# CHAPTER 1

## INTRODUCTION

### 1.1 INTRODUCTION

Energy is one of the most compliant rudimental ingredients necessary to reduce penuriousness and to set up the economic development of a country. Fossil fuel, sunlight, air, dehydrogenase monoxide Source, and nuclear power plant are the origin of energy unique the world. The major energy source is still the fossil fuel but detain is declining. Fossil fuel is being used though it cast down greenhouse gases for ecumenism warming which is a threat to climate change and sustainable progress. In this situation, sustainable and tightly closed energy is a major anxiety for the universal. Under this situation, there is an alteration ongoing in the energy sector. It is transpiring due to the downfall in fossil fuel presence, diminishing of ecumenical escape for mitigating climate change and energy safety. Under the transmuted aspects renewable energy especially solar energy is extending for it foremost in availing to ecumenical climate change and carbon trading expectation. United Nations Framework Convention on Climate Change (UNFCCC) has taken implantation for Clean Development Mechanism (CDM). In this thesis, solar energy is becoming a comprehensive source of energy throughout the world. To meet the growing market for power in the industries, carrying and household utilizes many exhibited countries are already utilizing solar energy as renewable sources. This is not the only assembly the additional sizably large portion of energy demand but adscitiously giving complying socio-economic benefit and support to sustain an unsullied environment. Bangladesh is a deeply populated warm country which has no wide supply of energy. At present around 62 percent (including renewable energy) of the demography has entrance to electricity;

The per capita energy consumption is only 321 KWh per annum (Website: Power Division, GOB).Residual 38 percent of the demography dependent on costly kerosene and natural sources. Bangladesh is yet immensely centralized to its capital city. Many locations outside the capital do not get advantageous attention. Impoverished people cannot deliver to have electricity for their circadian deeds. Many faraway islands and highlands are not attached to national grid lines.

While expanding the national grid in those isolated regions are very uncontrolled and are not cost-efficient, solar energy could be an effective choice to perfect the electricity vital in these off-grid areas.

After using the Solar home system in the rural site, now for more generating electricity using renewable energy (solar power) recently in the urban areas using Solar Rooftop System (SRS) is growing expeditious for solar electricity, although it has a high initial cost. As a developing country, Bangladesh and its people are bearing from power and electricity deficit. But the geographical condition and propitious climate conditions provide extraordinary scope to utilize solar power for virtually every aspect of our rural, urban, semi-urban subsistence of the Bangladeshi population.

## **1.2 STATEMENT OF THE PROBLEM**

Electricity emergency is the intense question in Bangladesh now. Our key well-spring of electricity production is the natural gas which is the deficit and is going to give-out. Some power stations are fire pit limited and some others are oil dependent. This kind of power stations is more costly and they are not atmospherically neighborly. They produce greenhouse gas which perishes the Ozone layer and causes global warming. There are some power stations which conduct by renewable energy source, namely Hydroelectric power Scheme, Tidal power Scheme, Windmill, Nuclear reactor, and Solar Cell. Hydroelectric power plan imperious a large field Au store Ovate. They are expensive to build and they are not granted d in all time. This power station has low efficiency. Tidal power plan also needs a large field to store water. This kind of plan building cost is very high and they are not granted in all time because its output relay on the tides comes in or goes out. This power station has low efficiency. Windmill power scheme also needs a large field to build and their primary building cost is very high. Their output relay on the wind flow which is not fixed in all time, i.e. they are not granted in all time. This power station has low efficiency.

The nuclear power station is very capable but their primary building cost is very high and their fuel is not available in Bangladesh. The fuel of this power station has to import from outdoors.

The most regarding of this power station is the security. That's way, before building this power station we have to confirm 100% security because if a calamity happens, its effect subsists for a long time. Radioactive dust is very injurious to the human being and also for other animals.

Solar Cells are inexpensive to establish. Bangladesh is a county where 13 hours Sunlight is gain able within 24 hours. They are environment-neighborly because they do not produce any injurious gas. The most usual solar cells are silicon solar panel. Some personal 9 institutions establish solar cells in various districts in Bangladesh which are working well. Silicon Solar cells are costly. Recently a few countries, namely Switzerland, Netherlands, New Zealand, U.S.A. etc. discovered Polymer solar cells which are more capable and inexpensive. Different kinds of researches are going on about Polymer solar Cells in In Bangladesh. Fibers are obtainable in Bangladesh. So, it is easy to produce Polymer Solar cell. In Silicon, the cost per unit electricity generation is close to 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 generation sources might be reduced but Sunlight never recedes. Thus ID if we can establish Polymer Solar Cells in ubiquitously in Bangladesh, we will get rid of the electricity disaster in all esteem. As electricity can be used to produce additional source of energy, i.e. electrical energy can be renewed into any other form, so we can eliminate our energy calamity problem and we can grow our country in all respects.

### **1.3 OBJECTIVES OF THE RESEARCH**

The main objectives of this project (Fieldwork) are how the performance of the solar rooftop system under DPDC and the situation is going; we observed the present situation of this SRS system (off-grid or on-grid) from home to home and collected the exact data information from the consumers.

- To trace the role of Solar Rooftop system (SRS) and meant to the peoples about the advantages of SRS.
- Already has the solar rooftop system (SRS) on that rooftop but they are not using it. Need to tell them, about all the advantages of Solar Rooftop system (SRS).

- To play an important role as a partner with DPDC in the Solar Roofs Initiative and earn extra money for generating more energy from solar power.
- Any training in installation, operation, and maintenance for manage this whole system.
- To use the present systems as demonstration units for visitors from a community, industry groups, and clients of solar energy products suppliers and installers.
- How much electricity they are generating from solar and meant them for increasing the capacity.

## 1.4 SCOPE OF THE RESEARCH

Bangladesh has a sizably massive dissatisfied demand for energy. The country generally expertise uncontrollable demand-supply gap of electricity, especially during summer. The energy gap is one of the most astronomically unquantifiable bottlenecks for economic magnification in Bangladesh. By some calculation, the People's Republic of Bangladesh economic magnification may are around octavo had it not been embarrassed by energy shortage. To keep up and prosperous economic magnification, the rule of the People's Republic of Bangladesh is actively dedicated to energy crisis administration.

The national energy policy includes a clear goal of providing the entire country with electricity by 2021. The People's Republic of Bangladesh accepted renewable energy policy-2008, that crave having a minimum of fifth power from renewable sources within the energy mingle by 2015 & tenth by 2020. Till now, the national capability of renewable energy predicated power is sort of ninety Mega Watt (MW) and it principally grows from solar power.

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capability of renewable energy predicated power is sort of ninety Mega Watt (MW) and it in the main grows from alternative energy.

## **1.5 OUTLINE OF THE STUDY**

Following the introduction the second chapter of this report will focus on review of selected literature and conceptual overview of solar rooftop system (SRS) . In third chapter, it will discuss the methodology of the research. The fourth chapter is analysis of the data, results and discussions. The fifth chapter is conclusions and recommendations and of this report.

# CHAPTER 2

## LITERATURE REVIEW

### 2.1 INTRODUCTION

An upside electrical phenomenon power plant, or upside PV system, could be an electrical phenomenon system that has its electricity-generating solar panels mounted on the upside of a residential or business building or structure. The output of solar PV systems (solar panels and inverter) produces power proportional to the power of coming back from the sun. This energy is instantly reborn into electricity that may be employed in the house or business. Solar energy could be a smart different to interchange fuel because the major energy supply as a result of alternative energy is renewable at fully no price to produce energy infinitely. Solar panels are ready to harness the energy from the sun and convert it into electricity. Therefore, the employment of solar panels is environment-friendly. Help the surroundings and facilitate the USA all. Alternative energy systems derive clean, pure energy from the sun. Putting in solar panels on your home helps combat gas emissions and reduces our collective dependence on fuel. Ancient electricity is sourced from fossil fuels like coal and gas. The potential environmental impacts related to alternative energy land use and surroundings loss, water use, and therefore the use of unsafe materials in producing will vary greatly looking on the technology, which incorporates 2 broad categories: electrical phenomenon (PV) solar cells or concentrating solar thermal plants (CSP). Solar energy creates clean, renewable power from the sun and advantages the setting. Alternatives to fossil fuels cut back carbon footprint reception and abroad, reducing greenhouse gases around the globe. Most of the electricity generated within the U.S. comes from fossil fuels like coal and fossil fuel.

## **2.2 DEFINITION OF ENERGY**

In physics, energy is that the quantitative property that has got to be transferred to Associate in the Nursing object to perform work on, or to heat, the object. Energy may be a preserved quantity; the law of conservation of energy states that energy is often regenerate in kind, however not created or destroyed.

## **2.3 CLASSIFICATION OF ENERGY**

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

1. Primary and Secondary energy
2. Commercial and Non-commercial energy
3. Renewable and Non-Renewable energy
- 4.

### **2.3.1 PRIMARY ENERGY**

Primary energy sources are people who are either found or keep in nature. Common primary energy sources are coal, oil, fossil fuel, and biomass

Example: wood, cued oil natural gas, coal, nuclear fuel etc.

### **2.3.2 SECONDARY ENERGY**

Secondary energy refers to a lot of typical kinds of energy that are transferred from different primary energy sources through the energy conversion method. Example: steam, coke, electricity

### **2.3.3 COMMERCIAL ENERGY**

The energy sources that are accessible within the marketplace for an explicit value are referred to as commercial energy. Far and away the foremost necessary varieties of industrial energy are electricity, coal, and refined crude oil merchandise. Industrial energy forms the premise of industrial, agricultural, transport and industrial development within the fashionable world.

Within the industrialized countries, commercial fuels are a predominant supply not just for economic production however additionally for several chores of the overall population. Examples: Electricity, lignite, coal, oil, fossil fuel etc.

### **2.3.4 NON-COMMERCIAL ENERGY**

The energy sources that aren't accessible within the industrial marketplace for a value are classified as non-commercial energy. Non-commercial energy sources embody fuels such as fuel, keen dung, and agricultural wastes that are historically gathered, and not bought at a value used particularly in rural households. These are also referred to as ancient fuels. Non-commercial energy is commonly neglected in energy accounting. Example: fuel, Argo waste in rural areas; alternative 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.

### **2.3.5 RENEWABLE ENERGY**

Renewable resources are natural resources that can be replenished in a short period of time. Example: Solar, Hydro, Biogas, Wind, water, Alcohol, Hydrogen, Air, Soil, wood

### **2.3.6 NON-RENEWABLE**

A non-renewable resource is a natural resource that cannot be remade or regrown at a scale comparable to its consumption. Example: Fossil fuel (Coal, petroleum, gas-coal, Natural gas), Nuclear energy.

## **2.4 RENEWABLE ENERGY SOURCES**

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. Renewable energy often provides energy in four important areas: electricity generation, air and water heating/cooling, transportation, and rural (off-grid) energy services.

Based on REN21's 2017 report, renewables contributed 19.3% to humans' global energy consumption and 24.5% to their generation of electricity in 2015 and 2016, respectively. This energy consumption is divided as 8.9% coming from traditional biomass, 4.2% as heat energy (modern biomass, geothermal and solar heat), 3.9% hydroelectricity and 2.2% is electricity from wind, solar, geothermal, and biomass. Worldwide investments in renewable technologies amounted to more than US\$286 billion in 2015, with countries such as China and the United States heavily investing in wind, hydro, solar and biofuels. Globally, there are an estimated 7.7 million jobs associated with the renewable energy industries, with solar photovoltaic being the largest renewable employer. As of 2015 worldwide, more than half of all new electricity capacity installed was renewable.

Renewable energy resources exist over wide geographical areas, in contrast to other energy sources, which are concentrated in a limited number of countries. Rapid deployment of renewable energy and energy efficiency is resulting in significant energy security, climate change mitigation, and economic benefits. The results of a recent review of the literature concluded that as greenhouse gas (GHG) emitters begin to be held liable for damages resulting from GHG emissions resulting in climate change, a high value for liability mitigation would provide powerful incentives for deployment of renewable energy technologies. In international public opinion surveys, there is strong support for promoting renewable sources such as solar power and wind power. At the national level, at least 30 nations around the world already have renewable energy contributing more than 20 percent of energy supply. National renewable energy markets are projected to continue to grow strongly in the coming decade and beyond. Some places and at least two countries, Iceland and Norway generate all their electricity using renewable energy already, and many other countries have the set a goal to reach 100% renewable energy in the future. For example, in Denmark, the government decided to switch the total energy supply (electricity, mobility and heating/cooling) to 100% renewable energy by 2050.

While many renewable energy projects are large-scale, renewable technologies are also suited to rural and remote areas and developing countries, where energy is often crucial in human development. Former United Nations Secretary-General Ban Ki-moon has said that renewable energy has the ability to lift the poorest nations to new levels of prosperity. As most of the renewables provide electricity, renewable energy deployment is often applied in conjunction

with further electrification, which has several benefits: Electricity can be converted to heat (where necessary generating higher temperatures than fossil fuels), can be converted into mechanical energy with high efficiency and is clean at the point of consumption.

In addition to that electrification with renewable energy is much more efficient and therefore leads to a significant reduction in primary energy requirements; because most renewables don't have a steam cycle with high losses (fossil power plants usually have losses of 40 to 65%). Renewable energy systems are rapidly becoming more efficient and cheaper. Their share of total energy consumption is increasing. Growth in consumption of coal and oil could end by 2020 due to increased uptake of renewables and natural gas. [1]

## **2.5 TYPES OF RENEWABLE ENERGY**

### **1. Hydro-Energy**

Hydro-Energy Water is vital natural resources. All living organisms want water to measure. Humans want water for several functions like drinking, cleaning, and cookery and for growing crops. Water flowing into the watercourse or water hold on during a dam is sources of hydro energy. The straightforward methodology to use hydro energy is to convert it into the current.



Figure 2.5.1: Hydro-energy system

## 2. Wind energy

Wind energy Winds are perpetually being created in nature. The windmill could be a supply of current. These windmills are typically established solely at places wherever most of the times during a year expertise robust winds. The energy from this wind is employed for grinding grain, pumping water and to supply electricity. In India, several windmills are founded in several places like province, geographic area, Rajasthan, Kerala, West Bengal, and Gujarat.



Figure 2.5.2: Wind energy system

## 3. Biogas

Biogas could be a variety of fuel that could be a mixture of gases like methane series, dioxide, element etc. that is obtained by decomposition of animal and plant wastes like animal dung, with

the assistance of micro-organisms within the presence of water. It's used as fuel in kitchen range particularly in rural areas.

#### 4. Solar power

Solar power Sun could be a massive supply of energy. The energy that we tend to get from the Sun is named solar power.



Figure 2.5: Solar energy system

The entire phenomenon just like the flowing of wind, water cycle, chemical action etc. is potential solely thanks to solar power. Now a day, solar power is getting used to cooking food with the assistance of solar cookers, heat water, lightweight streets, and pump water for irrigating fields etc.

## 2.6 TECHNICAL BACKGROUND OF SRS

A top PV system or top electrical phenomenon power plant could be an electrical phenomenon technique that has its electricity-producing solar panels upon on the top of a housing or mercantile building or structure. Solar Energy is that the energy from the Sun. It's usually known as 'alternative energy' to fuel and has been utilized by humans for thousands of years. The



photovoltaic/solar module (Figure-2.10) converts the daylight into electricity. It usually contains a capability of between twenty to 100WP. The battery stores the electrical energy for utilization in the dead of night or throughout cloudy weather. In several countries, low-cost automotive batteries are used for this purpose, though they're technically not like-minded for PV applications. The charge controller could be a device that manages the electrical flow through the system and protects the battery from harm. It alerts the user as shortly because the battery desires a charge or once the module isn't operating properly. Wires and connected switches distribute the electricity inside the system and to the load like lights or electric appliances.

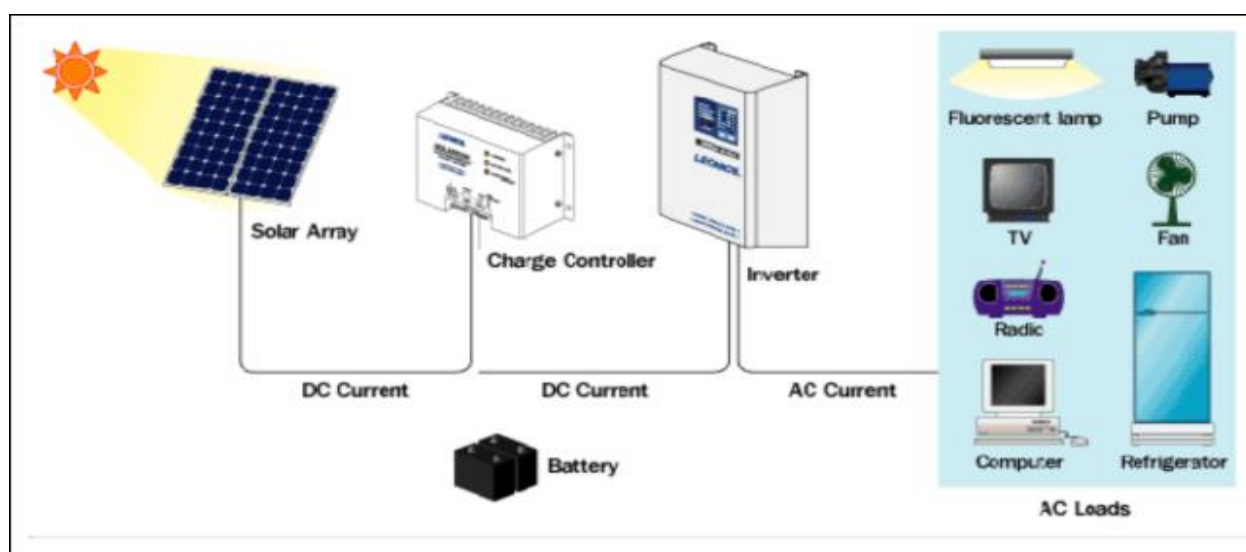


Figure 2.10: Solar panel and its applications

## 2.6.1 SOLAR BATTERY

Solar batteries are accustomed to store alternative energy (solar electricity). Solar array discharge power as and once required. Rechargeable solar batteries are employed in off-grid PV systems to store excess electricity. Some solar array banks use wet cells, whereas others use sealed or gel cell batteries. NiMH batteries are most well-liked and most typical once it involves alternative energy as a result of there are higher than commonplace storage battery batteries in terms of charging and unharness cycles. Some solar array banks use wet cells, whereas others use sealed or gel cell batteries. Each of those batteries features a totally different temperature, mounting, and ventilation necessities. It's to be noted that each solar array is intended for a particular form



Figure: Solar Battery

of charge and discharge cycle. For example, automobile solar batteries have skinny plates to stay their charge and are designed for a significant discharge lasting some seconds, followed by a protracted amount of slow re-charge. On the opposite hand, Golf cart solar batteries have terribly thick plates designed for many hours of serious discharge daily, followed by a quick recharge in mere some hours nightly.

A 6-volt golf cart battery is that the least pricey and best to seek out a solar array. If you're attending to install a solar array, please be noted that a solar array should be ready to offer long periods of deep discharge each evening and night. Discharge ought to be followed by a full recharge in mere some hours of daylight each afternoon. Not all solar batteries will take a deep discharge-recharge cycle daily. The battery bank gets the required voltage to individual inverters.

## 2.6.2 SOLAR CHARGE CONTROLLER

A solar charge controller manages the ability going into the battery bank from the solar panel. It ensures that the deep cycle batteries aren't overcharged throughout the day which the ability doesn't run back to the solar panels long and drain the batteries.



Figure: Solar Charge Controller.

Some charge controllers are obtainable with extra capabilities, like lighting and cargo management; however, managing the ability is its primary job. A solar charge controller is offered in 2 completely different technologies, PWM and MPPT. However, they perform in a very system is incredibly completely different from one another. Associate in Nursing MPPT charge controller is dearer than a PWM charge controller, and it's typically worthwhile to pay the additional cash.

### ● PWM SOLAR CHARGE CONTROLLER A PWM

Solar charge controller stands for “Pulse breadth Modulation”. These operate by creating an affiliation directly from the solar panel to the battery bank. Throughout bulk charging, once there's never-ending affiliation from the array to the battery bank, the array output voltage is

'pulled down' to the battery voltage. Because the battery charges, the voltage of the battery rises, that the voltage output of the solar battery rises further, mistreatment additional of the solar energy because it charges. As a result, you wish to create certain you match the nominal voltage of the solar panel with the voltage of the battery bank. \*Note that once we see a 15V solar battery, which means a panel that's designed to figure with a 15V battery.

The particular voltage of a 15V solar battery, once connected to a load, is near eighteen  $V_{mp}$  (Volts at most power). This can be as a result of the next voltage supply is needed to charge a battery. If the battery and solar battery each started at the identical voltage, the battery wouldn't charge. A 15V solar battery will charge a 15V battery. A 30V solar battery or solar panel (two 15V panels wired in series) is required for a 30V battery bank, and also the 60V array is required for a 60V bank. If you are attempting to charge a 15V battery with a 30V solar battery, you'll be throwing over half the panel's power away. If you are attempting to charge a 30V battery bank with a 15V solar battery, you'll be abandonment a thousandth of the panel's potential, and should truly drain the battery further.

## ● MPPT SOLAR CHARGE CONTROLLER

An MPPT star charge controller stands for "Maximum wall plug Tracking". It'll live the  $V_{mp}$  voltage of the panel and down-converts the PV voltage to the battery voltage. As a result of power into the charge, controller equals power out of the charge controller once the voltage is born to match the battery bank, the present is raised, thus your mistreatment additional of the obtainable power from the panel. You'll use the next voltage solar panel than the battery, just like the sixty cell nominal 20V grid-tie star panels that are additional pronto obtainable. With a 20V solar battery, you'll charge a 12V battery bank, or 2 serial will trouble to a 24V battery bank, and 3 serial will trouble to a 48V battery bank. This release an entire big selection of star panels that currently will be used for your off-grid system.

### 2.6.3 SOLAR INVERTER

A star electrical converter or PV electrical converter could be a style of converter that converts the variable DC (DC) output of an electrical phenomenon (PV) electrical device into utility

frequency electricity (AC) which will be fed into a billboard electrical grid or employed by an area, off-grid electrical network.



Figure: Solar Inverter.

It's an essential balance of system (BOS)–component in an exceedingly electrical phenomenon system, permitting the employment of standard AC-powered instrumentation. Alternative energy inverters have special functions tailored to be used with electrical phenomenon arrays, as well as most electric outlet pursuit and anti-islanding protection.

### ● CLASSIFICATION

Simplified schematics of grid-connected residential electrical phenomenon installation solar inverters could also be classified into 3 broad types:

### ● STAND-ALONE INVERTERS:

Employed in isolated systems wherever the electrical converter attracts its DC energy from batteries charged by electrical phenomenon arrays. Several complete inverters conjointly incorporate integral battery chargers to make full the battery from Associate in Nursing AC

supply, once accessible. Usually, these don't interface in any approach with the utility grid, and in and of it, aren't needed to possess anti-islanding protection.

- **GRID-TIE INVERTERS:**

That matches part with a utility-supplied undulation. Grid-tie inverters are designed to pack up mechanically upon loss of utility providers, for safety reasons. they are doing not give backup power throughout utility outages. Battery backup inverters are special inverters that are designed to draw energy from a battery, manage the battery charge via Associate in Nursing aboard charger, and export excess energy to the utility grid. These inverters are capable of provision AC energy to choose hundreds throughout a utility outage and are needed to possess anti-islanding protection.

## **2.7 ELECTRICITY SECTOR IN BANGLADESH**

The utility electricity sector in Bangladesh has one national grid with an installed capacity of 16,048 MW as of July 2018. Bangladesh's energy sector is booming. Recently Bangladesh commenced construction of the 2.4-gigawatt (GW) Rooppur Nuclear Power Plant expected to go into operation in 2023. According to the Bangladesh Power Development Board in July 2018, 90 percent people have access to the electricity but still the per capita energy consumption in Bangladesh is considered low. Electricity is the major source of puissance for most of the country's economic activities.

Bangladesh's total installed electricity generation capacity (including captive power) was 15,351 megawatts (MW) as of January 2017. As 2015, 92% urban population and 67% rural population have the access to the electricity for their source of light. Averages of 77.9% of the population have the access to electricity in Bangladesh. Bangladesh will require an estimated 34,000 MW of potency by 2030 to sustain its economic magnification of over 7 percent. Quandaries in Bangladesh's electric power sector include high system losses, delays in completion of incipient plants, low plant efficiency, erratic power supply, electricity larceny, blackouts, and shortages of funds for power plant maintenance. Overall, the country's generation plants have been unable to meet system demand over the past decade. On 2 November 2014, electricity was recuperated after a day-long nationwide blackout. A transmission line from India had failed, which "led to a

cascade of failures throughout the national power grid," and reprehension of "old grid infrastructure and poor management. "However, in a recent root-cause analysis report the investing team has demystified that fault was authentically due to a lack in electricity management and poor transmission and distribution health infrastructure that caused the blackout. [2]

## 2.8 RECENT STATUS OF SOLAR ENERGY IN BANGLADESH

Table I: Implementation of solar energy:

Grameen Shakti	One of the largest and fastest growing rural based renewable energy companies in the world; Installed about 250,000 SHSs
LGED	Demonstrates diversified applications of renewable energy technologies and contributes in capacity building; Installed 600 SHSs.
REB	Installed 806 SHSs in 1996-97 two riverine islands, generating 62 kWp powers; Installed about 12,000 SHSs in remote rural areas.
BPDP	Implemented projects of wind, solar and small hydro at remote locations where grid electricity could not be reached; Installed solar household system of total 54 kWp in off grid rural area.

## 2.9 USE OF SOLAR PV IN BANGLADESH

Solar PV installation rates in Bangladesh are increasing rapidly. By July 2009, 25 MW of solar PV had been installed in the forms of Solar Home Systems, Centralized (AC) Systems, Centralized (AC) market electrification and roof top PV mini-grid system to pump water, for railway signaling, to power refrigerators, etc. Much of this is being driven by investment through donor agencies or international aid agencies.

The current aim is that by 2012 one million households will be powered form solar PV panel, producing 50 MW of power. However, the World Bank notes that the market for SHS may become saturated before the 1 million targets is reached due to their relative upfront expense, and the risk that consumer confidence in the technology may fall as current SHS equipment wears

out, and requires greater maintenance. Typically systems are sold in the range of 20-150 Wp and are coupled with an energy storage system consisting of batteries.

Prices range from 15k to 79k Taka respectively. Main players are the Infrastructure Development Company Ltd which had installed more than 400,000 systems by October 2009, Grameen Shakti which had installed more than 283,000 systems by October 2009 and Bangladesh Rural Advancement Committee. Grameen Shakti aims to install more than 1 million systems by 2015, and a further 1 million biogas plants, and 10 million improved cooking stoves. Manufacturers typically provide the peak power of their solar panels which is calculated under Standard Testing Conditions (STC) which is equivalent to 1000 W/m<sup>2</sup> at 25°C and is primarily a function of the efficiency of the solar cells.[3]

TABLE II: PROJECTION FOR FUTURE ENERGY DEMAND, ECONOMIC & POPULATION GROWTH

Year	KWh	Population Millions	Total energy /TWh	Electricity Demand /TWh (GW)	Present Electricity	S/capita
Yearly growth	6%	0.56%	6.6%	10%	n/a	6%
2010	2150	160	344	28 (32 GW)	8.1%	\$600
2020	3850	169	651	73 (83 GW)	11.1%	\$1075
2030	6895	179	1234	188 (21.5 GW)	15.3%	\$1924
2040	12349	189	2336	489 (56 GW)	20.9%	\$3446
2050	22114	200	4424	1267 (145 GW)	28.6%	\$6171

For calculations of solar resource arbitrary efficiencies of 10% are normally assumed. The global supply chain in Solar-PV is far larger than in Bangladesh. With installation rates in 2008 of 5.6 GW and an annual growth rate approaching 40%, as shown in table-III By 2030 the installation rate would have reached almost 1 GWp a year, which is highly plausible considering the European Photovoltaic Industry Association predict that the solar-PV supply chain is expected to deliver and sustain production to support a market between 80 GW and 160 GW a



year worldwide by 2030. Bangladesh would therefore represent approximately 1% of the global market under this scenario.

TABLE III. THE STATUS OF SOLAR-PV IN THE WORLD

Year	Installed capacity (GWp)	Annual growth rate	Installation rate (GWp)
2004	3.8	38%	1.1
2005	5.2	34%	1.3
2006	6.8	31%	1.6
2007	9.2	35%	2.4
2008	14.7	61%	5.6

More than 500 potential consumers have been trained on the operation and maintenance of the entire PV system. This was conducted by BCAS and CMES experts. AEC initiated solar PV program (SPV) in 1985. The systems installed over the period 1985-1994 are 9790 watt peak. Most of the systems are not functional at present because of the lack of fund for spare parts, maintenance and back-up service.[3]

TABLE IV: PROGRESS OF SOLAR PV INSTALLATION

System type	No. Of units supplied	Watt Peak
I	Nil	Nil
Ii	233	Charging Station
Iii	27	Charging Station
Iv	113	5198
V	115	10588
Total of Household systems	188	
Charging station	3	29440
Health clinic	1	828
		46054

## **2.10 THE SOLAR ROOFTOP SYSTEM**

The shift toward clean, reliable, cheap electricity within the USA is most visible within the speedy proliferation of solar panels mounted on the roofs of homes and businesses. Between 2008 and 2014, residential, commercial, and institutional upper side solar grew a mean of quite fifty p.c p.a. Solar is, to a good extent, Associate in Nursing civil rights for renewable energy, with adequate sunshine across the state to create solar a lovely choice in each state.

A well-sited five-kilowatt solar (photovoltaic, or PV) system will generate the equivalent of the common fraction to three-quarters of a typical household's electricity use. Individuals and businesses are attracted not simply to the environmental edges of solar energy, however additionally to the power to come up with their own power and to the fastened and competitive value of electricity that these systems offer. Workers putting in upper side solar panels Rooftop solar are progressively cost-efficient for owners, business homeowners, and their communities. Reductions in technology costs, innovative funding, and growing networks of solar installers and monetary partners all helped drive down the costs for unit systems within

Us by 45% from 2010 to 2014. In addition, a federal solar investment decrease returns 30% of that terms, and state and native tax credits, rebates, and alternative support in leading states will then cut the whole value even more. Dropping costs are thanks to economies of scale and technological advances. The falling value of upper side PV systems results from enhancements within the technology and economies of scale among makers. International solar battery production (for upper side and alternative markets) exaggerated from 24,000 megawatts (MW) in 2010 to 40,000 MW in 2014. PV prices within them are plagued by international market conditions, together with the emergence of lower-priced solar merchandise from China. PV costs within the USA have additionally benefited from reductions in "soft" prices, like those associated with sales, permitting, inspection, affiliation to the electricity grid, and therefore the profit margins of shops and installers. These reductions are due partly to larger volumes and concentrations of system installations additionally as native agencies streamlining allowing processes and a few community-led efforts to pool native home-owner demand for the solar.



Figure 2.8: Rooftop Solar System

The solar upside is solar panels placed on prime of roofs of business, institutional or residential buildings. This setup is additionally referred to as a solar upside electrical phenomenon system. It produces a clean; Eco-friendly style of energy, which means that it's that doesn't manufacture any variety of pollution or harmful gases.

## **2.11 ROOFTOP SOLAR SYSTEM CONNECTED TO GRID**

It has 3 initial technologies by those solar energies are unremarkable harnessed: photovoltaic (PV), that in real time convert light-weight to electricity; concentrating alternative energy (CSP), that conduct heat from the thermal energy (sun) to drive utility-scale, electrical turbines; and heating with cooling systems, that gather.

The grid associate electrical converter converts the DC electricity adult by the solar panels connected into 240V AC electricity, which may then be utilized by the property/household. If a grid is part of the system is generating a lot of (power) that is being delayed, the superfluity is fed into the center grid.

In grid-connected top or tiny SPV system, the DC power generated from SPV panel is reborn to AC power victimization power acquisition unit and is fed to the grid either of 33kilovolt/11 KV three section lines or of 440V/220V three/single section line betting on the native technical and legal necessities.

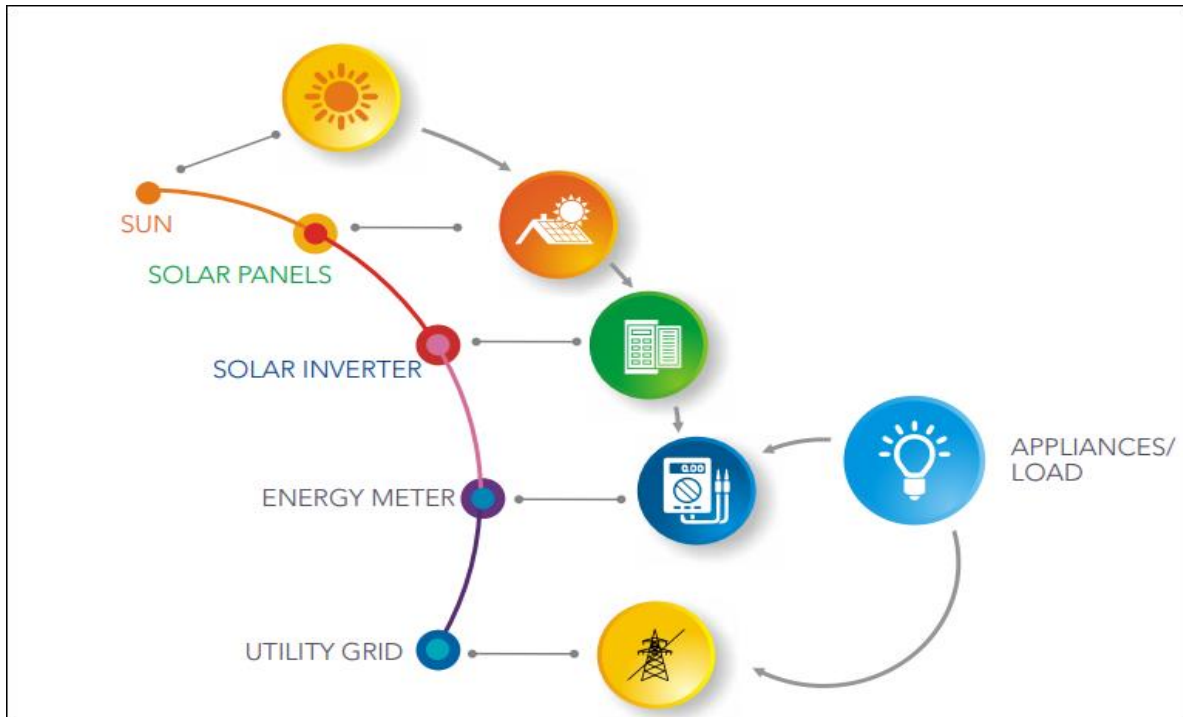


Figure 2.9.1: RSS Connected to grid

These systems generate power throughout the daytime that is used by powering captive hundreds and feed excess power to the grid. In case, once power generated isn't sufficient, the captive hundreds are served by attraction from the grid.

The conception of top solar relies on the actual magnitude of a PV plant instead of the actual fact of whether or not it's placed on a roof/terrace or not. Hence, the definition of RTS additionally includes tiny solar plant on the bottom.

In grid-connected upside or tiny SPV system, the DC power generated from SPV panel is reborn to AC power victimization power acquisition unit and is fed to the grid either of 33 kV/11 kV three-part lines or of 440V/220V three/single part line betting on the native technical and legal needs. These systems generate power throughout the daytime that is used by

powering captive masses and feed excess power to the grid. In case, once power generated isn't decent, the captive masses are served by attractiveness from the grid. The conception of upside star relies on the dimensions of the PV plant instead of the very fact of whether or not it's located on a roof/terrace or not. Hence, the definition of RTS additionally includes tiny star plant on the bottom.

## **2.12 ADVANTAGES OF ROOFTOP SOLAR SYSTEM**

1. The rooftop solar may be a nice step toward combatting temperature change.
2. Solar panels contribute to the “green economy”
3. Solar power is improbably economical.
4. It may be put in quickly.
5. Solar energy needs marginal maintenance.
6. Solar panels to have zero emissions.

So what are the benefits of topside solar panels vs. ground-mounted panels? whereas everyone has professionals and cons, the advantages of topside solar energy are laborious to ignore.

### **● HOMEOWNERS GET PLEASURE FROM TOP SIDE SOLAR PANELS.**

As one of the foremost reasonable varieties of solar product on the market, it's not stunning that top side panels diagrammatic over seventy-two % of all power superimposed within us in 2013. The systems are verified to reinforce a property's inexperienced credentials and residential resiliency. Solar panels will even add thousands of greenbacks to a home's selling price.

### **● ADDITIONAL TOP SIDE SOLAR ADVANTAGES INCLUDE:**

Infinitely Renewable – The sun can continuously be there to produce the U.S.A. with light; so, you wish to not worry regarding this supply of unpolluted and free energy being lost.

Represent Quality of Life – you'll set a decent example with solar systems as a result of they enhance property price and demonstrate environmental consciousness.

Work year-round – once positioned at the correct angle, panels can add the sun, rain, wind, and snow.

Operate all told Areas – there's an idea that homes should be set within the south to use top side panels; they're verified to figure in each state.

### ● HOW MUCH WOULD TOP SIDE SOLAR PROFIT YOUR HOME

The biggest advantage of topside solar — or ground-mounted solar, for that matter — is lower electrical bills. Whether you pay 5000 TK per month, 8000 TK per month, or quite 12000 TK per month, your invoice is lower with solar power on your top side. You'll see savings within the 1st month, and your solar panels can pay for themselves in 5-7 years through lower utility bills.

## 2.13 DISADVANTAGES OF SOLAR ROOFTOP SYSTEM

### 1. HIGH INITIAL COST

The initial value of buying a scheme is fairly high. Though the united kingdom government has introduced some schemes for encouraging the adoption of renewable energy sources, for instance, the Feed-in Tariff, you continue to must cowl the direct prices. This includes paying for solar panels, inverter, batteries, wiring, and for the installation. Yet, solar technologies are perpetually developing, thus it's safe to assume that costs can go down within the future.

### 2. NEED TO DEPEND ON THE WEATHER

Although alternative energy will still be collected throughout cloudy and rainy days, the potency of the scheme drops. Solar panels are addicted to daylight to effectively gather alternative energy. Therefore, some cloudy, rainy days will have a lucid impact on the energy system. You ought to conjointly take into consideration that alternative energy cannot be collected throughout the night. On the opposite hand, if you furthermore may need your water heating resolution to figure at the hours of darkness or throughout the time of year, physics panels are another to think about.

### **3. ALTERNATIVE ENERGY STORAGE IS COSTLY**

Solar energy needs to be used immediately, or it may be holding on in massive batteries. These batteries, utilized in off-the-grid solar systems, may be charged throughout the day in order that the energy is employed at the hours of darkness. This is often an honest resolution for victimization alternative energy all day long; however, it's conjointly quite costly. In most cases, it's smarter solely too merely to simply use alternative energy throughout the day and take energy from the grid throughout the night (you will only try this if your system is associated with the grid). Fortuitously our energy demand is usually is typical higher throughout the day so you'll meet most of it with alternative energy.

### **4. NEEDS LOTS OF AREAS**

The additional electricity you would like to provide, the additional solar panels you'll like, as you would like to gather the maximum amount of daylight as doable. Solar panels need lots of areas and a few roofs aren't sufficiently big to suit the number of solar panels that you simply would love to possess. Another is to put in a number of the panels in your yard however they have to possess access to daylight. If you don't have the area for all the panels that you simply needed, you'll go for putting in fewer to still satisfy a number of energy you desires.

### **5. CONNECTED TO POLLUTION**

Although pollution associated with alternative energy systems is much less compared to alternative origins of energy, alternative energy may be related to pollution. Transportation and installation of solar systems are related to the emission of greenhouse gases. There are some cyanogen etic materials and dangerous product used throughout the producing method of solar photovoltaic, which might indirectly have an effect on the atmosphere. Yet, alternative energy pollutes so much but alternative energy sources.

## **2.14 SRS & SOCIO ECONOMIC DEVELOPMENT IN BANGLADESH**

### **● ECOLOGICAL EFFECTS**

Solar rooftops would like solely the sunshine of the sun to come up with electricity, creating it a cleaner supply of energy than most alternative usual forms. Its renewable nature guarantees property. No health hazards are concerned and no pollutants are emitted by solar rooftops. No additional land is needed to line up rooftops. With widespread usage, solar rooftops will facilitate in minimizing heating. In most cases, solar panels even have no impact on life as a result of they're usually put in already engineered environments. Solar panels do involve materials that require careful handling whereas the panels are factory-made and at the tip of their helpful lives. Like laptop chips, producing solar panels involves a spread of venturous materials—for example, acid, acid, aqua for tis, and fluoride. Non-silicon solar cells, as well as ones made of metallic element compound, copper-indium-gallium- dieseline, and the metal chemical compound, contain a lot of toxicant materials than those utilized in ancient semiconducting material cells.

### **● ECONOMIC INFLUENCE OF SOLAR ROOFTOPS**

Solar rooftops are terribly valued effective. They're one-time investments that still serve each nature and also the society for a far longer time. Within the future, they prove to be more cost-effective as compared to diesel generators or perhaps grid electricity. Those switch to solar power expertise an enormous cut in electricity bills, thence saving lots of cash.

### **● SOLAR ROOFTOPS IN HOUSING AREAS**

Solar rooftops are currently being progressively used for residential areas each giant complex additionally as a medium to large-scale non-public housing e.g. Concerning 280 households in Gandhi agar were fitted with solar panels last year. Marketing worth of a house also will increase if it comes with associate put in solar top system. Cash the money spent on alarming electricity bills are going to be curbed and also the money saved will facilitate a family invest in an exceedingly higher fashion.



## ● SOCIAL ALLEGATIONS OF SOLAR ROOFTOPS

Setting up solar rooftops is additionally philanthropic in nature. It does not solely serve the setting, however, serves society as a full. There are colleges and faculties in varied little districts of the state wherever the provision of electricity is improper, this poses a threat to the education of the pupils, conjointly due to lack of power the scholars in villages cannot take up digital education, particularly throughout the night they're ineffectual to review due to darkness. Of these issues may be overcome by adopting solar techniques. The hospitals won't face any obstacle in treating their patients due to lack of power. The utilization of cleaner energy also will increase the life rate among individuals.

## ● SOLAR POWER AND JOBS

Solar power, as well as upper side solar, has verified to be a powerful driver of economic development. In 2014 the U.S. solar trade utilized over 170,000 people, experiencing employment rate that outpaced the economy's rate by twenty times. By 2014 us was home to over 6000 solar firms, unfold across all fifty states and is investment virtually \$15 billion within the U.S. economy annually.

Because upper side solar may be put in cities and cities, as opposition remote locations, it offers job prospects for native employees. Labor unions, community faculties, and nonprofits across the country have established job coaching programs and alternative community partnerships to coach native workforces to put in a solar. For instance, GRID Alternatives, a noncommercial solar installation organization active in numerous states, works with volunteers and employees in job coaching programs to put in upper side solar in low-income communities.

## **SUMMARY:**

In this chapter, we discuss the whole solar energy system in Bangladesh and outside Bangladesh. How can we generate more electricity and ensure our socio-economic development by properly using this method and this is the main reason for this project. Here we discuss what is the present condition of the solar system in Bangladesh and how can we develop this system more effectively in our country. What kinds of renewable energy will a better alternative than

commercial energy also we discuss it? In 2010 the yearly demand electricity is 6% but it will increase by more than 28% in 2050. In 2004 the situation for solar system installation capacity is 38% but in 2008 it increases 61%. In Bangladesh has also tremendous progress for installation of this solar system outside of the village. This all are from urban areas like total households, charging station and health clinics, although it happened for policy obligation in our survey we have seen some are also install it their own decision.

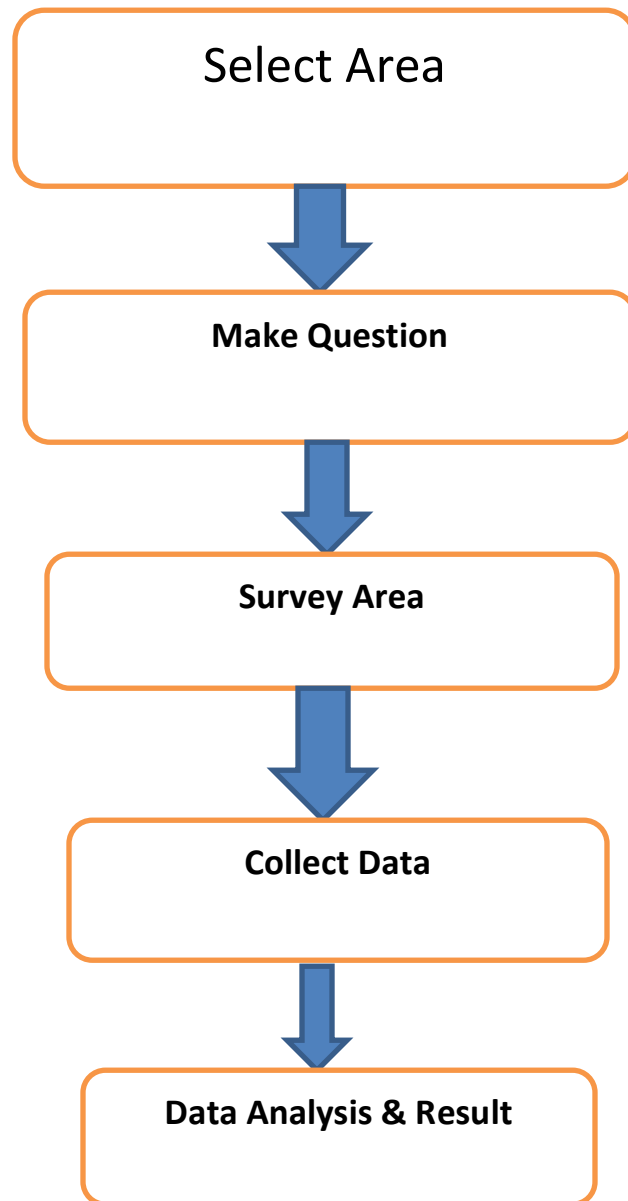
# CHAPTER 3

## METHODOLOGY

### 3.1 INTRODUCTION

As it is observed inside the title, this section constructs the analysis methodology of the thesis. In further details, throughout this half, the creator outlines the analysis technique, the analysis methodology, the analysis direction, and also the device of knowledge assortment, the selection of the sample, the analysis assumption, and also the sort of data analysis, the ethical problems and thus the analysis restriction of the project. This audit was ideal to analysis the socio-economic effects of star upside system and realize the answers concerning what do the users consider its accuracy. This study is employed to the business and industrial areas of the Asian nation. Because the survey at first supported on social analysis, some wealthy in smart qualities and quantitative method direction are applied. Initially, the final data concerning the facility of star electricity and its effectiveness are collected through a robust unit survey technique victimization type. Primary data of the survey is truly collected from the users of a star roof system. Every day take a look at was solid to search out the opinions concerning the keeping of the system and also the approach individuals are taking the service. Opinions are taken by the homeowners or the users of this technique. The survey type is meant as a gift and before SRS installation to measure the role of SRS within the socio-economic development of a geographic region.

### 3.2 FLOW CHART:



### 3.3 SITE SELECTION OF RESEARCH

It's referred to as before that the survey supported the economic areas of the Asian nation. The survey is specially lined in one in every of the busiest cities of the country, Narayanganj concerning a twenty-four kilometers secluded from Dhaka. It's referred to as a city in the central Asian nation. It's inside the Narayanganj district, near the capital city of Dacca and options a population of regarding a combine of 2 million. The city is on the bank of the Shitalakshya stream. The realm of town is thirty-three.57 km<sup>2</sup> (12.96 sq. meters). The realm of Narayanganj could be a vital shipping and industrial center of the country. It's collectively a middle of business and trade, significantly the jute trade and method plants, and additionally the textile sector of the country. It's nicknamed the Dundee of Asian nation due to the corporation of its many jute mills. Per the premise of the analysis, this town was chosen for this study. Concerning forty fields concerning industries and buildings are seldom visited for the analysis of the thesis. These fields are circulated below the help of DPDC. Some areas concerning new chasara, Allama Iqbal Road, north chasara, Chandpura Adarsha Chasara, Nag road are given for the survey.

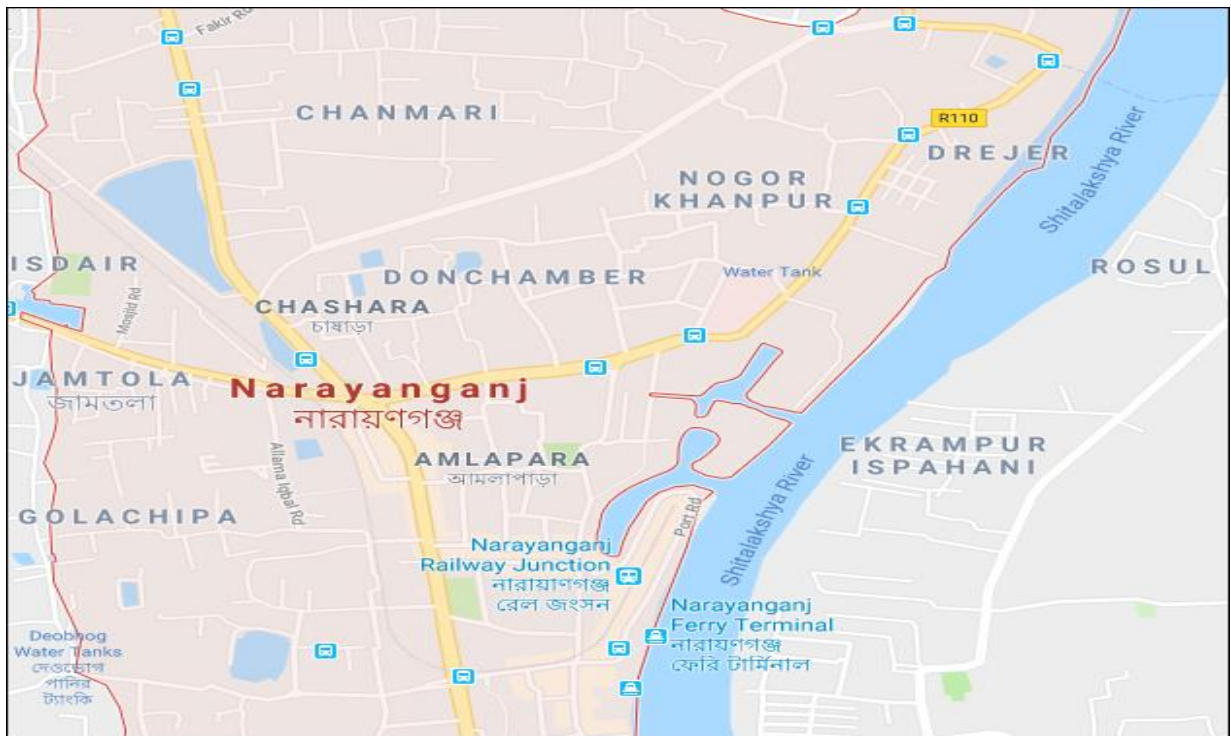


Figure 3.1: Site selection of research area

More than 40 SRS owned house information was collected from the areas. Survey places are at randomly chosen as there are lots of SRS-owned buildings and industries. For secondary sources of information journal, reports, in operation paper and documents regarding. Solar energy is consulted. Moreover, personal experiences and informal interview technique are also used to have some lots of information regarding the matter. The standard length of interviews was regarding concerning twenty minutes and it's found that the interviewed organization members showed terribly keen interest to the survey activity. The queries are asked in Bengali for well understanding and it had been taken as easy because it is feasible as nobody gets hesitated.

At the most of the buildings wherever the survey was enclosed, homeowners of the buildings don't seem to be found there. So, the question is truly asked the one that functions the system. Some fields couldn't give the U.S.A. with the correct information and data. So, the information's taken from the homeowners of the system or the one that takes care of the system through a telephone call as they're not gifted over there. The noticeable issue is that almost all of the operators or the homeowners of the system are terribly useful to the survey activity that makes the project go completely. To create the survey easier, the number of help is provided by the DPDC. It clearly makes the method easier and to search out the places of the SRS-owned space.

### **3.4 SURVEY SHEET**

Through data assortment and observation of the prevailing SRS, a clean set up was developed concerning this standing of star upside system inside the households, the difficulties baby-faced by them, maintenance facilities and thus the time of correction required throughout fault condition was noted in many cases. Normally, it takes a number of the times if the fault develops inside the SRS. There is a smart impact of alternative energy on our country what is more than on our rural people. It's calculated to undertake to work out but the lifestyle is plagued by alternative energy. We have a tendency to get a top-level view from the queries sheet.

SL No	Indicator	Question	Description
01	Consumer Information	Owner Name: Mobile No: Address: Capacity: Date of Installation:	Consumer information and correlated data for several systems are collected in this method.
02	Installation Information	<ul style="list-style-type: none"> <li>i) Why do you install this SRS?</li> <li>ii) How many days ago you install this SRS?</li> <li>iii) What kind of solar roof top system SRS are you using?</li> <li>iv) Are you fed your solar electricity to the grid?</li> </ul>	The reason behind installing the system, type of the system has been asked in this step.
03	Maintenance	<ul style="list-style-type: none"> <li>i) Is your SRS in operation?</li> <li>ii) Do you test it regular basis?</li> <li>iii) What is the main reason of system disorder?</li> <li>iv) Do you want to repair it?</li> <li>v) Do you get any training for SRS operation?</li> <li>vi) Do you clean your SRS?</li> </ul>	In this step, we tried to find out the operating condition of the system whether it is in operation or not. Sequentially, the information about the maintenance of the system and training way was also noted here.

04	Consumer Satisfaction	<ul style="list-style-type: none"> <li>i) Do you think this SRS are useful?</li> <li>ii) Do you think it is a waste of money?</li> <li>iii) Do you face any kind of survey?</li> <li>iv) DO you want to increase capacity of your SRS?</li> <li>v) Do you satisfied to use SRS?</li> </ul>	<p>In this step, the main discussion was about to point out their satisfaction with the system. It was intended to find out that how many of them take it as a way of wasting money. Moreover, People who were found pretty satisfied with the system were questioned whether they want to increase the capacity or not.</p>
05	Cost Analysis	<ul style="list-style-type: none"> <li>i) What is the total cost of your SRS?</li> <li>ii) Is the meter reading of the solar electricity taken?</li> <li>iii) Do you have record on solar electricity?</li> <li>iv) How much electricity do you get SRS?</li> </ul>	<p>In this section, the electricity generation and its per unit cost are calculated.</p>

Table 3.1: Survey format

Most of the star upside systems were found on the grid and operative. Additionally, a number of the systems were found uninstalled likewise. There's a question concerning whether or not the individuals realize it helpful or not.



Generally, a significant range of individuals realizes it helpful and happy to use the electricity from the system for his or her varied functions.

The entire prices of the system were about found between eighty thousand and 6 lakhs. Several interviewed individuals showed their keen interest to extend the capability of the system likewise that could be a smart sign of the accuracy of the star upside system on our country. There's a touch on now that what percentage of them spotless the system and repair it and what's the particular length to scrub it. because it is found that almost all of the individuals don't seem to be well-trained to control the system, some numbers of individuals were found United Nations agency cleans the system inside the bond length and take a look at the system in an exceedingly regular basis. Aboard with all the queries, there's a really restricted support from the govt. to extend the crews of users of the star upside system.

### **3.5 DISCUSSION**

As mentioned earlier home, terribly tiny business and tutorial foundation were surveyed. It's clear that the star upside system is essentially used for organization use as fuel price is reduced to an honest extent by victimization SRS. The perfect issue from the study is that a variety of individuals are coming back to grasp the utility of the system. Because of the lack of information concerning it, some individuals additionally realize itself simply a waste of cash. Per the study, there's little doubt to mention that legal opinion realizes the system acceptable for reducing the worth of electricity. If the govt. offers correct support, a facet of the users can become old step by step and plenty of these users are calculated to extend the capability of a star upside system.

# **CHAPTER 4**

## **RESULTS, DATA ANALYSIS AND DISCUSSIONS**

### **4.1 INTRODUCTION**

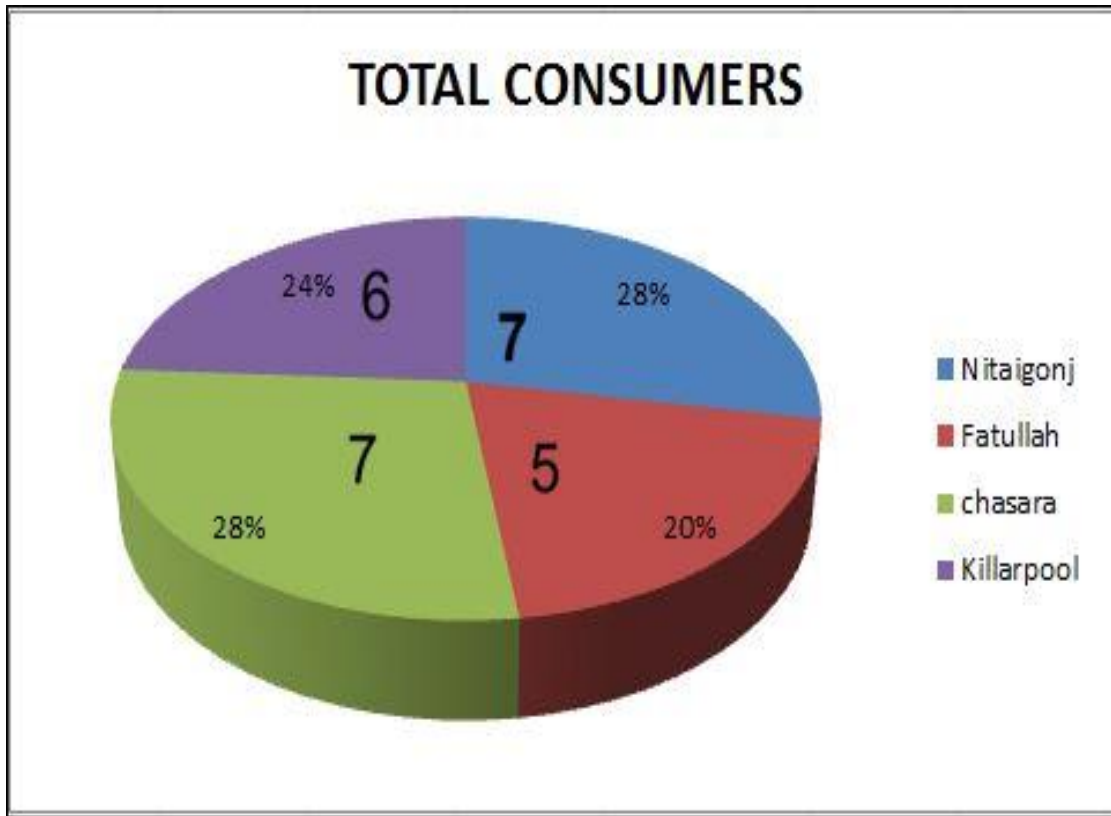
It is observed from the previous discussion that energy plays the key role for development. Due to the increase in fuel value and increasing carbon emission worldwide, there's a worldwide shift toward renewable energy like solar, wind etc. Being in an exceedingly tropical region, Bangladesh could be a solar energy-rich country. Solar power will play an important and secure energy supply for property development. The main objective of this study is to assess the impacts of solar power on socio-economic development altogether over Bangladesh. To verify the target by trial and error, a crosswise of one hundred arbitrarily chosen households within the urban areas are surveyed with a structured form. The survey results are analyzed as follows within the following sections.

### **4.2 CONSUMER INFORMATION**

For our survey, we created a survey sheet and consumer's information is one of the main parts. In this part, we divided consumer's information into two parts one is total consumers and another is total capacity. Describe the two parts below.

#### **4.2.1 TOTAL CONSUMERS**

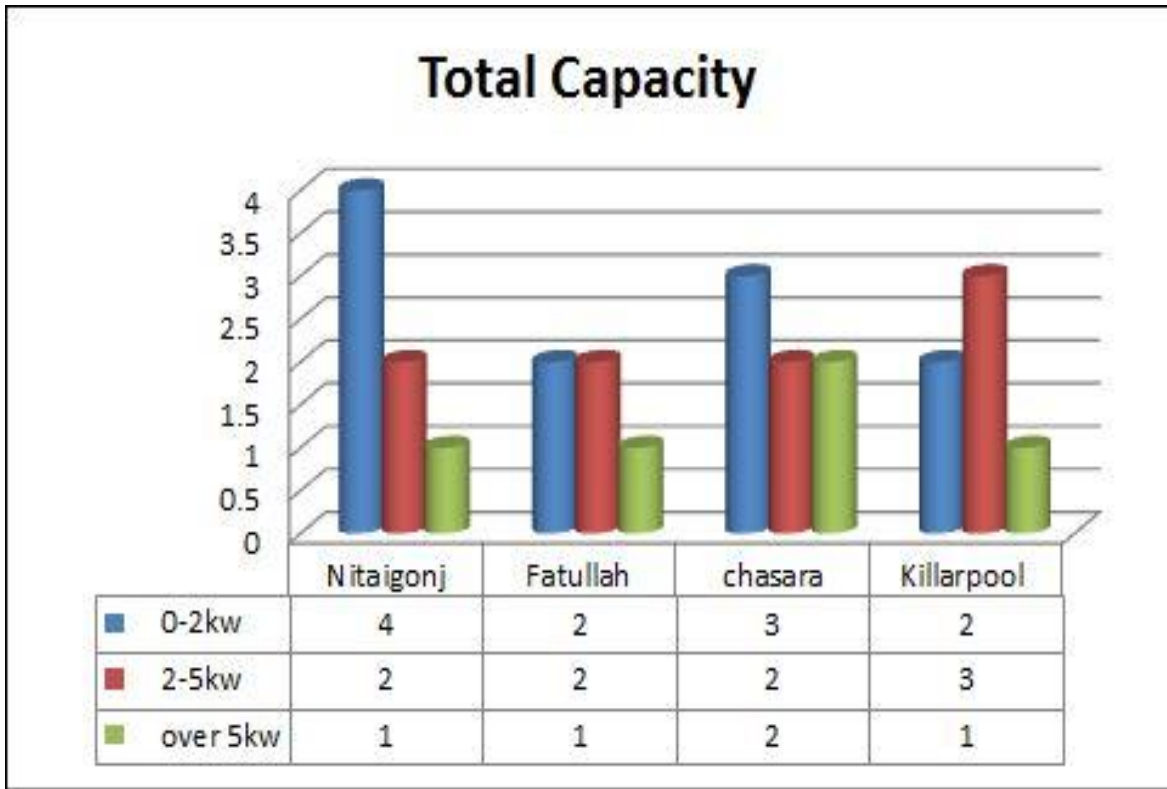
In Graph 4.1, indicates that we used our surveys information for creating the results. The surveys number was 5 and between this 5 surveys information, we have accepted 25 consumers from four regions of DPDC under Narayangonj NOCS, 7 consumers from the region of Nitaigonj, 5 consumers from Fatullah, another 7 consumers from Chasara and 6 consumers from Killarpool. The total amount of 100 survey sample, we are using 25 surveys data between these 100 surveys.



Graph 4.1: Total consumers

#### 4.2.2 TOTAL CAPACITY

Graph 4.2 shows that after calculating the total capacity, the total capacity result is 0-2 KW capacity stay on 4 householders in the Nitaigonj, Fatullah has 2 house, Chasara has 3 house, and killarpool has 2 hose. 2-5 KW capacity stay on 9 householders and over 5 KW capacities has 5 householders on those regions.



Graph 4.2: Total capacity

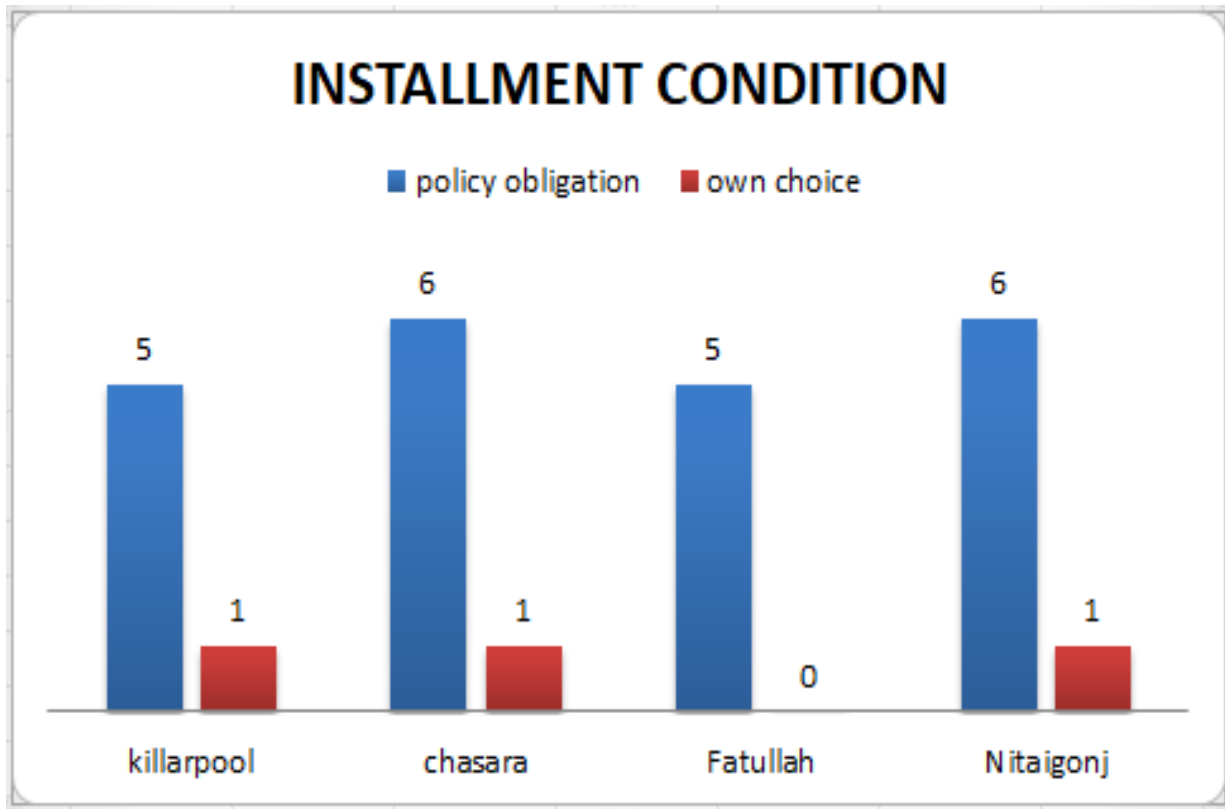
### 4.3 INSTALLATION INFORMATION:

Another important part is installation information. In this part, we divided installation information into three parts one is installation condition and others are installation year and brought the SRS. Describe these three parts below.

#### 4.3.1 INSTALLMENT CONDITION

Graph 4.3 provides information that in Nitaigonj 5 peoples bought this SRS for policy obligation and only one person bought his own choice. On the other region (Fatullah,Chasara and Killarpool) maximum consumers bought it for this same reason policy obligation and the percentage is more than 90% negative and some regions has almost 100% negative. peoples are established the solar cause of policy liability. That means they have not enough interest to

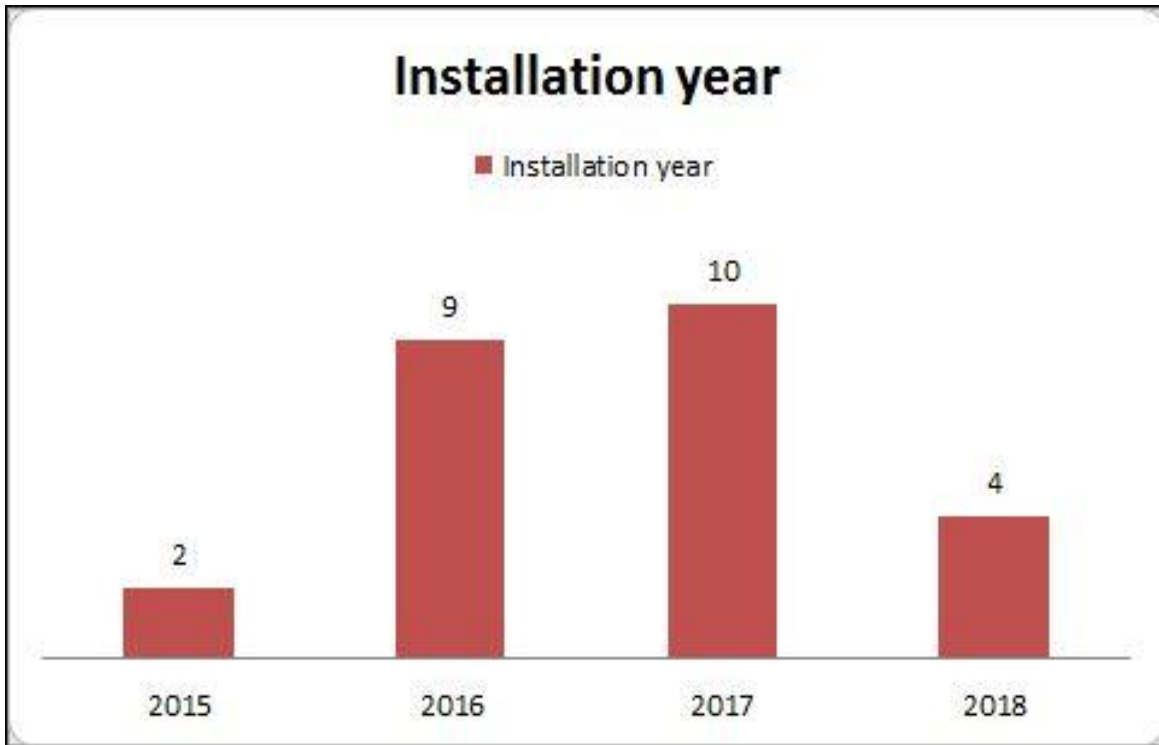
establish or installed the solar rooftop system. They are known very well about the future of Bangladesh electricity.



Graph 4.3: Installment Condition

### 4.3.2 INSTALLATION YEAR

In this graph 4.4 we saw that in 2015 the installation number is only 2 among 25 consumers, in 2018 the result is increasing because the installation number is 4. But in 2016 and the 2017 result was better than 2015 and 2018. In this time the installation number was respectively 9 and 10. From this installation graph we can understand that the result is very bad now in 2018. So for the better result, we need to meant the peoples in some effective way.



Graph 4.4: Installation year

### 4.3.3 BOUGHT THE SRS

Graph 4.5 shows that we selected 25 consumers' data sample between the all consumers data samples in Nitaigonj, Fatullah, Chasara, Killarpoll that is under DPDC Narayangonj NOCS. In these regions 14 consumers are brought from the market between the 25 and the others 11 consumers are brought from many kinds of the solar agency to establish the solar system on their rooftop. The mandatory is that when anyone builds a high range building he needs to install solar energy for getting the electricity connection.



Graph 4.5: Bought the SRS

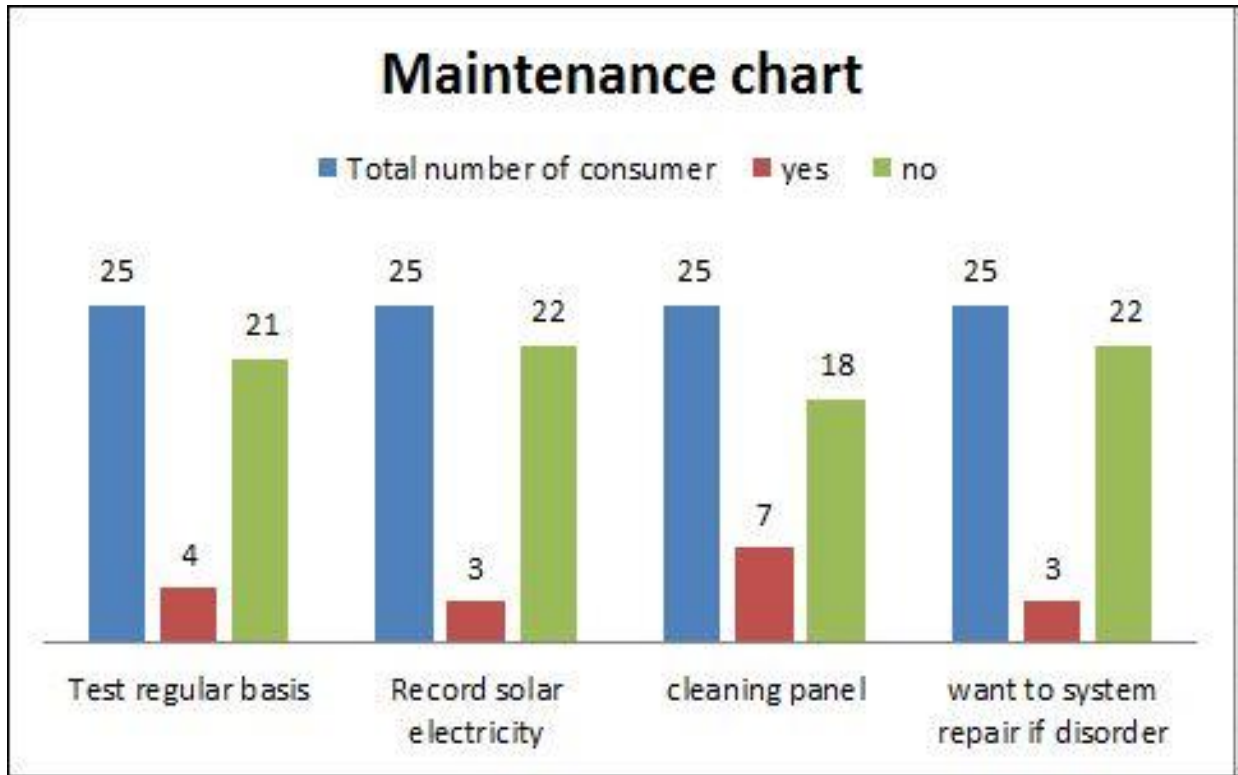
## 4.4 MAINTENANCE:

Maintenance was another important part of our survey sheet. In this part, we divided maintenance into three parts one is maintenance information and others are operating condition and training for SRS operation. Describe these three parts below.

### 4.4.1 MAINTENANCE INFORMATION.

Graph 4.6, shows that 3 users are recorded the solar electricity. And 22 users are not recorded the solar electricity. These data indicates that they don't check the meter whether or not is operated or not operated. Graph 4.8 provides also the negative result again. From this chart, we see that among the 25 consumers only 4 people's maintenance it regular but on the other hand 21 peoples are not maintenance it. Similar result for cleaning process and system repair, among 25 peoples only 7 are clean this solar panel regularly and 3 are want to repair it again if disorder. Shocking

news is that they clean the solar battery once 4 months or six months. There's not good for improvement this condition.

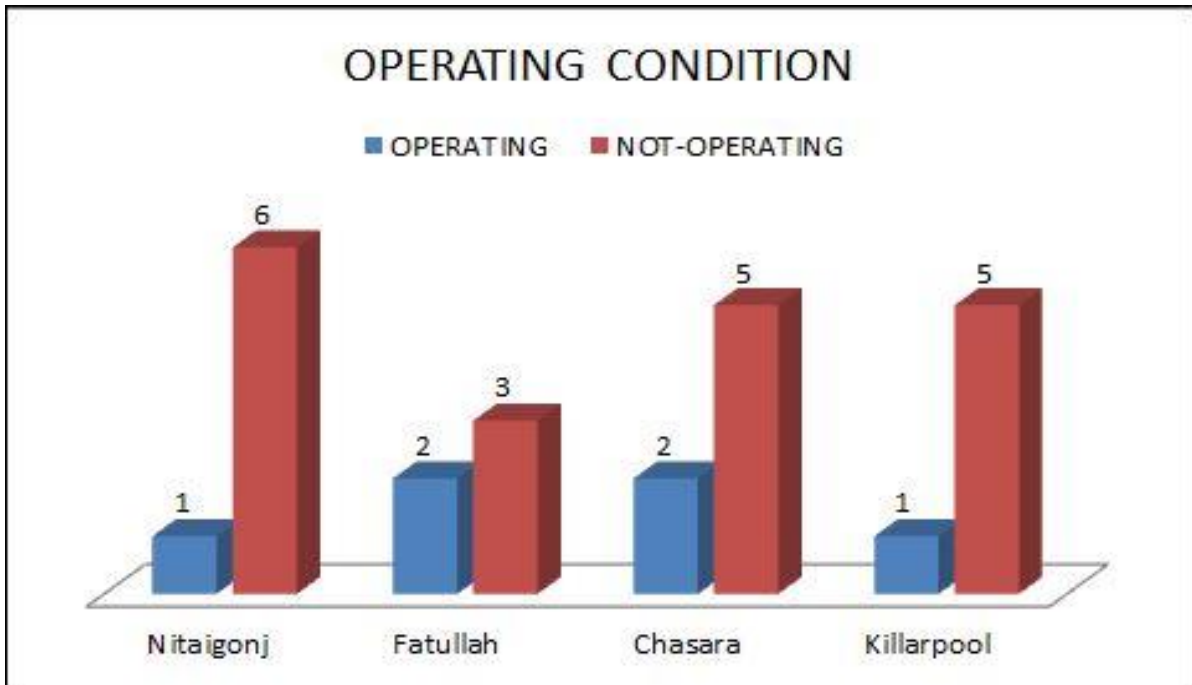


Graph 4.6: Maintenance Information.

#### 4.4.2 OPERATING CONDITION

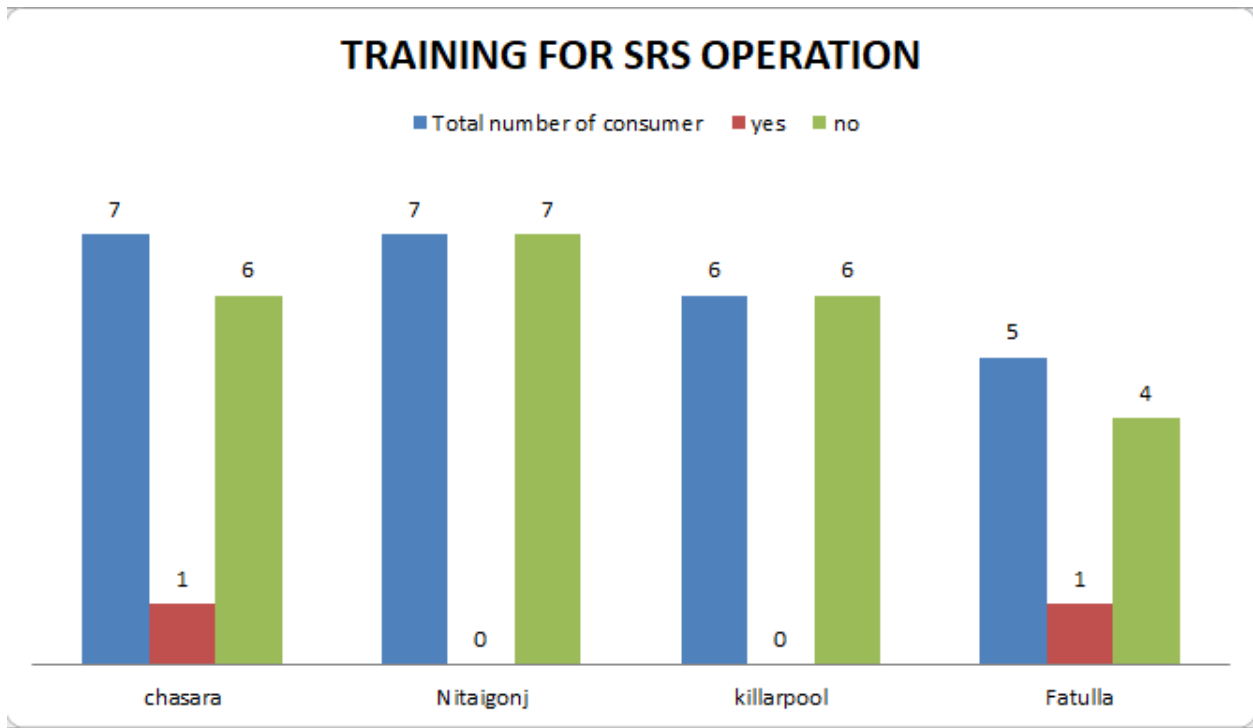
Graph 4.7 indicates that most of the consumers are establishing the solar rooftop system for getting the electricity connection of their house. This statement proves that in Nitaigonj between 7 peoples only person operates this system and others are not. Same in Chasara, Killarpool most of the peoples are not operate this system because they are not very much interested about it. But in Fatullah, result is better than others regions. They think that this system gives them some extra benefits.





Graph 4.7: Operating condition

#### 4.4.3 TRAINING FOR SRS OPERATION



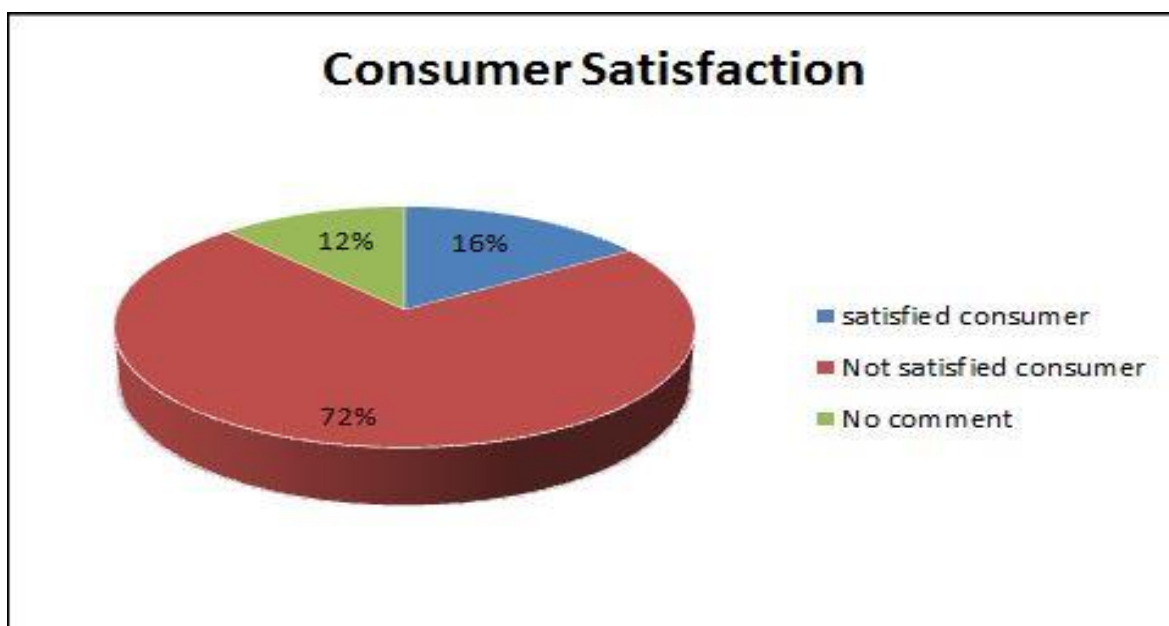
Graph 4.8: Training of SRS Operation

Graph 4.8 indicates that in our 25 consumers in 4 regions, we can't find any positive result. There is not enough proper training for them who are using it in their rooftop. In our survey, we saw that maximum peoples were filling bore when we ask any kinds of question about this system. They have not any kinds of knowledge that how many benefits they can get from it if they use it properly.

## 4.5 CONSUMER SATISFACTION:

Consumer satisfaction is the main important part of our survey. We divided consumer satisfaction into four parts one is consumer satisfaction and others are facing any kinds of survey, increasing capacity of the solar and consumer opinion. Describe these four parts below.

### 4.5.1 CONSUMER SATISFACTION

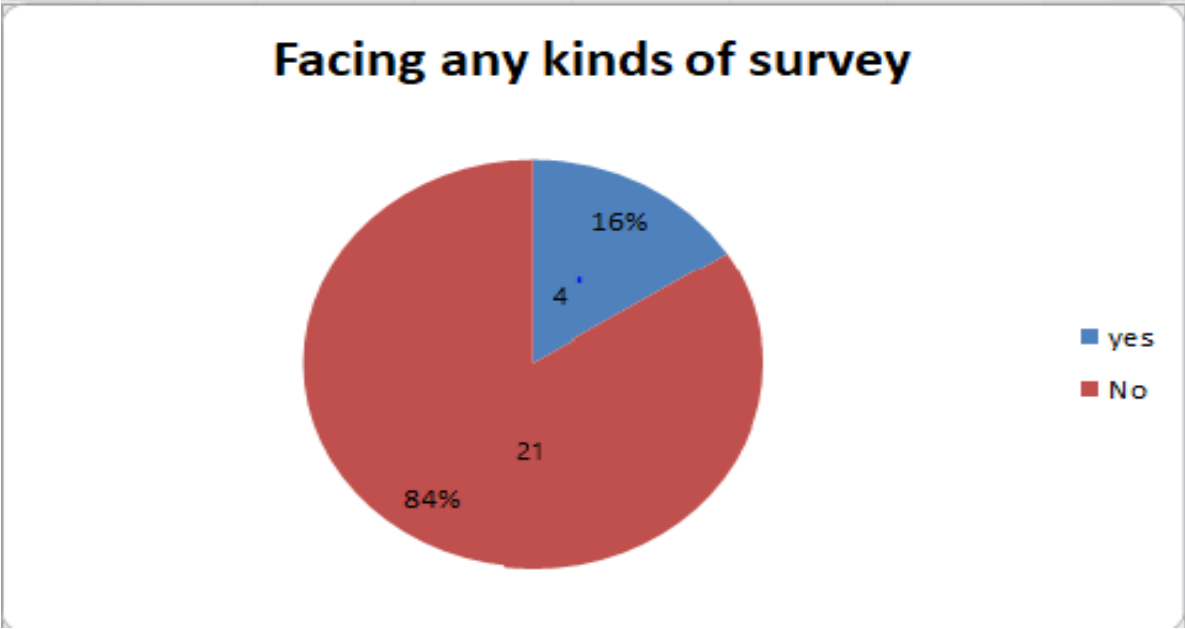


Graph 4.9: Consumer satisfaction

We can see the consumers' satisfaction percentage in graph 4.9. Satisfied percentage is 16% and they are really interested about this system and want to increase their plane capacity in future. But the 72% consumers are not satisfied and they have a lot to complain for this, we understand when they are frustrated for giving us information. The 12% of people has not any comment because they don't enter us in their house.

### 4.5.2 FACING ANY KINDS OF SURVEY:

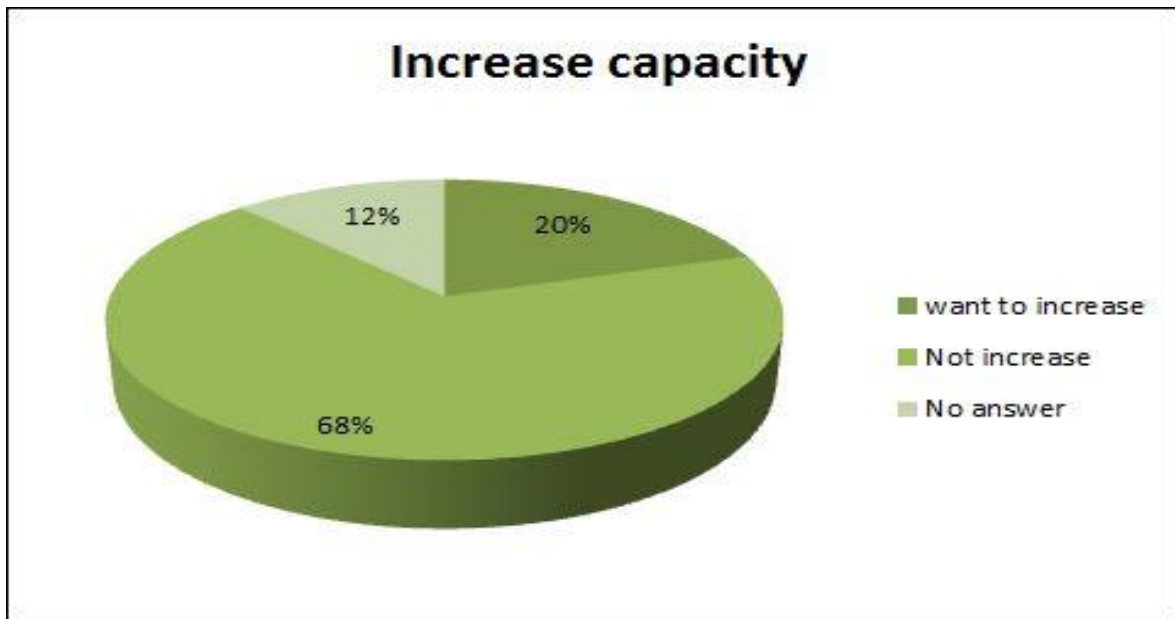
Graph 4.10 showing the pie chart its percentage adds value of the survey. The pie chart indicates that 16 percent users are facing any kinds of survey one or more time. And 84% users are not facing any kinds of survey.



Graph 4.10: Facing any kinds of survey

### 4.5.3 INCREASING CAPACITY OF THE SOLAR:

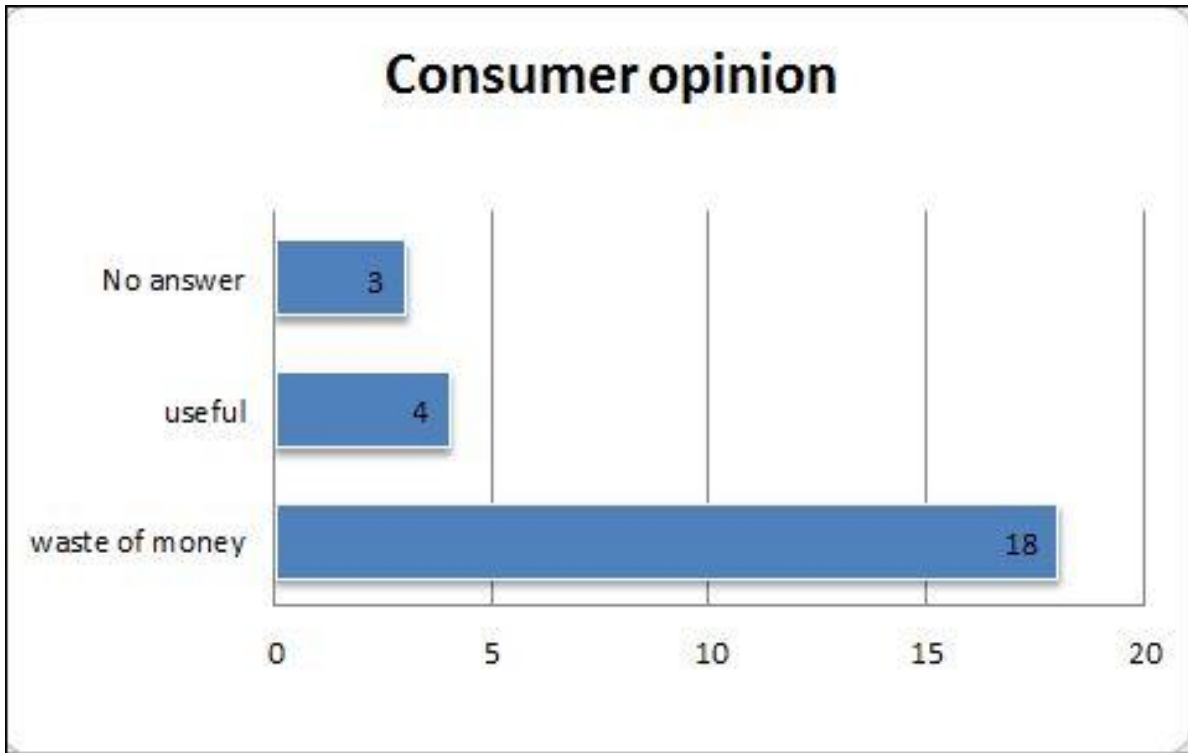
Graph 4.11 indicates the survey of increasing the capability of the solar system. It provides the data that 68% users didn't want to increase the capability of the system. They think that the system isn't helpful and 12% didn't give any answer but the joyful news is that 20% want to increase their capability.



Graph 4.11: Increasing the capacity of the solar

### 4.5.4 CONSUMER OPINION

Graph 4.12 provides, between the 25 consumers 3 peoples have not any interest about this system that's way they didn't have any answer. It is not useful for them; think the 4 peoples and the shocking news is that the 18 consumers think that it is totally waste of money. They didn't consider the condition of future electricity.



Graph 4.12: Consumer opinion

## 4.14 COST ANALYSIS

SL	Total Cost	Capacity	Life Time	Cost / KWh
01	350000	5000W	20	8.46 TK
02	325000	5000W	20	8.81 TK
03	100000	500W	20	7.4TK
04	450000	2KW	20	5.54 TK
05	150000	2.5KW	20	5.40 TK
06	100000	1.5KW	20	4.32 TK
07	150000	1.2KW	20	6.25TK
08			20	
09	550000	8.4KW	20	3.27TK
10	250000	5KW	20	7.30TK
11	100000	3KW	20	4.00TK
12	350000	2KW	20	8.89TK
13	200000	1.5KW	20	6.67TK
14	100000	1KW	20	5.00TK
15	300000	3KW	20	3.34TK
16				
17	200000	2.5KW	20	6.92TK
18	450000	8.4KW	20	4.68TK
19	400000	5.5KW	20	6.36TK
20	350000	3.5kw	20	6.25TK
21	250000	5KW	20	4.33TK
22	100000	2 KW	20	3.00TK
23	450000	5.5KW	20	5.11TK
24	250000	5KW	20	5.30TK
25	100000	1KW	20	5.00TK

Table 4.14: Cost Analysis

## CALCULATION OF COST ANALYSIS

(1)

*Life time=20*

*Total cost= 35,0000*

*Date of install= 20-6-2016*

*Date of survey=20-11-2018*

*Time duration=2 years 5 month*

*=2.416 years*

*Capacity=5000w*

*Yearly generated= 5000/2.416*

*= 2069.54 kwh/year*

*Total generation= 2069.54\*20=41390.73kwh*

*Cost of per unit of solar= 350000/41390.73*

*= 8.46 Tk/kwh.*

(2)

*Life time=20*

*Total cost= 325000*

*Date of install= 01-03-2016*

*Date of survey=20-11-2018*

*Time duration=2 years 8 month19 days*

*=2.71 years*

*Capacity= 5KW=5000W*

*Yearly generated= 5000/2.71*

*= 1845.02 kwh/year*

*Total generation= 1845.02\*20 = 36900.37 kWh*

*Cost of per unit of solar= 3,25,000 / 36900.37*

*= 8.81 TK/KWH.*



## **4.15 THESIS FINDING:**

- Need to provide proper guidance before installation the SRS system. Most of the consumers are not enough interested in the SRS because they do not understand the advantages of the SRS systems.
- Although some consumers are using the SRS, for lack of training they are not cleaning it on time. If the Provider Company or agency should manage the training then most of the problems will decrease.
- If peoples use it properly then they will get benefit from the net metering system but almost 90% peoples do not have any idea what is net metering systems and how can they will get benefit from it. So, the provider should need to inform the consumers about the benefits of the net metering system.
- The majority number of the consumers complains that SRS system totally wastes of money and they are not getting enough energy from it. Actually, they have installed it for the policy obligation otherwise they will ignore it. Almost 98% of consumers said that the initial cost is very high and if any problems occur then get the instrument is so tough and costly in market. To solve this kind of problems provider company or agency need to reduce the price for more popular this system. From this survey, at last we can say that not only consumers need a proper guideline, also need proper training for the surveyors who will collecting the exact data from consumers and meant them, inspire them properly for using this SRS system in urban areas.

## **SUMMARY:**

In this chapter 4, we discussed the entire survey report. The number of totals consumers, the total capacity of the 100 consumers, how they bought the solar system, what was the installment condition. What kinds of problems they were facing for this system. Are the consumers cleaning the solar panel in time? For using this system, how much training they got and what is the generation capacity after using the whole time duration and how much curiosity about this system. At last, we create a cost analysis sheet depends on our survey report.

# CHAPTER 5

## CONCLUSION

This paper discusses totally star roof system with its utility and significance to the trendy society. Because the technology itself is growing days when days, the person is obtaining accustomed this and exploitation all of it for the betterment of future. The benefits and downsides, varied limitations of star upper side system are mentioned here. Among all the benefits of star panels, the foremost necessary issue is that alternative energy can be associate really renewable energy provide. It's typically controlled in every region of the earth and the market daily. We've a bent to give out of alternative energy, in distinction to variety of opposite energy of source. Alternative energy goes to be get-at-able as long as we find the power of the sun.

As you need to arrange a meeting for the variety of our power wishes with your system of the electricity was generated, your energy bills will drop. What proportion you protect on thane bill goes to be hooked into the shape of the method and yours electricity, heat usage. In addition, not alone are you able to be protection over the electricity bill, However, if possible that you can generating further electricity that you utilize, the surplus goes to be consigned after the grid and you may take extra payments for this volume (considering that your device the system has associated with the grid). Deposit be able any cultivate in case you could Ancash extra electricity at the elevated values throughout the day then acquire Electricity power since 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 doing the duty. At the tip of the time, public demand matters.

Solar upper side system is that the easiest method to scale backs 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 inside a positive means or not. Within the analysis, it's found that the bulk of individuals don't grasp either the importance or the utility of the star upper side system. Being a developing country, the govt. ought to clearly worry with this technique concerning; however, the system is often developed in the trendy society. Some steps are to be taken as individuals get

the 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.

## **FUTURE WORK**

This survey was taken inside varied areas of Narayanganj throughout associate inquiry type. it's found that 90% of the interviewed individuals aren't glad about the system and its actualization. A theoretic discussion has been happening that another survey is going to be coated inside national capital town beneath DPDC in addition. The principle of this objective is to flow into the utility and its effectiveness to those that keep a restricted data concerning star upper side system. Among the circulation, associate inquiry types are going to be conjointly provided to the interviewed crew. it's hypothesized that a stimulation lesson is going to be mentioned with the individuals not taking the system thanks to having below data concerning it.

It will be stressed that solar power systems sometimes don't would like an excellent deal of custody. You need only for placement to them comparatively neat and clean, hence cleansing them some of the times annually will do the task. The technology inside the power of solar business is systematically advancing and enhancements will intensify inside the long run. Innovations in natural science and subject can likely increment the usefulness of solar dashboard and double, or even triple, the electrical input of power of solar systems.

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