THE PERFORMANCE OF SOLAR ROOFTOP SYSTEMS

The 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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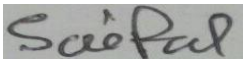
Certification

This is to certify that this thesis entitled "**THE PERFORMANCE OF SOLAR ROOFTOP SYSTEMS**" 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.

Signature of the candidates



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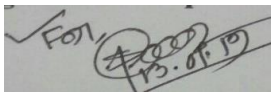

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Dedicated to

Our Parents

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List of Abbreviations

SRS	Solar Rooftop System
RRB	Rural Electrification Board
IDCOL	Infrastructure Development Company Limited
PV	Photovoltaic
SHS	Solar Home System
PPA	Power Purchase Agreement
SDGs	Sustainable Development Goals

ACKNOWLEDGEMENT

First of all, we give thanks to Allah or God. Then we would like to take this opportunity to express our appreciation and gratitude to our project and thesis supervisor **Dr.M. Shamsul Alam. Professor, Department of EEE and Dean** of **Faculty of Engineering** for being dedicated in supporting, motivating and guiding us through this project. This project can't be done without his useful advice and helps. Also thank you very much for giving us opportunity to choose this project.

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ABSTRACT

One critical objective for any creating nation is to set up and give electric capacity to its residents; an attempt started by the Government of Bangladesh numerous years back Sustainable power source is a key part for improvement and Bangladesh has effectively made noteworthy walks in achieving the greater part of the nation's populace; both in Urban and Rural regions. The renewable energy projects initiated by the Government are helping Private sector. Renewable energy is potential solution to meet up electricity demand. Among all the renewable technologies, solar voltaic (pv) is most potential .we have investigated the installed solar rooftop system in Dhaka. These thesis are increasing the awareness of customers and increasing the right use of the benefits providers and solar home systems. This seen that a few among them find the system useful and want to increases its capacity. Many consumer do not know how to maintained or operate the system. So government should take more step to develop this. Various specialized issues influencing sustainable power source investigate are additionally featured, alongside gainful cooperation's between direction strategy structures and their future prospects. So as to assist open novel courses with respect to sun based vitality research and practices, a future guide for the field of sun powered research is talked about. The creators prescribe the commencement of persuasive mindfulness by approach designers of Bangladesh, for the accomplishment of supportable development in the creation of sustainable power source

CHAPTER 1
INTRODUCTION

1.1 Introduction

Electricity assumes an imperative job in the economy and the country's development. About 166,368,149 of the present population in Bangladesh. Bangladesh has about 60% electricity usage in Bangladesh and it will take at least 15 years for electricity to be supplied. [1] We are totally vulnerable about power to expand work prospects, approach and confirmation to build the accessibility of horticultural and modern areas for improvement. In any case, each day our interest increments and the power emergency has turned into a major issue for our nation these days. To comprehend this vitality emergency, we can utilize distinctive types of sustainable power source regularly to produce control. Sustainable power source originates from different kinds of characteristic assets, which ordinarily originates from rain, daylight, wind, tide and geo warm, natural fuel. One of them is the solar rooftop system, which works with a variety of renewable energy sources and non-governor mental institutions provide electricity to the general public. Solar power system has become popular in Bangladesh due to Solar Rooftop System (SRS) to meet our electricity needs, so that most of the people of our country have been able to fulfill the human needs of the solar system. For this reason solar panels project resources have played a very strong role. They make the common people differently, and make different opportunities. Solar energy has become popular in Bangladesh due to solar Rooftop system (SRS) to meet our electricity needs, because it can be easily and easily available in the debt market. Sun based vitality has turned out to be prominent in Bangladesh through the Solar Rooftop System (SRS) to meet our power needs. The usage of the SRS program is brought out through two diverse conveyance models. The principal show is executed by the country Electrification Board (RRB), state-possessed utility in charge of framework zap in provincial territories. The second model is a private advancement organization, through Infrastructure Development Company Limited (IDCOL), which moves.

Frameworks utilizing a miniaturized scale fund plot actualized by privately owned businesses, for example, country control. Specifically, provincial power has assumed an essential job in advancing SRS in rustic Bangladesh and its credit program has achieved many low salary families. The program achieved 3 million families starting late 2014 and, with in excess of 50,000 frameworks being included every month since 2009, the World Bank has considered it the quickest developing sun based Rooftop framework program on the planet. The Bangladeshi government is moving in the direction of all inclusive power access by 2021 with the SRS program anticipated to cover 6 million family units by 2017. [2] There is a good prospect of roof-top grid-connected solar power generation. Residential solar systems have become much more affordable in the past five years and they routinely offer fixed power costs 25-50% less than utility rates. Our proven approach to utility cost reduction combines solar and efficiency products and can help you. [3]By and by global warming and atmosphere changes impact is the consuming issue everywhere throughout the world. Bangladesh will be the most influenced nation in the atmosphere changes impact round the world. There are such a large number of reasons for a dangerous atmospheric devotion. Among them control age is the most noteworthy one. We cannot think about any development without power (Electricity). Finally, sources of conventional energy like Fossil fuel, Natural gas and Coal are limited. If we used them in the present rate it will be finished within the short time. So, there is no other way to think about environmental friendly renewable energy production sources. In Bangladesh context solar energy is the most effective source for renewable energy production. Even if fuel is available within the country transporting that fuel to remote, rural village can be difficult .There are no loads or supporting infrastructure in many remote villages where transportation by animals is still common. Transportation by animals limits loads capacities and some loads, diesel generators, for example may be impossible to bring to such locations. The use of renewable energy is attractive for solar energy application in many developing countries. This technology, referred to as photovoltaic (PV), converts the sun energy into electricity through electromagnetic means when PV module is exposed to sunlight .The solar radiation energy is converted into DC power and requires an inverter it into AC power[4]. But still some problems have that make it uncomfortable to us. Its efficiency is so much low and the prices of its energy still so high. So in this paper we try to find way to make it comfortable.

1.2 Problem Statement

- Most of the homes that have gone to the solar panels do not care for solar panels, the dust is in the sand, and most of the solar panels are frustrating.
- The main problem of Solar Rooftop System is that it relies on full sunlight. In the rainy season, it is not enough to get energy from energy.
- Compared to coal, water and nuclear sources, electricity from the sun is five to eleven times more expensive.
- The costly semiconductor material is used for direct sunlight to produce electricity.
- More space is required to install solar panels.
- There are also some toxic materials and hazardous products used during the manufacturing process of solar photovoltaics, which can indirectly affect the environment.
- Solar energy cannot be collected during the night.
- Requires user training and maintaining.
- The cost of battery charging is much higher.

1.3 Objective

The objective of this work is to provision the Government of Bangladesh to develop a disposable policy for different group.

- The main objective of Solar Rooftop System is to make opportunities for all the people of Bangladesh to meet the demand for electricity.
- Provides four basic needs, such as four effective and reliable sources of solar power, lighting, education, entertainment and communication, improves the quality of life and reduces rural poverty.
- Applying solar energy technology as a technology capable of sustainable development.
- Our main goal is to meet the low cost biological needs.
- Establish a financial mechanism for RE integration to grid.
- Popularize RE based rooftop or grid-tie system in the country.

- Reduce electricity bill of customers by lowering the use of electricity from the grid and securing payment made for the electricity fed into the grid in the event of surplus generation.
- Support the utility to allow the consumers interconnect with the distribution network.
- Contribute to the reduction of greenhouse gas emission through promoting generation of electricity from renewables while lessening the country's dependence on costly imported fossil fuels.
- To meet the needs of rural people in rural areas and to meet the needs of people who can work in agriculture.
- Adequate to build up some genuine suggestions for enhancing access to SRS in zones where sufficient power supply is constrained.
- Prepare a guideline for net metering system.

1.4 Scope of the research

There are a lot of chances for research in Bangladesh, there is a lot of room required for sun oriented vitality creation. What's more, Bangladesh is a calm nation.

The vulnerable interest for power is in Bangladesh. Nations for the most part feel the inconceivability of supply-request unthinkable, particularly in the midyear. The vitality hole in Bangladesh is one of the real segments of Bangladesh's monetary development. A few appraisals of Bangladesh's financial development have been around 8%, on the off chance that it was not restricted by the vitality deficiency. For the improvement and advancement of financial development, the Bangladesh government is effectively engaged with the administration of the power emergency the national energy policy has clear targets for electricity supply throughout the country by 2021. Bangladesh has adopted the renewable energy policy-2008, of which at least 5% of the power renewable sources and 10% by 2020 are required by 2015. Now, renewable energy-based power is about 90 megawatt (megawatt) and it originally comes from solar power. [5]. SRS to transform people's lives in rural areas we can Solar power is a way to provide solutions for solar, electricity, electricity, education, telecommunications, rural and rural electricity. The administration, advancement accomplices, inquire about establishments, NGOs and non-government associations are attempting to change Bangladesh into a vitality effective nation by utilizing sunlight based vitality. Sun oriented Power The most plausible wellspring of sustainable power source assets in

Bangladesh. By receiving the material arrangements, tenets and directions, sun powered vitality can decrease the nation's developing power request. Hence, in the present investigation, the exercises identified with the utilization of SRS will be distinguished and in the provincial regions it will be financial effect.

1.5 Outline

1. Introduction
2. Literature Reviews
3. Methodology
4. Results
5. Conclusions

CHAPTER 2

LITERATURE REVIEWS

2.1 Introduction

Bangladesh is a subtropical country, 70% of year daylight is dropped in Bangladesh. We can utilize sunlight based boards to deliver power generally. Sun based radiation fluctuates from season to season in Bangladesh. Bangladesh gets a normal every day sun based radiation of 4– 6.5 kW h. The sun oriented vitality can be an extraordinary hot spot for comprehending the power emergency in Bangladesh.

2.2 Definition of Energy

The capacity to work or cause charge is called vitality. At the point when an article or life form works on an others object a portion of its vitality is exchanged to that object.

2.3 Types of energy

1. Primary energy and Secondary energy
2. Commercial energy and non-Commercial energy
3. Conventional energy and non-conventional energy
4. Renewable energy and non-renewable energy

2.3.1 Primary energy and Secondary energy

Primary energy: The energy that is found by natural means and it is not in any other way under the human transformed process and it is the power of the raw material and the strength of other energy obtained as a system input. Some examples include Coils, Gas, Sunlight, Coil Oils etc.

Secondary energy: Optional vitality alludes to any vitality that is from an essential vitality source utilizing talking change process. For some examples Electricity, Coke, oil etc.

2.3.2 Commercial energy and non-Commercial energy

Commercial energy: Business Energy are those that are change whale in the commercial center and have showcase cost**. .**For some examples residential, industrial, or transportation energy etc.

Non-Commercial energy: Non-commercial energy are those which de not pass through a market place and accordingly do not have a market price. For example fuel wood, straw, dried dung etc.

2.3.3 Conventional energy and non-conventional energy

Conventional energy: Conventional energy are those that are obtained through commonly used technology.

Non-conventional energy: Non-conventional energy are obtained a sing new and novel technology.

2.3.4 Renewable energy and non-renewable energy

Renewable energy: In the event that any fundamental imperativeness is gained from a consistently available stream the essentialness known as feasible power source.

Non-renewable energy: A non-sustainable wellspring of vitality is none where essential vitality originates from a limited supply of plan of action.

2.4 Types of renewable energy

1. Wind Power
2. Biomass
3. Geothermal Energy
4. Hydroelectric Power
5. Solar Power

2.4.1 Wind power:

The wind energy is use to run the wind mill. There is a small generator .The generator is arranged to charge the batteries. The batteries supply the energy when the wind stops. There is a picture given below wind power.

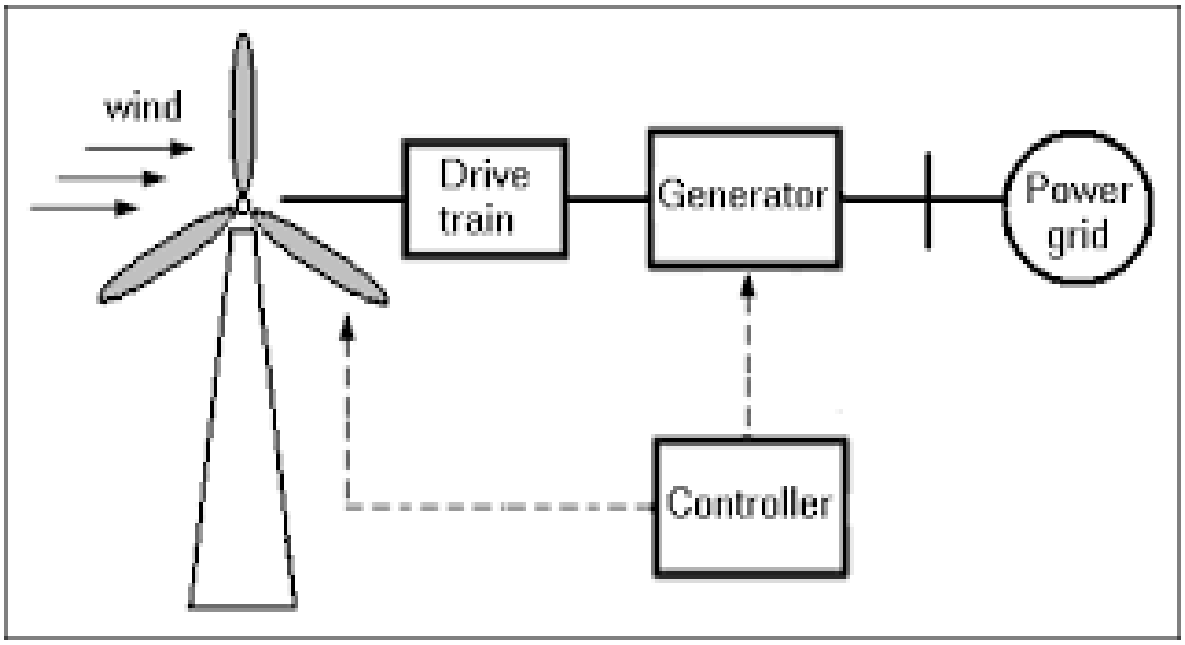


Fig: 2.1 Wind power

2.4.2 Biomass

Biomass: Is one of the potential renewable energy sources in our country. Agricultural crop residues, animal manure and civil strong waste are the significant wellsprings of biomass vitality in the nation. Now day by day it is more popular Biomass. There is a picture given below about Biomass.

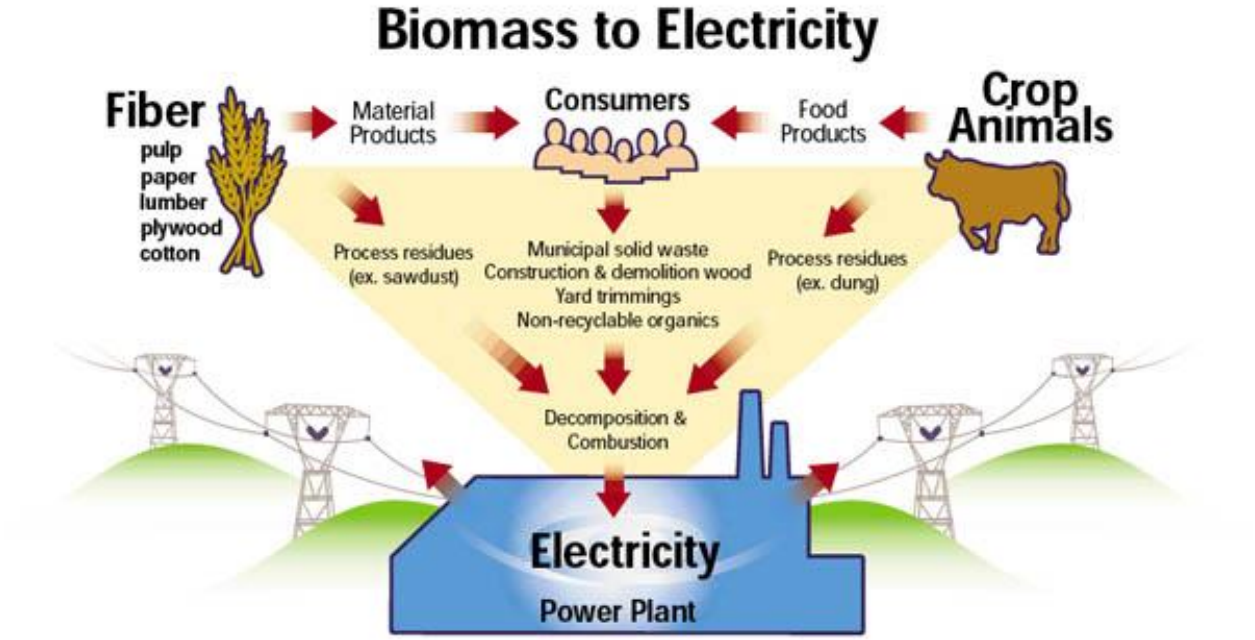


Fig: 2.2 Biomass

2.4.3 Geothermal Energy

Vitality that can be removed from the warmth in the earth helpful minerals, for example, zinc and silica, can be separated from underground water. Geothermal vitality is "homegrown." This will make occupations, a superior worldwide exchanging position and less dependence on oil delivering nations. There is a picture given below about geothermal energy.

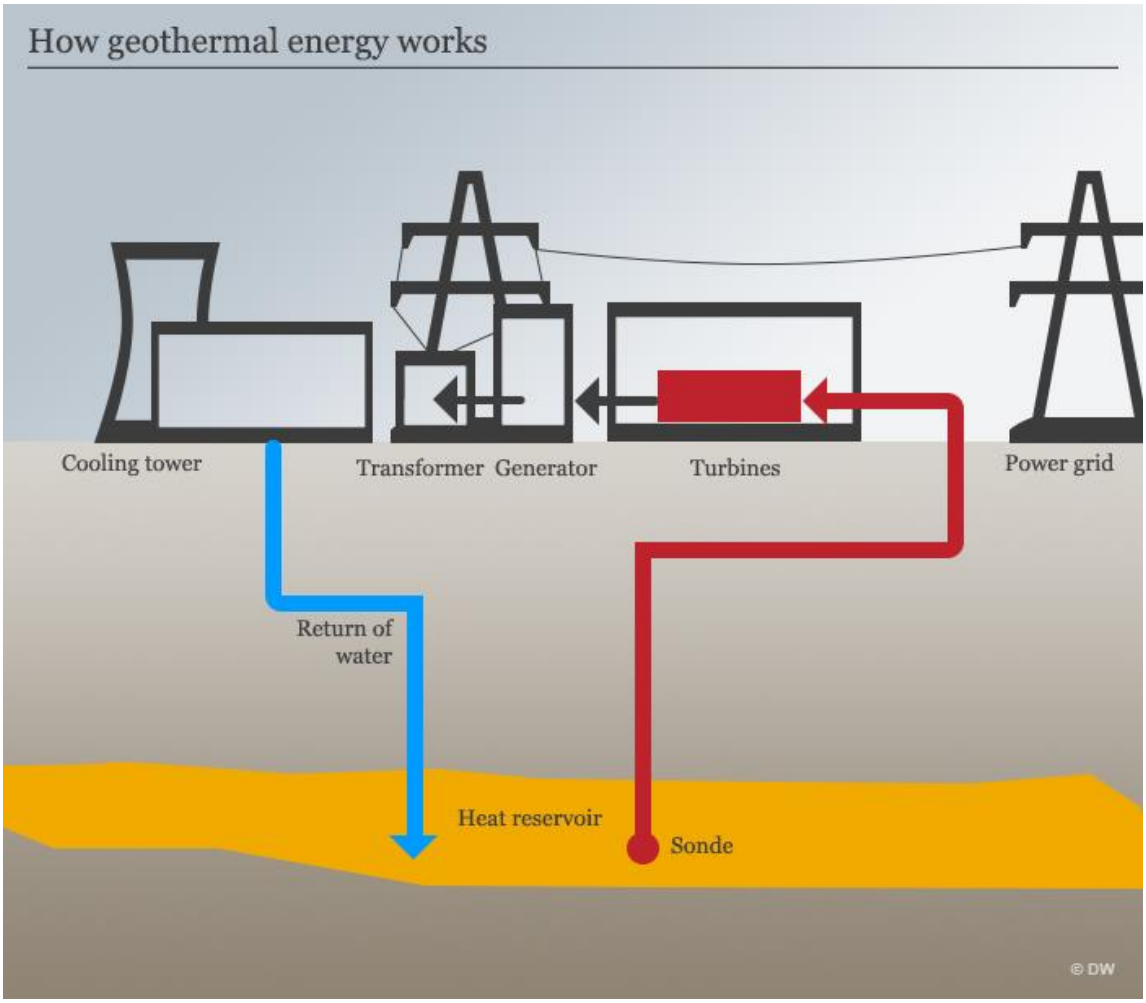


Fig: 2.3 Geothermal Energy

2.4.4 Hydroelectric Power

A creating station which uses the potential vitality of water at an abnormal state for the age of electrical vitality is known as a hydro-electric power station. Hydro-electric power stations are commonly situated in sloping zones where dams can be manufactured conveniently and vast water stores can be acquired. In a hydro-electric power station, water head is made by developing a dam over a waterway or lake. From the dam, water is directed to a water turbine. The water turbine catches the vitality in the falling water and changes the pressure driven vitality into mechanical vitality at the turbine shaft. The turbine drives the alternator which converts mechanical energy into electrical energy. Hydro-electric power stations are becoming very popular because the reserves of fuels are depleting day by day. They have the added importance for flood

control, storage of water for irrigation and water for drinking purposes. There is a picture given below about hydroelectric power.

Fig: 2.4 Satellite view of Karna fully hydropower plat

2.5 Advantages of Renewable Energy*:*

One noteworthy preferred standpoint with the utilization of sustainable power source is that as it is inexhaustible it is in this manner economical thus will never run out. Much more imperatively, sustainable power source delivers next to zero waste items, for example, carbon dioxide or other synthetic poisons, so has negligible effect on the earth. Sustainable power source offices by and large require less support than customary generators. Their fuel being gotten from regular and accessible assets decreases the expenses of activity. Sustainable power source undertakings can likewise bring financial advantages to numerous territorial regions, as most tasks are found far from expansive urban focuses and rural areas of the capital urban communities. These monetary advantages might be from the expanded utilization of nearby administrations and in addition the travel industry.

2.6 Solar Energy

Solar: Solar vitality is created through the suns warm. To put into setting the gigantic intensity of the sun, the whole supply of coal, oil and gaseous petrol is identical to the

power put off by the sun in only 20 days. This vitality can be tackled using photovoltaic sun powered board that can be put on rooftops, on building and even on vehicles.

2.6.1 Impact of solar energy in public health

Contamination originating from power plants spoils our air supply and causes asthma. Using sustainable power source, we could wipe out these hurtful substances noticeable all around, prompting a more advantageous populace.

2.6.2 Cost and Supply

When the sun based boards are introduced and the windmills are set up, sustainable power source is basically free. It costs obscure to utilize the sun's beams, and exploiting a breezy day is free. Moreover, the supply of wind wouldn't decrease. The sun's beams are additionally settled and will exist for many years.

2.7 Solar overview

Sun based abilities are arranged as either detached or dynamic relying upon the way they The Earth gets 174 (PW) of approaching sun based radiation at the upper environment. Practically 30% is reflected back to space while the rest is consumed by mists, seas and land masses. The range of sun based light at the Earth's surface is generally spread over the unmistakable and close infrared extents with a little part in the close bright. A large portion of the total populace live in regions with insolation dimensions of 150– 300 watts/m², or 3.5– 7.0 kWh/m² every day.

Sunlight based radiation is dazzled by the Earth's property surface, seas – which cover about 71% of the globe – and air. Warm air covering vanished water from the seas rises, causing barometrical flow or convection. At the point when the air achieves a high elevation, where the temperature is low, water vapor gathers into mists, which rain onto the Earth's surface, finishing the water cycle. The dormant warmth of water buildup intensifies convection, creating climatic signs, for example, wind, tornados and enemies of twisters. Daylight consumed by the seas and land masses keeps the surface at a normal temperature of 14 °C. By photosynthesis, green plants convert sun oriented vitality into synthetically put away vitality, which produces sustenance, wood and the biomass from which petroleum products are inferred. The total solar energy absorbed

by Earth's atmosphere, oceans and land masses is approximately 3,850,000 oxyjoules (EJ) per year. In 2002, this was more energy in one hour than the world used in one year. Photosynthesis captures approximately 3,000 EJ per year in biomass. The amount of solar energy reaching the surface of the planet is so vast that in one year it is about twice as much as will ever be obtained from all of the Earth's non-renewable resources of coal, oil, natural gas, and mined uranium combined

The potential solar energy that could be used by humans differs from the amount of solar energy present near the surface of the planet because factors such as geography, time difference, cloud cover, and the land available to humans limit the amount of solar energy that we can acquire.[5]

Topography influences sunlight based vitality potential since zones that are nearer to the equator have a more noteworthy measure of sun oriented radiation. Nonetheless, the utilization of photovoltaics that can pursue the situation of the sun can altogether build the sunlight based vitality potential in zones that are more distant from the equator.

Time variety impacts the capability of sun based vitality on the grounds that amid the evening time there is minimal sunlight based radiation on the outside of the Earth for sun oriented boards to retain. This restrains the measure of vitality that sun powered boards can assimilate in one day. Overcast cover can influence the capability of sunlight based boards since mists square approaching light from the sun and lessen the light accessible for sun powered cells.

In addition, land availability has a large 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 capture, convert and distribute sunlight and enable solar energy to be harnessed at different levels around the world, mostly depending on distance from the equator. Although solar energy refers primarily to the use of solar radiation for practical ends, all renewable energies, other than geothermal power and Tidal power, derive their energy either directly or indirectly from the Sun. [6]

Dynamic sun oriented strategies use photovoltaics, concentrated sun oriented power, sun powered warm authorities, siphons, and fans to change over daylight into valuable

yields. Uninvolved sun based systems incorporate choosing materials with good warm properties, planning spaces that normally course air, and referencing the situation of a working to the Sun. Dynamic sun based innovations increment the supply of vitality and are viewed as supply side advancements, while inactive sun based advances lessen the requirement for substitute assets and are commonly viewed as interest side advances.

2.8 How does solar panel work?

Sun oriented boards are prepared up of numerous PV cells. Each PV cell covers two layers of semiconductor apparatuses, like materials in PC chips. At the point when daylight hits the cells, it thumps electrons free from their particles. As these electrons course through the cell, they produce coordinate flow (DC) power. Each sunlight based board houses an inverter, which changes over DC control into flow (AC) power and allows the sun oriented board to control your home's uses and electronic frameworks. There is a picture given below about solar panel work.

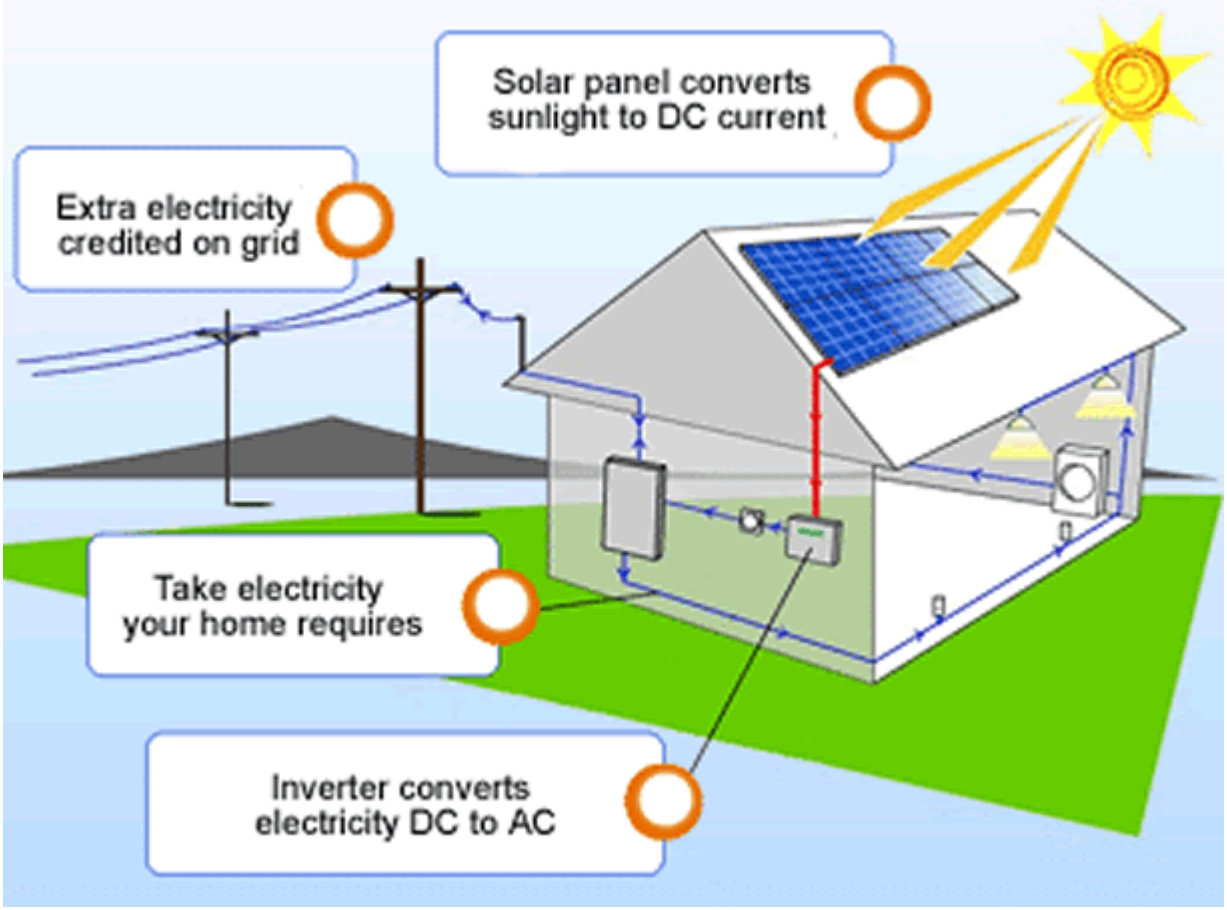


Fig: 2.5 Solar panel work.

2.9 Types of solar panel

There are many types of solar panels like as

1. Monocrystalline panels.

2. Polycrystalline Panels.

3. Hybrid Panels e.g. Panasonic pails.

Here we discuss about three types of solar panels.

2.9.1. Monocrystalline panels

Monocrystalline boards were a piece of the primary influx of universes that were displayed. They've been being used since the 1970. Which is more than adequate time to discover every one of the issues and fix them. As it were, makers are very much

aware of the weaknesses the boards can have. Be that as it may, throughout the most recent 40 years the innovation for this single silicon gem board has enhanced incredibly. This is likewise what makes them so unique in relation to the rest since they use an amazingly unadulterated type of silicon. They have a uniform darker shading since they are retaining a large portion of light. There is an image given underneath about monocrystalline boards.

Fig: 2.6 Monocrystalline panel.

2.9.2 Poly Crystalline Panels

Polycrystalline panels are made up from the silicon off cuts, molded to from tablets and create a cell made up of several bits of pure crystal. Because the different crystals is arc not necessarily all impeccably aligned together and there are losses at the joints between them, they are not quite as efficient. However, this misalignment can help in some circumstances, because the cells work better from light at all angels, in low light etc. For this reason, I would argue that polycrystalline is slightly better suited to the UK's duller conditions, but the difference is marginal.

The appearance is also changed - you can see the random crystal arrangement and the panels look a little bluer as they reflect some of the light. There is a picture given below about poly crystalline.

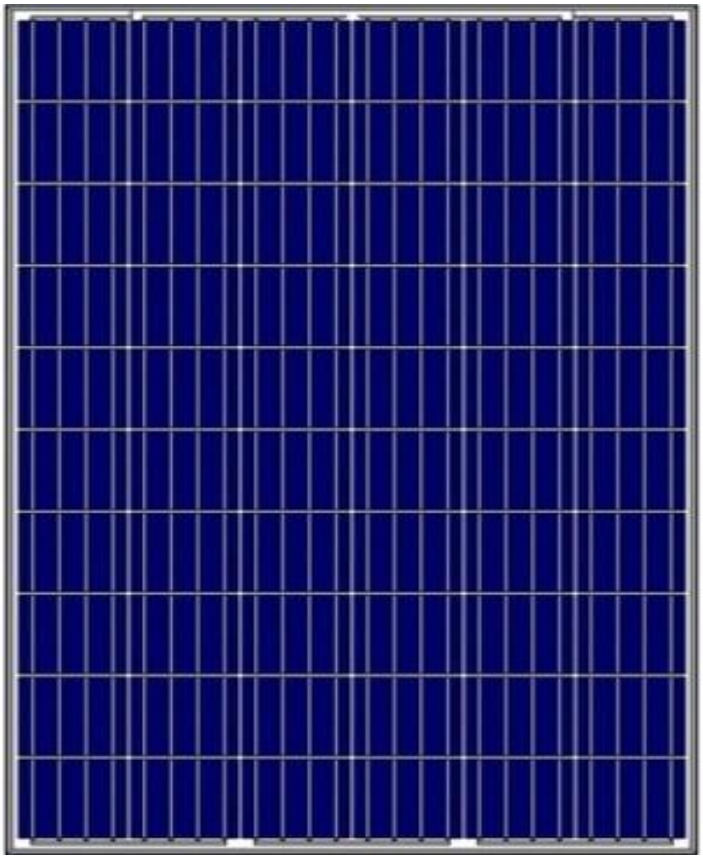


Fig: 2.7 Polycrystalline panels.

2.9.3 Hybrid Panels e g Panasonic panels

The main producer of hybrid panels is Panasonic (formerly Sanyo). Their HIT module which has a thin layer of formless solar film behind the monocrystalline cells. The extra amorphous layer extracts even more energy from the available sunlight, particularly in low light conditions. These are the most efficient panels available so they take up the least space on your roof.

Fig: 2.8 Hybrid Panel diagram

Unless you have a very small roof and want to extract the maximum amount of energy from it, we would not recommend using the hybrid panels at the moment. Hybrid panels are a lot more expensive than mono or poly-crystalline panels, so at the increase in energy produced does not justify the extra cost of buying them.

Never choose hybrid panels if there is space on your roof to tit the same amount of power with crystalline panels, otherwise you will just be paying lot more to generate the same amount of electricity.

2.10 Present performance of solar in World

The rising energy demand of developing countries has created concern about energy security. It is essential to use the unreadable feasibility of renewable organizations. Grid-connected PV systems have become the best option for renewable energy on large scale. Performance analysis of these grid connected plants can assist in the design, operation and maintenance of new grid systems. One of the countries is China which is in the direction of technology. In the world. The rising energy demand of developing

countries has created concern about energy security. It is essential to use the unreadable feasibility of renewable organizations. Grid-connected PV systems have become the best option for renewable energy on large scale. Performance analysis of these grid connected plants can assist in the design, operation and maintenance of new grid systems. One of the countries is China which is in the direction of technology in the world. The commercial concentrated solar power plant was first developed in the 1980s. The 392 MW Iwanpah installation is the world's largest concentrated solar power station in the desert of Muzov in California. There is a picture given below about performance of solar in word.

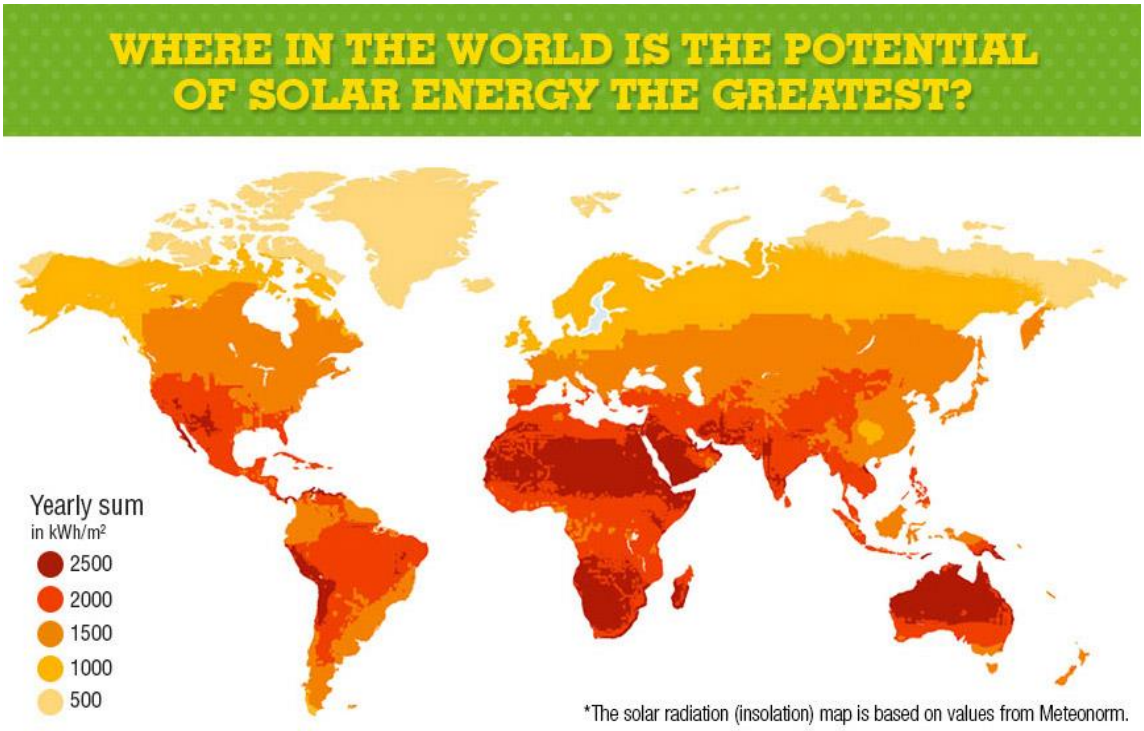


Fig: 2.9Solar performance of world.

Solar power consumption has decreased, hundreds of grid-connected solar PV systems are built and hundreds of megawatts are built with utility-scale solar power stations. Solar PV is quickly becoming a cheap, low-carbon technology to use faster renewable energy from the solar system. The largest photovoltaic power station in the world has 850 MW Long Island land Dam Solar Park in Qinghai, China.

Solar photovoltaics and frequent solar energy will contribute 16 and 11 percent of global electricity consumption by 2050, according to the International Energy Agency's 2014 release, and will be considered as the world's largest source of solar energy. Electricity Most solar installations will remain between China and India. In 2017, solar power provides 1.7% of global electricity generation, which increases 35% a year. [7]

2.11 Present performance of Solar in Bangladesh

As the time passes by, demand of energy is increasing with an increase in the world's population. From different corporations to small households, people need energy to perform daily tasks. As the science and technology is developing, people's lives are also becoming more complex .To meet energy demands, renewable energies such as solar is used besides other sources. This research intends to investigate whether there is any future prospect of solar energy in Bangladesh. It is an exploratory research.

Bangladesh is a south Asian country that is located in between latitudes 20°34' and 26°39' north and longitudes 80°00' and 90°41' east. Therefore, it is an ideal location for solar energy utilization. Also, as it is subtropical country, 70% of the year sunlight is plentiful.[8]

The daily sunlight hours in Bangladesh to range from 10 to 7 hours; they further reduced this by 54% (to 4.6 hours) to account for rainfall, cloud, and fog. [9] So, this rich solar energy has a large potential to be used in various sector in Bangladesh reducing the traditional fossil fuel-based power consumption and ensuring a green environment for the future generation.

2.12 Importance of Solar Energy for Rural Electrification in Bangladesh

Bangladesh is a small over populated developing country. In many remote areas of the country there is no supply of electricity. Rural electrification through solar PV technology is becoming more popular, day by day in Bangladesh. Solar Home Systems are highly devolved and particularly suitable for remote, distant areas. So in our country

the commercial of solar power system may do by some government as well as nongovernmental organization. The chance of the business is high in our country. Solar power systems are changing the face of rural Bangladesh. And it would be a billion dollar industry within a few years. At present there are 32 organizations doing solar energy business in Bangladesh. Solar insolation is the most abundant renewable energy source of Bangladesh.

2.13 Solar Home System (SHS)

Solar Home Systems (SHS) is the energy that is collected from a direct sunlight in a special way, the solar home system. Solar home systems work in rural areas, which is not yet connected with the grid, it is light and economically effective and environmentally friendly.

Fig: 2.10 Solar Home System

In mid-1990s renowned vitality specialists anticipated that oil, gas and coal will remain the significant fuel for power age until 2030. This will offer approach to petroleum gas turning into the general fuel in 2050; the fight between non-renewable energy sources and sustainable (sunlight based and wind) for control over world vitality market will start vigorously by 2060 and the fight will unmistakably swing for renewables by 2070. The scientists are beginning to believe that this will happen in a timeframe earlier than suggested above. There are two reasons for such notion: firstly, the advances in solar and wind technology have been and will continue to be fast moving, thus lowering the cost and becoming logistically more acceptable and secondly, the green lobby has successfully influenced the governments worldwide to be more proactive towards the campaign for renewable replacing fossil fuels.

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. At present the on-grid solar power generation capacity amounts to 15MW including one well-publicized solar park with 3MW capacity built on 8 acres of land in Sarishabari in Jamalpur district.

With such low level of development it would be impractical to believe that the growth of solar power would reach anything near the projected target by 2021. To date, the government has approved proposals for establishing 19 on-grid solar power parks submitted by different private companies. The SHS project has had a significant positive impact, reaching roughly 12 present of the entire Bangladeshi population. [10] Individually the proposed solar parks have generation capacity ranging from 5MW to 200MW and the cumulative power generation of all these installations would amount to 1070MW. Among these, only six companies have so far reached the final stage of negotiations by signing power purchase agreement (PPA) and implementation agreement with the government. According to the prevailing regulation, a company has to complete the construction and start power generation within one and a half years from signing the PPA and IA. Unfortunately, none of the companies could complete construction and start power generation till date although the deadlines have passed. From the above, it appears that the development of the on-grid solar has so far failed to provide a realistic hope of achieving projected government target. [11].

2.14 Solar Rooftop System (SRS)

A few urban communities and towns in the nation are encountering a considerable development in their pinnacle power request. City Corporations and the power utilities are thinking that its hard to adapt to this quick ascent sought after and thus the majority of the urban areas/towns are confronting serious power deficiencies. Different businesses and business foundations for example Shopping centers, Hotels, Hospitals, Nursing homes and so forth lodging edifices created by the manufacturers and designers in urban communities and towns use diesel generators for back-up power notwithstanding amid the day time.

Fog: 2.11 Solar Rooftop System

These generators limits shift from a couple of kilowatts to several MWs. By and large, in a solitary foundation more than one generator are introduced; one to cook the base load required for lighting and PC/other crisis tasks amid load shedding and the others for running ACs and different activities, for example, lifts/other power applications. With a goal to diminish reliance on diesel genets a plan to supplant them with SPV is being proposed. Further, so as to use the current rooftop space of structures, the plan proposes to advance rooftop top..

2.15 Conclusion

Sustainable power source, particularly sun based and wind control, as it is the main answer for power in future. All save of petroleum product, for example, gas, oil and coal, which are the key elements for traditional power age, will run out in the following couple of decades. Sustainable power source is vitality that is gathered from inexhaustible assets, which are normally recharged on a human timescale, for example, daylight, wind, rain, tides, waves, and geothermal warmth. It regularly gives vitality in four essential territories: power age, air and water warming/cooling, transportation, and

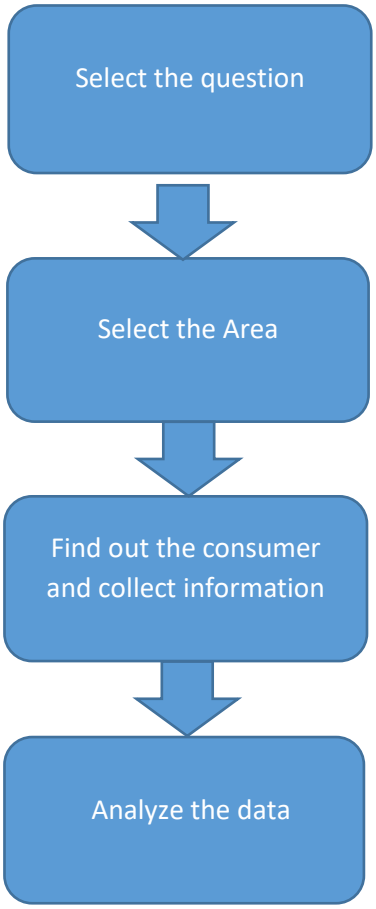
provincial (off-network) vitality administrations.. Bangladesh has a good future in solar power generation as the country can use its land to produce food and power simultaneously.

CHAPTER 3
Methodology

3.1 INTRODUCTION

Methodology Energies existed ample to find out Customer Desire of the Solar Rooftop System package in Bangladesh. The board populace of this investigation was the clients of Solar Rooftop System in Dhaka City who are provided benefits by the Solar Rooftop System benefit specialists. We select Zigatola as these zones close to Dhaka city so the reaction from the area to a ton degree will coordinate with the impression of the habitation of Dhaka. The examples were chosen by tolerating the handiness test process as there is no information available about the all .out number of clients of the Solar Rooftop System check in Bangladesh. This investigation utilized shape based study to gather required information. Both the adaptable and close-finished inquiries were incorporated into the survey. Overview was cautiously created and tried before it was finished. Sweats were finished to discover client culmination of the Solar Rooftop System benefit in Bangladesh.

3.2 Working Steps



3.3 Site selection

Dhaka

We survey Zigatola, Dhannondi,r,a , New road– Zigatola, Hazaribag, Sikdar Real Estate. We collect most of data from because it is central point of Zigatola and here many commercial building and market and house has many industry's societies.

Fig: 3.1 Dhaka survey area

3.4 Questionnaire

Table3.1: Description of questionnaires.

SL No:	Indicator	Questions	Description
1	Consumer Information	Owner Name: Consumer No: Name of the NOCS: Address:	We collect consumer information.
2	Information of Installment	i) Date of installation: Capacity: ii) What kind of solar rooftop system (SRS) are you installed? a) Do you use the electricity from your system? b) In which purpose?	Here, we talk about the installation date, capacity.
3	Maintenance	a) Is your SRS in operation? b) Do you test it regular basis? c) How many days ago? d) What is the main reason for the system disorder? e) Do you want to repair it? f) Do you get any training for SRS operation?	The consumers are do not how to clean it .The consumer have not enough knowledge about it .They were not any trained.

		g) Do you ever clean SRS? h) How often it is done?	
4	Consumer opinion	Do you think this SRS useful? Why do install this SRS? Do you think it is a waste of money? How much electricity do you get from SRS? a) Is the matter reading of this solar electricity taken? b) How often it takes place? Do you have any record on solar electricity? From where you bought SRS? a) Are you fed your solar electricity to the grid? b) Is there any support from govt.? Do you face any kind of survey? Do you want to increase the capacity of your SRS?	We told the consumer about benefit net metering system. Some consumer agree with us to develop their SRS capacity. Some consumers were unhappy because they think total system is useless and waste money,
5	Installment cost	What is the total cost of SRS? Inverter cost	We asked total installment cost of their SRS. Some consumers can give us clean information and some consumers cannot tell any thinks

3.5 Conclusion

A number of information gathered from the conglomerates who had the opportunity to go home. That was a lot of opportunity for us to survey, which would be more opportunity for us to increase the use of the Solar Rouge Top System on the next day. Most of the houses that I went to do not use the solar system, are inefficient. Some households have no battery connection with the solar system, there is no battery connection, why they are questioned most, they have lost their batteries, and the new battery are very expensive, so a new battery was not fitted. The number of Better connections in the house did not get the meter rating. They did not give the facility from the DPDC, enough idea about using our systems, give us the idea of how to serve them. They are more interested in using Solar Rooftop system in most of the houses. But if they get the correct idea of how they will study and how they will study, they can be used to provide more facilities from DPDC, they will use them again and many more new ones. Due to the provision of special training to the consumer interested in solar power system by any DPDC, they would benefit many and the new consumer demand would have increased. The main purpose of DPDC would be a lot easier. The demand for the grid used to be reduced, as the demand for electricity was reduced to such a large extent.

Chapter 4

Result

4.1 INTRODUCTION

Work environment should make the best utilization of their solar rooftops by introducing sunlight based boards to get control for their very own utilization and for the national network. The expense of power age will be much lower than that of the lattice control if housetop sun based boards are utilized. In the meantime, the plants would have the capacity to move their abundance power at the levy rate of the network control. Net metering is a charging component that credits sunlight based vitality framework proprietors for the power they add to the network.

4.2 Consumer information:

4.2.1 Area

Our survey experience was very good. In every area we try to collect information but sometimes we failed for some reason. In Sikder estate area we can collect only 6 consumer's information. Zigatola area 4 consumers, Hazaribag 2 consumers and Dannondi are 3 consumers.

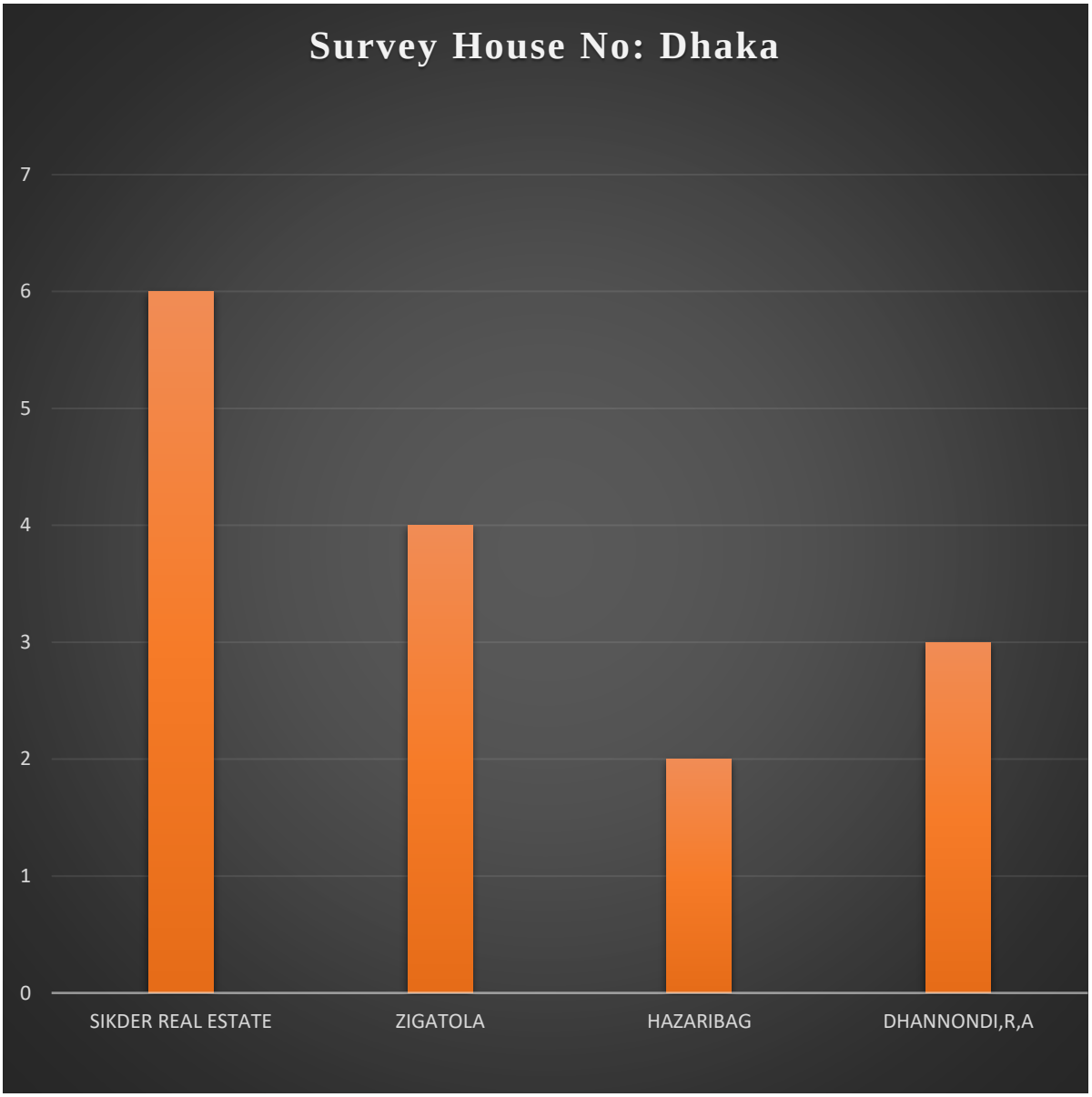


Fig. 4.1 Consumer information

4.3 Cost Analysis

Installment Cost

Some consumers installment cost are given below which collect from our survey at Dhaka, Zigatola

Consumer name: Common service Disney design and develop

Address: Plot-63,64, Sikdar,real easte,Rayer bajar

Date of installment: 06-03-2018 to 09-12-18

Capacity: 2.5 kW

Meter reading: 1255.896 kWh

Generation for 9 month=1255.896 kWh

Generation for 1 month =139.54 kWh

Generation for 1 year =1674.53 kWh

Life time generation=33490.57 kWh

Total cost of installment=177500

Per unit cost=5.3TK

4.4 Maintenance of SRS

4.4.1 SRS Cleaning

After discussing with a few people, they were unaware of the care of the house, and we went to the solar panel and found that most of them are dirty, leafy leaves, feathers and feathers. We know that we have to clean with water and water in the battery every week but they do not maintain adequate protection for them. For this, they have not enough solar energy. SRS cleaning that is showing fig in 4.4 below

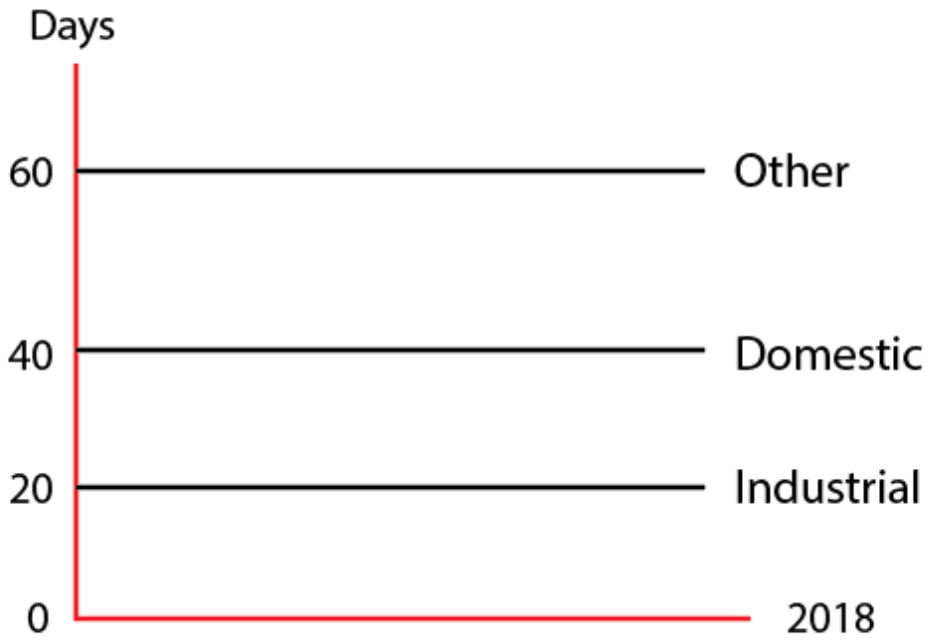


Fig: 4.2 SRS Cleaning time sector

4.4.2 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 and 1% trained which is showing in figure: 4.4

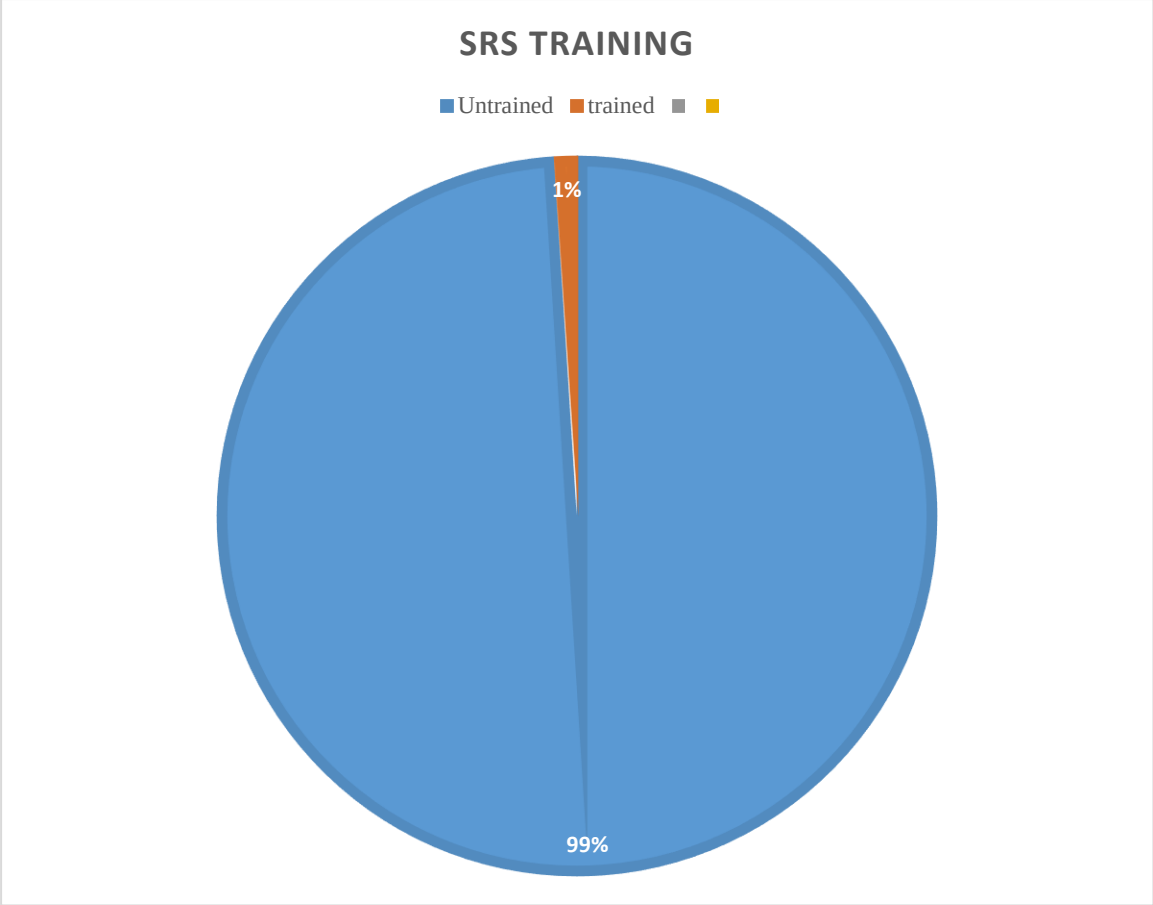


Fig.4.3 SRS Training

4.5 Installation Information

4.5.1 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.

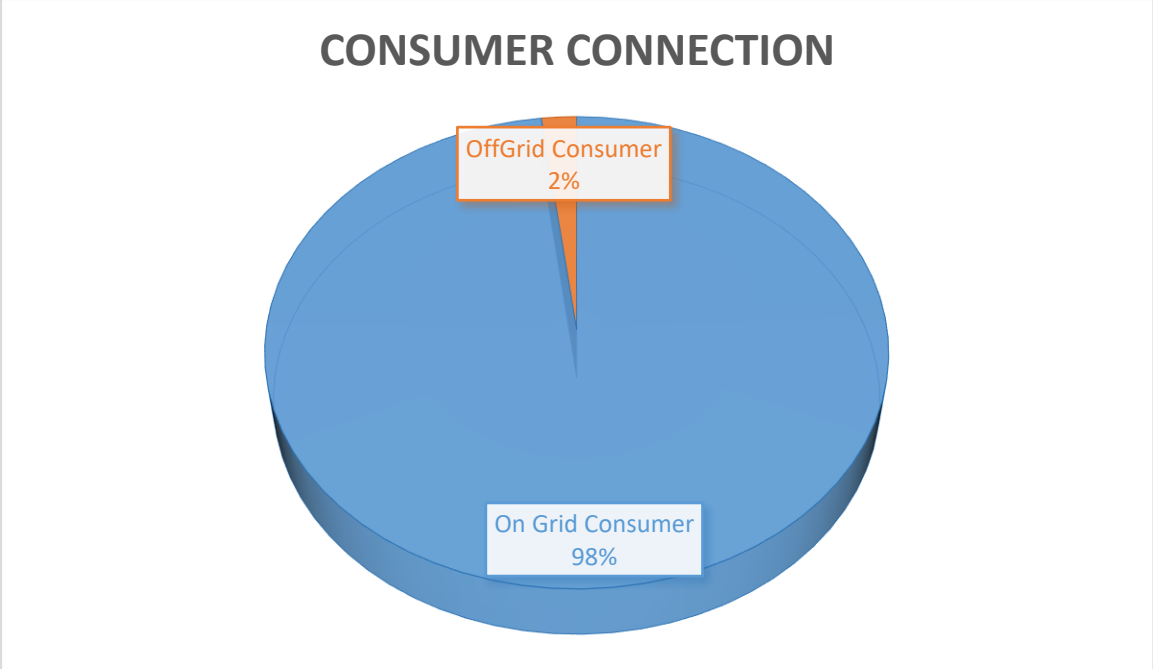


Fig.4.4 Consumer connection

4.6 Conclusion

Being concerned about roof damage with a solar panels installation certainly isn't unreasonable. Putting racking and solar panels on your roof alter one of the core parts of your home's structural makeup, and there are parts to the installation process that put your roof at risk if done incorrectly.

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CHAPTER 5

CONCLUSIONS

5.1 CONCLUSIONS

Sun powered vitality has the ability to give the majority of the vitality we will ever require. Albeit sun based home framework is very famous in Bangladesh, however sunlight based rooftop top framework can't do this. Certain limitations like high age cost, absence of adequate back up help by battery, visit battery substitution because of high rate of DOD, yield decrease because of shading Band dust collection, temperamental activity amid stormy seasons and overcast climates and so on posture genuine dangers to the wide scale utilization of SRS in future. As the off network rustic family units don't have any decision yet to utilize the SRS as it is the accessible wellspring of power, any PV based incorporated power age will change the general situation in the use of discrete sun based home framework. Because of the limitations in the current SRS set up, rustic families will be hugely profited by presenting sun oriented based little/smaller scale matrix idea. While being used, sun oriented boards make definitely no waste or discharges. Dissimilar to non-renewable energy source control plants, they deliver spotless, sustainable power source from a fuel source that requires no finding, unearthing, transportation, or burning. It's a less complex, less expensive, cleaner, and all-around better vitality arrangement. Renewable. Renewable source of energy, does not require dedicated land, and saves on precious water use, it is an environmentally benign option. Further, with grid interconnection and banking facility, the use of batteries, which have significant environmental implications, is also avoided. The sun is a ground-breaking source that can help our planet by giving us spotless, reusable vitality to control our reality. The utilization of this vitality is free, does not make contamination, and whenever utilized carefully can enable us to end up less subject to other all the more expensive and harming types of intensity. I trust you can see the advantages of this significant asset and help change the future for vitality use. We can reap this energy, but we should contribute more cash and future create and

ideal the innovation at hand. Therefore we trust that sun based vitality is the vitality requests including killing the contamination caused by different types of power age.

Presently a-days the force, elements and supportability of a development rely upon vitality. Thus, a nation can be considered as cultivated one on the off chance that it has adequate access to vitality as required for the modern, agrarian and monetary development. There are heaps of areas to utilize sun powered power in rustic zone of Bangladesh. Utilization of sun oriented power in family unit beneficial work, network wellbeing facilities, schools, association data focuses and surge/violent wind focuses in the remote and difficult to achieve regions, would not just upgrade personal satisfaction and profitability in the rustic territories yet additionally add to all the more quickly accomplish the Sustainable Development Goals (SDGs). In overview, it is discovered that smaller scale financing framework builds the reasonableness to buy a close planetary system in country territories. The job of SRS on family unit salary is seen to be very constrained, as SRS power is scarcely ever utilized profitably. Absence of learning and preparing on beneficial utilization of SRS and the non-accessibility of sun based electric machines are observed to be the principle explanations behind this circumstance. The SRS job on social advancement is increasingly sensational contrasted with encourage on financial improvement. Clear family lighting and natural air enhance instruction, wellbeing, encourages in access to data, correspondence, excitement, and increment recognition on security. These components get radical changes the customary public activity of country individuals. In spite of the fact that the utilization of SRS electric machine is somewhat constrained, way of life has altogether enhanced because of the accessibility of sun based power. Family unit individuals quote families work condition enhances because of electric lighting and shirking of lamp fuel related work. Sun oriented electric lighting broadens evening long stretches of family unit action. Staring at the TV, gainful exercises and the concentrate of school going youngsters are regular exercises profited from the all-encompassing night time. SRS power additionally enhances family conditions for training as it gives clear light and outside air just as longer contemplating hours for kids. If there should arise an occurrence of medical advantage, it is additionally discovered that SRS possessed family units get enhanced indoor air, accessibility of data on medical problems just as decreased mishaps identified with lamp oil use.

SRS-Household get information, education and entertainment for using TV, Radio and mobile phone. Due to widespread ownership of mobile phones, electricity from SRS is

becoming an essential factor for telecommunication in remote rural areas, where it constitutes the source of power to charge the cell phone batteries. Increased perception of safety and social activity due to social gatherings for watching TV and listening radio are also observed in SRS owned households. Reduction of carbon dioxide (CO2) emissions is observed in comparison to former utilization of kerosene for lighting purposes. But disposal of old batteries constitutes the only potential negative impact of SRS that might represent a serious threat to natural resources. Emphasizing old batteries collection and introduction of reliable battery recycling system can reduce the threat. Increase economic growth, quality education, health benefit and access to information can significantly improve the productivity, skill and livelihood of the rural people. In combination with other comprehensive rural development programmers, SRS will ensure sustainable socio-economic development in the long run. Human life directly depends on electricity. In Bangladesh, the generation of electricity is mostly dependent on gas and diesel fuel. Since these resources are limited, solar energy will be the main source of electricity. Researcher, policy maker, development partner acknowledged the immense prospect of solar electricity in rural area of Bangladesh. Despite the potential of solar electricity to catalyze rural development, access to this technology has not been translated into widespread adoption in rural area. Right incentives, policy alignment, development of local technological capabilities, political and institutional support is very much essential for sustainable and effective use of SRS. Now it is high time to integrate structural set up for using this untapped resource. [12]

5.2 Limitations of the Work

Set number of provider and absence of involvement in the sun based innovation showcase, coming about the high cost of SRS. So it is important to build innovation showcase. During Rainy season sometimes sunlight aren‘t available. Initial costing is high that‘s why some middle class family can‘t afford it. If Solar panel is damage then have to change the panel. [13]. This is the Installed Capacity not the output power. So Output may vary.

Solar radiation is not in consideration. Solar radiation is not same in all over the country.

1. All houses are not in south facing.

2. All the roofs are not in suitable condition to install RPV.

5.3 Future Scopes of the Work

A framework can both be obtained and financed specifically or through an outsider (by means of sun based renting or power buy assertion). The two alternatives require evaluating the net speculation cost as an initial step. This can be accomplished utilizing promptly accessible data, for example, demonstrative statements or qualities for comparative activities. On the off chance that a business opportunity for PV frameworks has not been set up in the nation, it might be important to get intermediary costs from business sectors in different nations. The net speculation cost is the expense of the framework less any cost counterbalances. The expense of the framework incorporates the segments and work for structure and establishment, task and upkeep, enthusiasm on advances, in addition to the expense of any required grants. Cost balances would incorporate duty credits, impetuses or refunds, yearly power investment funds, and any income from renting the rooftop .In the short word we can say the growing rate of SRS is around the middle class family & the poorest are still unable to afford it. Again one thing we can suggest to increase their research & development sector for having more new ideas. Some strategies could include:

1. Offer little framework, with the goal that underlying venture sum is decreased.

2. May make SRS progressively open to the needy individuals.

3. Installing SRS in school, school, market may expand working hour.

4. At present there are predetermined number of provider and absence of involvement in the sunlight based innovation advertise, coming about the high cost of SRS. Again the parts are not constantly accessible or hard to source. So it is important to build innovation advertise. Pops all together can make that conceivable.

These days with the expanding number of SRS establishment medical problem is including new measurement. Battery reusing process is obligatory undertaking for every association to guarantee the wellbeing and natural issue. Besides, at the best end

of the association tree, endorsed particular, rules and innovation ought to be refreshed as often as possible to keep running with present day vitality world. Again in the base of the association tree the need to expand their specialized preparing to guarantee the correct support benefit. Anyway there are grumbles that as of late introduced SRS execution is unquestionably exacerbated from the underlying establishments. So, figuring the future point of view of the SRS association should worry about their quality. Yet the developing rate of SRS is exceptionally noteworthy and that credit goes to accomplice association. Along these lines, we can trust that by expanding their administration they will put a genuine effect on the national power age.

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