

**ANALYSIS OF SOLAR ROOF TOP SYSTEM
UNDER DHAKA POWER DISTRIBUTION
COMPANY (DPDC) OF BANGLADESH**

**A Field study and Thesis work 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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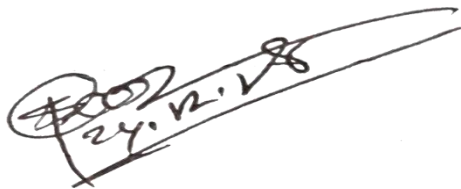
December 2018

TO
OUR BELOVED PARENTS
&
HONOURABLE SUPERVISOR
Dr. M. Shamsul Alam
Professor

Certification

This is to certify that this project and thesis entitled “analysis of solar roof top system under dhaka power distribution company (DPDC) of bangladesh” 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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LIST OF ABBREVIATIONS

SRT	Solar Roof Top
UNFCCC	United Nations Framework Convention on Climate Change
CDM	Clean Development Mechanism
SHS	Solar Home System
BPDP	Bangladesh Power Development Board
REB	Rural Electrification Board
LGED	Local Government Engineering Directorate
IDCOL	Infrastructure Development Company Limited
NGO	Non Government Organizations
MW	Mega Watt
PV	photovoltaic
AGM	Absorbed Glass Mat
DC	Direct-current
DPDC	Dhaka Power Distribution Company

List of Symbols

δ	Declination Angle
λ	Longitude
f	Fundamental Frequency
φ	Latitude
Θ_a	Solar Azimuth
λ_B	Bragg wavelength
n_{eff}	Effective index
ω	Angular frequency

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ABSTRACT

Daily headlines make everyone aware of the dangerous long-term effects of power generation from the fossil fuels. It is widely believed that continuing to depend on fossil fuels to generate electricity can cause serious environmental problems. Moreover, fossil fuels are finite in amount and cost a lot of money as well. Hence, renewable energy is a potential solution to meet up electricity demand for the developing countries like Bangladesh. Among all the renewable technologies, solar photo voltaic (PV) is the most potential, favorable and promising one which converts solar energy into electrical energy, including or excluding battery backup. Although solar technology has nearly been successful in rural areas where most of the technologies are adopted based on Solar Home System (SHS), it has not yet been effective in urban areas after the imposed rule of meeting 3% of light fan load of a building. We have investigated the installed solar rooftop of 86 houses in Narayanganj, where the solar system of most of the houses were found inactive. Among them only 50 systems are active. In this thesis the overall analysis of urban solar prospect has been done in three layers based on this investigation. A comparable discussion on cost efficiency of different solar panels has been given depending on amounts of loads being run. Efficient batteries are modeled by SHS in context of Bangladesh to improvise PV systems. A cost analysis has been performed by SHS for different types of watt peak ranges. Apart from these, a renovated design of solar system has been proposed to make urban rooftop solar installation effective and successful.

CHAPTER-1

INTRODUCTION

1.1 Background of the study

Power is among the most significant fundamental elements necessary to relieve lower income and also to produce socio-economic improvement of the nation. Fossil energy, sunshine, atmosphere, drinking water supply as well as nuclear energy grow would be the causes of power around the world. Main power source continues to be fossil energy however the book is actually decreasing. Fossil energy has been utilized although this gives off green house gas with regard to worldwide heating the industry risk in order to environment alter as well as environmentally friendly improvement. With this scenario environmentally friendly as well as safe power would be the main issue globally. Below these types of conditions there's a changeover underway within the power field. It's occurring because of decrease within fossil energy accessibility, decrease associated with worldwide emissions with regard to mitigating environment alter as well as power protection. Underneath the transformed viewpoint green power specifically solar power has become well-liked for this importance within factor in order to worldwide environment alter as well as co2 buying and selling prospective client. Un Construction Conference upon Environment Alter (UNFCCC) has had effort with regard to Thoroughly clean Improvement System (CDM). With this framework, solar power has become common supply of power around the world. To satisfy the actual developing need with regard to energy within the sectors, transport as well as home make use of numerous created nations happen to be utilizing solar power because green resources. This isn't just conference the larger part of power need but additionally supplying substantial socio-economic advantage as well as helping preserve thoroughly clean atmosphere. Bangladesh is a densely populated tropical country which has no sufficient supply of energy. At present around 62 percent (including renewable energy) of population has access to electricity, the per capita energy consumption is only 321 KWh per annum (Website: Power Division, GOB). Remaining 38 percent of the population depends on costly kerosene and natural sources. Bangladesh is still very

1.2 Statement of the problem

Energy program associated with Bangladesh depends upon fossil energy sources each within personal field as well as stateowned energy vegetation. Regarding 89% associated with produced energy originates from co2 emitting gas, fluid energy, fossil fuel as well as hydropower. The actual way to obtain gas isn't adequate to satisfy the actual need. Present gasoline manufacturing capability within Bangladesh can't assistance household requirements in addition to broader electrical power era for that nation. The present book associated with gas and oil is going to be worn out soon. Simultaneously globally there's a need with regard to thoroughly clean as well as environmentally friendly power. The requirement with regard to building green causes of power such as photo voltaic, blowing wind, bio-mass, and so on. includes a higher feeling associated with emergency. Like a exotic nation Bangladesh is actually rendered along with solar power. With this framework solar power is really a dependable, inexpensive as well as safe power for that nation. However the existing reveal associated with green power with regard to electrical power manufacturing is just 0. 5% from the complete. Main individuals associated with Bangladesh reside in non-urban places. There's powerful need energy accessibility within remote control towns. Bangladesh offers inlayed along with lots of solar power. We now have a lot possible to become a photo voltaic electricity-rich nation. Institutional, monetary as well as technical abilities behave as key elements with regard to achieving the preferred degree of photo voltaic electrical power manufacturing as well as utilizations. However we now have insufficient info as well as incorporated investigation with this area.

Solar energy based rural electrification begun in the country in 1988 at Norshingdi. Bangladesh Power Development Board (BPDB), Rural Electrification Board (REB), Local Government Engineering Directorate (LGED), Infrastructure Development Company Limited (IDCOL) and a significant number of private sector agencies including Non Government Organizations (NGO) are involved in solar electricity development.

1.3 Objectives of the research

The objectives of the study are as follows:

- To know the present condition of SRS in Bangladesh and the opinion of the consumers about it.

- Calculate the per unit cost of solar electricity
- Try to make concern consumers about the usefulness of using SRS system.
- Find out the problems that consumers are facing when they are using SRS.
- To give information to the consumers about net metering system of on grid SRS

1.4 Significance of the study

Bangladesh is really a exotic nation associated with huge solar power. However an extremely small quantity of it's utilized. Although the beginning associated with SHS within Bangladesh is at 1988 however it had been untrained for a long time. Through this time around numerous programs associated with photo voltaic electrical power sometimes appears around the world. Now-a-days Cell offers electrical power with regard to photo voltaic vaccine fridge, photo voltaic drinking water disinfection (SODIS), photo voltaic meals more dry as well as photo voltaic pasteurization. This can help with regard to decreasing waterborne illnesses. Photo voltaic telephone, photo voltaic Wi-Fi, photo voltaic stereo improve non-urban conversation, decreases transportation price as well as decrease electronic separate. Next to photo voltaic oven as well as photo voltaic drinking water heating system, dependence upon conventional energy sources for example wooden or even grilling with charcoal, decreases interior air pollution as well as co2 emission. This particular raises the caliber of existence within non-urban places, enhance health insurance and training, decrease essential oil addiction, improve nearby work as well as decrease deforestation. Solar energy actions guide non-urban improvement.

Because of insufficient info as well as research SHS can be used just for home illumination within Bangladesh.

Photo voltaic irrigation technologies can also be obtaining well-liked within Bangladesh. Because farming dependent nation, utilizing solar energy irrigation program will be a main generating pressure with regard to non-urban improvement.

1.5 Limitations of the study

Throughout area function a few restrictions tend to be experienced. They are: Non-availability associated with Paperwork: 1 problem may be the trouble within collecting recorded info through

authorities. In some instances paperwork might not be discovered easily available as well as regarded as private.

Restricted period: Period is actually an additional restriction within the area function. Time provided for that information selection is actually as well brief. Qualitative research demands additional time to investigate information whilst collecting info. In the exact same occasions it might additionally require additional time in order to restructure its style within the gentle associated with brand new advancements as well as experience.

1.6 Outline of the study

Following a intro the 2nd section of the statement may concentrate on overview of chosen books as well as conceptual summary of SHS within socio-economic improvement. Within 3rd section, it'll talk about the actual strategy from the investigation. The actual 4th section is actually evaluation from the information, outcomes as well as conversations. The actual 5th section is actually findings as well as suggestions as well as of the statement.

Chapter-2

LITERATURE REVIEW

2.1 Introduction

Inexpensive, obtainable as well as safe way to obtain power performs the generating pressure with regard to improvement of the nation. Numerous current research uncover exactly how non-urban electrification through solar energy particularly assists within socio-economic improvement from the nation in a variety of methods. With this situation, solar power is actually regarded as the guaranteeing technologies with regard to electrical power era within remote control area from the building nations. This particular efforts to pay attention to the actual overview of chosen books, crucial idea of photo voltaic electrical power because generating pressure with regard to socio-economic improvement, problems as well as elements effecting socio-economic improvement such as home earnings, wellness, training, farming manufacturing, use of info along with other infrastructural providers.

2.2 Renewable energy

Green power is actually power that's produced through organic procedures which are constantly replenished. Including sunshine, geothermal warmth, blowing wind, tides, drinking water, as well as numerous types of biomass. This particular power can't be worn out and it is continuously restored.

2.2.1 Wind power

Blowing wind can be viewed as a kind of solar power simply because wind gusts tend to be brought on by the actual unequal cooling and heating from the environment through the sunlight (as nicely since the rotator from the planet along with other topographical factors). Blowing wind circulation could be taken through generators as well as changed into electrical power. On the scaled-down size, windmills continue to be utilized these days in order to pump motor drinking water upon farming Just how can a business utilize it? Blowing wind is among the durability suggestions with regard to

company that may be integrated in order to reduce company electrical power expenses. Commercial-grade wind-powered producing techniques can be found to satisfy the actual green power requirements of numerous businesses:



Fig 2.2.1: Wind power

Single wind generators produce electrical power like a health supplement for an organization's current electric provide. Once the blowing wind hits, energy produced through the program would go to counteract the requirement with regard to utility-supplied electrical power.

- Utility-scale blowing wind farming produce electrical power that may be bought about the at wholesale prices energy marketplace, possibly contractually or even via a aggressive bet procedure

2.2.2 Hydroelectric power

Probably the most acquainted kind of hydroelectric energy is actually produced with a program by which dams tend to be built in order to shop drinking water inside a tank. Whenever launched, water moves via generators to create electrical power. This particular is called “pumped-storage hydropower”-water is actually cycled in between reduce as well as top reservoirs to manage electrical power era in between occasions associated with reduced as well as maximum need. An additional kind, known as “run-of-river hydropower, ” funnels some associated with water circulation via a funnel as well as doesn't need a dam. Hydropower vegetation may variety in dimensions through substantial tasks such as the Haier Dam in order to micro-hydroelectric energy techniques.

Just how can a business utilize it? Immediate utilization of hydroelectric energy is actually normally determined by geographic area. Presuming the reliable river supply is available as well as obtainable, it may be utilized in the next methods:

- Micro-hydroelectric vegetation could be built to provide electrical power in order to plantation as well as farm procedures or even little cities.
- Small cities may funnel the power associated with nearby rivers because they build moderately-sized hydroelectric energy techniques.



Fig 2.2.2: Hydroelectric power

2.3 Solar panel

Solar power panels create electrical power through sunshine. The very first photo voltaic panel-powered satellite television premiered within 1958 through Hoffman Consumer electronics. The cell includes quantity of solar (PV) solar panels linked within sequence as well as parallel. These types of tissue comprise associated with a minimum of 2 levels associated with semiconductor materials (usually real silicon infused along with boron as well as phosphorous). 1 coating includes a good cost; another includes a damaging cost. Whenever attacks the actual cell, photons in the gentle tend to be soaked up through the semiconductor atoms, which in turn discharge electrons. The actual electrons, moving in the damaging coating (n-type) associated with semiconductor, circulation towards the good coating (ptype), generating an electric present

2.4 Why use solar power

The primary causes of world's power era would be the fossil energy sources (gas, essential oil, coal) as well as nuclear energy vegetation. Because of the using fossil energy sources, green house gas (CFC, CH₄, O₃, however primarily CO₂) give off to the environment. In the nuclear energy grow, co₂ is actually launched inside a bit (90 gr equal associated with co₂ for each kilowatt hour). [1] However the radioactive waste materials continues to be energetic more than 1000 many years the industry possible supply of environment air pollution.

Figure1 implies that electrical power era is actually supply of the greatest emission associated with co₂. Therefore, manufacturing of the thoroughly clean power is really adding the greatest in the direction of worldwide heating. Worldwide heating along with the environment air pollution is actually, within our occasions, the best environment risk in order to individual.

However, there's a good worrying power turmoil worldwide because fossil energy supplies reduce and also the aging energy vegetation are likely to near within not too distant future.

. Since the planet gets 3. 8 YJ [1YJ = 10²⁴ J] of one's that is 6000 occasions more than the actual sides usage. [3]

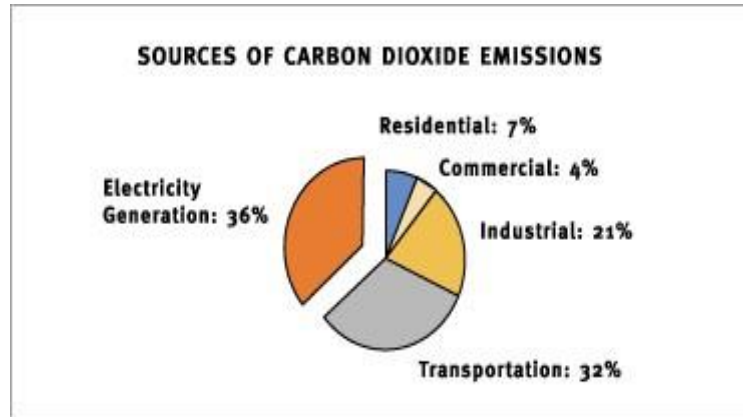


Figure2.4: Sources of carbon dioxide emissions [2]

The existing energy era capability is just close to 4200 MW while the entire energy necessity is actually 6000 MW. [4] Therefore, we could produce just 70% in our complete electrical power need. For this reason lack associated with electrical power not just we're dealing with fill losing in the united states but additionally the actual commercial field is actually terribly impacted. Leading to decreased commercial result as well as reduced foreign trade income.

2.5 Works on solar technologies around the world

You will find large functions, investigation, thesis, execution, style thing to consider as well as Enhancement upon photo voltaic systems is being conducted all over the world in addition to within our nation. That's the reason we now have a lot more than thirty-five [5] organization conducting business, execution as well as investigation upon photo voltaic systems.

College college students world wide dealing with photo voltaic program. Such as Several college students associated with Ahsanullah College associated with technology as well as technologies created the photo voltaic program for his or her college.

Commercialbuidings, homes, workplaces, businesses tend to be setting up photo voltaic program with regard to eco-friendly power. Like the biggest photo voltaic driven creating within Dezhou, Shangdong Land within northwest The far east [7].

The above mentioned image may be the biggest photo voltaic driven creating as well as it will likely be the actual location from the fourth globe photo voltaic town our elected representatives.



Figure 2.5.a: The largest solar power building in northwest china

Several college students from the Pa Condition College offers created as well as simulated the Dispersed solar program for his or her college because their own thesis. Once again Rajamangala College ofTecnology Thanyaburi associated with Thailand set up photo voltaic program for his or her college to advertise solar power task. Scientist focusing on building the actual solar power panels, such as scientist korea as well as Ca offers create a brand new method of improving the actual effectiveness associated with plastic material solar power panels [6].



Figure 2.5.b: 100% solar powered stadium in Taiwan.

The actual fig 3 implies that the actual 100% photo voltaic driven creating within Taiwan. It's 8, 840 solar power panels within the roofing and may create 1. fourteen zillion kWh/year. Through this particular it may avoid 660 a lot of co2 release a within the atmosphere [8].

Website as well as fill dependent: The actual solar energy is actually website or even area dependent. Solar energy was created as well as provided from the specific area to some specific consumer/s. This kind of as- a home or even condo may use it's roof, yard, backyard and so on in order to put into action their own photo voltaic program to find the preferred energy. Next to the solar energy grow is made for a specific quantity of fill, this kind of as-Sarnia Solar Energy Grow associated with North america may provide eighty MW associated with energy [9], Olmedilla Solar Recreation area associated with The country may provide sixty MW associated with energy [10].

2.6 Types of solar system design

There can be various types of solar system design. But there are three basic design consideration, they are- 1. Grid tie

2. Off-grid
3. Stand alone

2.7 Solar PV technologies

Using the developing need associated with solar energy brand new systems are now being launched as well as current systems tend to be building. You will find 4 kinds of photovoltaic tissue:

- Single crystalline or even mono crystalline

- Multi- or even poly-crystalline

- Thin movie

- Amorphous silicon

Single-crystalline or even mono crystalline: It's accessible and also the most effective tissue supplies amongst just about all. These people create probably the most energy for each sq . feet associated with component. Every cellular is actually reduce from the solitary very. The actual wafers after that additional reduce to the form of rectangle-shaped tissue to maximise the amount of tissue within the cell.

Polycrystalline tissue: These people are manufactured from comparable silicon materials other than which rather than becoming developed right into a solitary very, they're dissolved as well as put right into a mildew.

Amorphous Silicon: Amorphous silicon is actually most recent within the slim movie technologies. With this technologies amorphous silicon watery vapor is actually transferred upon a few mini meter heavy amorphous movies upon stainless comes. [13] When compared to crystalline silicon, this particular technologies utilizes just 1% from the materials. Desk 1 beneath exhibits the actual effectiveness associated with various kinds of solar panels.

Table 2.7: Efficiency of different types of solar cells

Cell type	Efficiency, %
Mono crystalline	12 – 18
Polycrystalline	12 – 18
Thin film	8 – 10
Amorphous Silicon	6 – 8

2.8 Components of a solar PV system

A typical solar PV system consists of solar panel, charge controller, batteries, inverter and the load.

Figure 2 shows the block diagram of such a system.

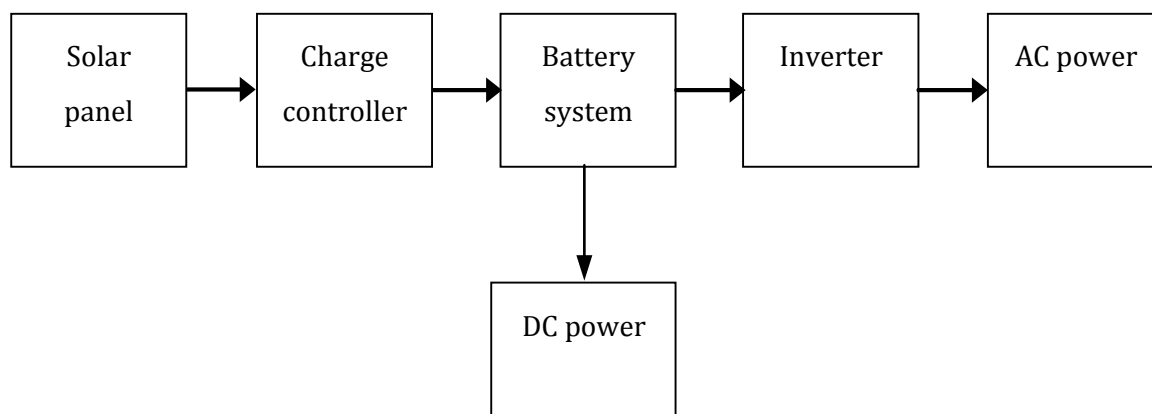


Figure 2: Block diagram of a typical solar PV system

2.9 Charge controller

Whenever electric battery is roofed inside a program, the need associated with cost controller arrives ahead. The cost controller regulates the actual unclear voltage develop. Inside a vibrant sun-drenched day time the actual solar panels create much more voltage which can result in electric battery harm. The cost controller helps you to keep up with the stability within getting the actual electric battery. [14]



Figure 2.9: Charge Controller

2.10 Batteries

In order to shop costs electric batteries are utilized. There are lots of kinds of electric batteries available for sale. However all are not really ideal for photovoltaic systems. Mainly utilized electric batteries tend to be nickel/cadmium electric batteries. There are several other forms associated with higher power denseness electric batteries this kind of as- sodium/sulphur, zinc/bromine circulation electric batteries. However for the actual moderate phrase electric batteries nickel/metal hydride electric battery has got the greatest biking overall performance. With regard to the long run choice iron/chromium redox as well as



Figure 2.10: Batteries

2.11 Inverter

Cell creates dc electrical power however the majority of the home as well as commercial home appliances require air conditioning present. Inverter changes the actual dc present associated with solar panel or even electric battery towards the air conditioning present. We are able to separate the actual inverter in to 2 groups. [16] These people are-

- Stand alone and
- Line-tied or utility-interactive



Figure 2.11: Inveter

2.12 Working Of Photovoltaics

Pv would be the immediate transformation associated with gentle in to electrical power in the atomic degree. A few supplies display a house referred to as the actual photoelectric impact that triggers these phones soak up photons associated with gentle as well as discharge electrons. Whenever these types of free of charge electrons tend to be taken, an electrical present outcomes you can use because electrical power. The photo voltaic cellular (also known as solar cellular or even photoelectric cell) is really a strong condition electric gadget which changes the power associated with gentle straight into electrical power through the solar impact. Crystalline silicon PHOTO VOLTAIC tissue tend to be the most typical solar tissue being used these days.

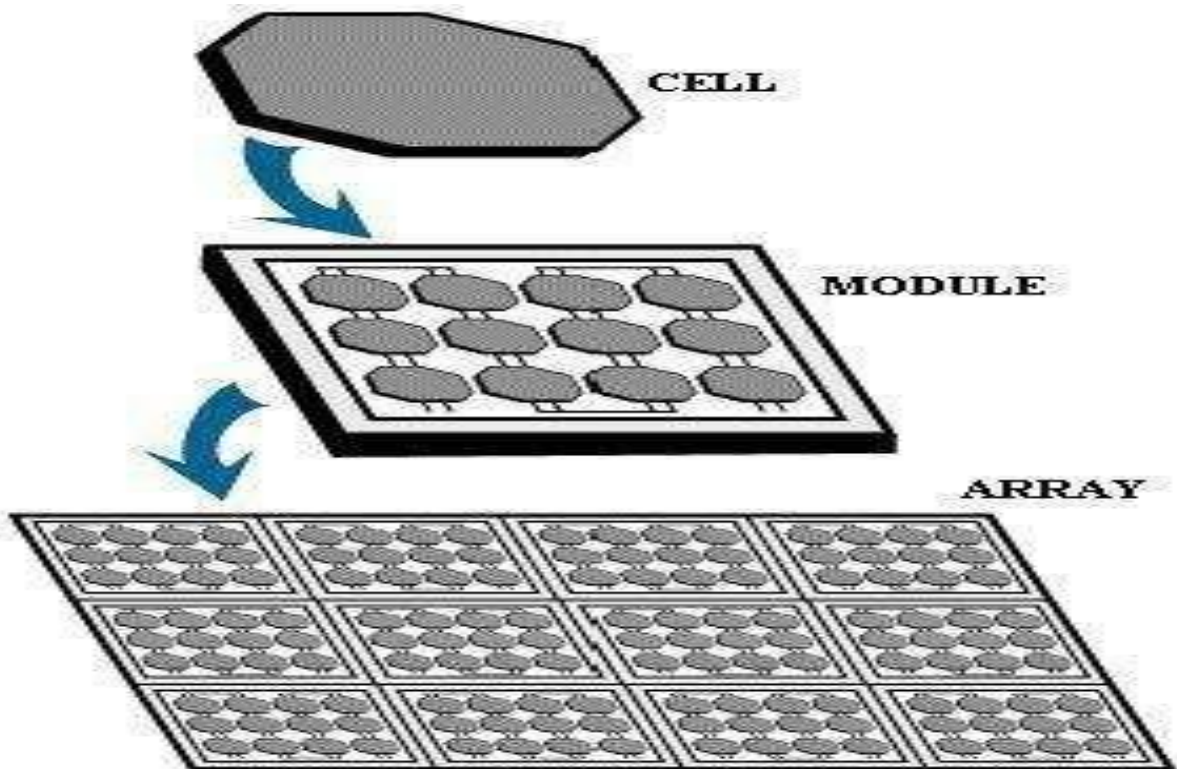


Figure 2.12: Photovoltaic panel or array

Numerous solar panels electrically linked to one another as well as installed inside a assistance framework or even body tend to be known as the solar component. Quests are made to provide electrical power in a particular voltage, like a typical 12 volts program. The present created is actually straight determined by

just how much gentle attacks the actual component. Several quests could be " cable " collectively to create a wide range

2.13 Types Of Solar Trackers

There are two types of tracking systems they are

- Passive tracking
- Active tracking

2.13.1 Passive Tracking Systems

The actual unaggressive monitoring program understands the actual motion from the program through the use of a minimal cooking stage fluid. This particular fluid is actually vaporized through the additional warmth from the sunlight as well as the middle of bulk is actually altered resulting in how the program discovers the brand new balance placement.

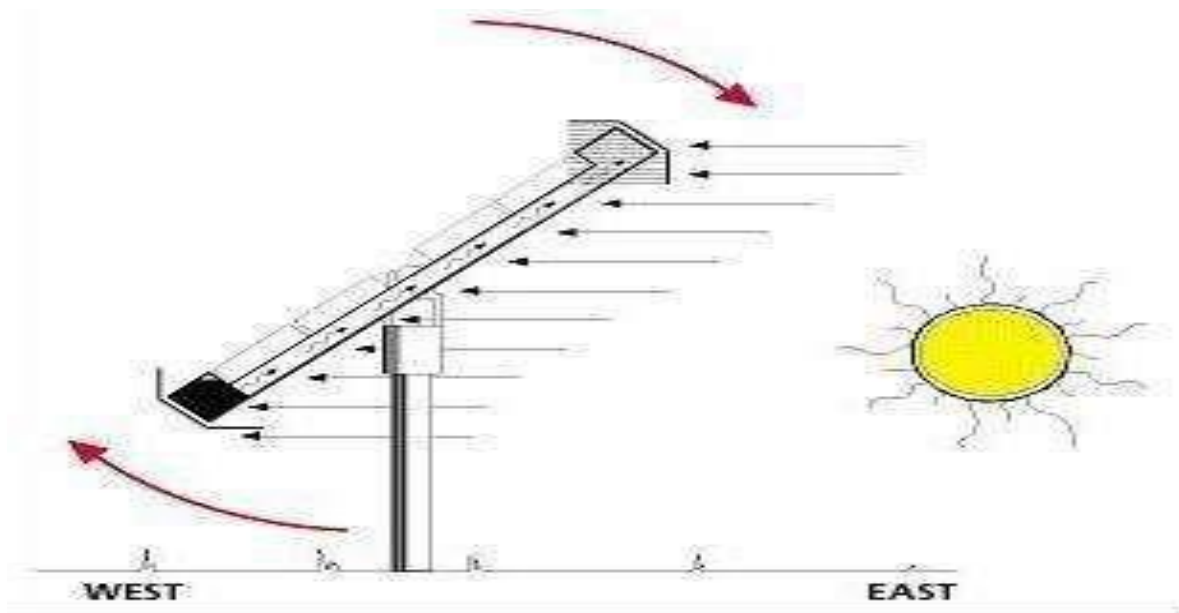


Figure 2.13.1: Passive tracking system

2.13.2 Active Tracking Systems

The two basic types of active solar tracker are single-axis and double-axis.

2.13.2.1: (A) Single Axis Trackers

The single axis tracking systems realizes the movement of either elevation or azimuth for a solar power system. Which one of these movements is desired, depends on the technology used on the tracker as well as the space that it is mounted on. For example the parabolic through systems utilize the azimuthally tracking whereas the many rooftop PV-systems utilize elevation tracking because of the lack of space. A single-axis tracker can only pivot in one plane – either horizontally or vertically. This makes it less complicated and generally cheaper than a two-axis tracker, but also less effective at harvesting the total solar energy available at a site. Trackers use motors and gear trains to direct the tracker as commanded by a controller responding to the solar direction. Since the motors consume energy, one wants to use them only as necessary

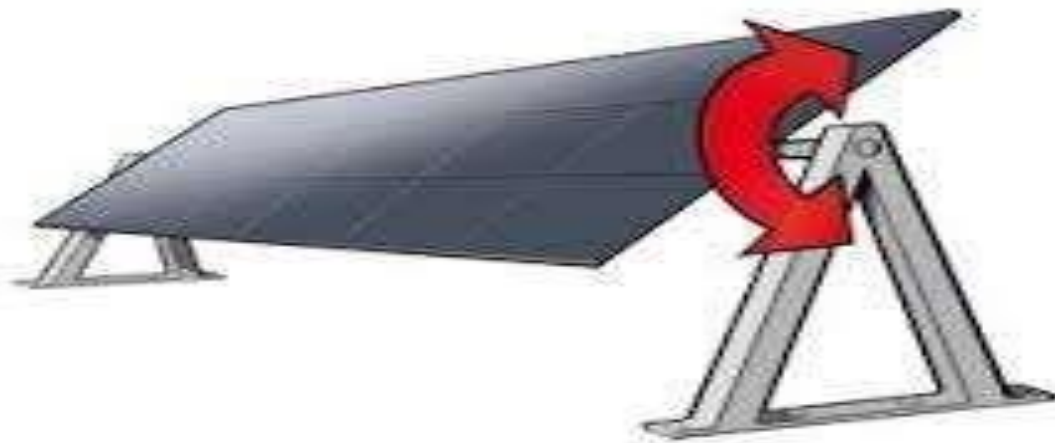


Figure 2.13.2.1(A): Single axis solar tracker

The actual solitary axis monitoring techniques understands the actual motion associated with possibly height or even azimuth for any solar energy program. That one of these simple actions is actually preferred, depends upon the actual technologies utilized on the actual tracker along with the room that it's installed on. As an example the parabolic via techniques make use of the azimuthally monitoring while the numerous roof PV-systems make use of height monitoring due to the insufficient room. The single-axis tracker may just pivot in a single airplane -- possibly flat or even vertically. This particular causes it to be simpler as well as usually less expensive than the usual two-axis tracker, but additionally much less good at cropping the entire solar power offered at a website. Trackers make use of engines as well as equipment locomotives in order to immediate the actual tracker because instructed with a controller answering the actual photo voltaic path. Because the engines eat power, I really wants to rely on them just because required

2.13.2.2(B) Dual Axis Trackers

Twin axis trackers because proven within the determine two. 6 possess 2 examples of independence which behave as axes associated with rotator. Double-axis photo voltaic trackers, since the exact same recommend, may turn concurrently within horizontally as well as up and down instructions, as well as utes to can stage precisely in the sunlight all the time in a area.



Figure 2.13.2.2.(B): Dual-axis solar tracking

2.14 Working principle of the tracker

Determine proven this is actually the monitoring gadget within away prototype. It's the the one that comes after the actual sun's motion through your day and offers continuous representation in order to the solar panel. The sun's rays sun rays may drop about the cell within 2 methods, that is, they'll drop on the actual cell as well as the reflector may reveal the actual event sun rays about the cell. Assume during the time of sunlight increase the sun's rays is within severe eastern the actual reflector may line up by itself in certain placement through which the actual event sun rays may drop about the cell. Right now once the planet revolves and also the sunlight will get altered type it's previously placement the actual representation from the event sun rays will even alter. Therefore consequently the actual gentle may drop about the sensors kept upon every aspect from the cell. The actual monitoring signal is really created that after representation drops upon state the actual sensor mounted on the best from the solar panel, the actual tracker may proceed for the remaining, as well as visa-versa.

2.15 Circuit Operation

Within our task we now have make use of cell in order to transform the actual gentle power to the electrical power. The sun's rays alter it's placement during the day that's the reason why all of us can't in a position to make use of the entire gentle power therefore we now have created the monitoring program by which cell could be turn according to the sun's rays modifications it's placement. We now have make

use of the 4 LDR Sensor in order to feeling the actual gentle and when the sun's rays alter it's placement after that particular LDR Sensor feeling the actual gentle as well as produce the greatest Voltage transmission which greatest voltage transmission given towards the comparator IC in addition to leftover devices additionally provide it's produced voltage degree towards the Comparator IC. Just about all Voltage transmission from the every LDR sensor which are in comparison through the LM324 tend to be given towards the microcontroller. Microcontroller have the voltage transmission in the any kind of i/o pin number from the controller as well as even comes close the actual every LDR result transmission in order to along with every LDR sensor result. Once the controller discover the Greatest voltage degree of any kind of LDR sensor provides the coaching towards the engine with the engine car owner signal in order to turn the actual cell about the solitary axis toward the actual LDR sensor that are producing greatest voltage result.

2.16 Selecting the PV module

Once we require large power as well as all of us don't have large region. Therefore, all of us chosen mono crystalline silicon component. The component choice depends upon price as well as effectiveness. The administrative centre expense associated with photovoltaic solar panel is extremely higher. Around, 60% from the complete program set up price is actually the buying price of component price. We ought to think about the price to get the very best result from the investment property. Price differs upon effectiveness associated with solar panel and also the materials may be accustomed to help to make the actual PHOTO VOLTAIC solar panel. The price of silicon photo voltaic cellular is extremely higher. Within our style all of us utilized mono crystalline silicon cellular.



Figure 2.16: Samsung LPC250S solar module

Fig. fourteen exhibits the actual Samsung photo voltaic component and also the design is actually LPC250S. It's optimum result energy is actually two hundred and fifty watt. In the event that irradiance is actually 1000 w for each meter sq . then your module's minimal energy result is actually two hundred watt in the event that irradiance is actually eight hundred w for each meter sq .. The actual irradiance associated with Dhaka Town is actually 694. '04 w for each meter sq .. Therefore all of us can get energy under two hundred w, around 173. fifty-one w. twenty five many years energy result guarantee is actually 80%. The actual solar panel effectiveness is actually 15. 62%. Brief signal present from the solar panel is actually 8. 66A from regular check situation as well as 6. 90A from minimal situation. [17.

2.17 Inverter selection

We selected a PV grid tied inverter. The model is ZZ-ZB10kW. It is a product of ZONZEN of China [18].

- The MPPT voltage range: 100-150 V
- Output power: 10kW
- Connection: 50Hz grid frequency and 3 phase 4 wire connection
- The efficiency of this inverter: 97%. • AC voltage: 230 Volt.



Figure 2.17:ZONZEN ZZ-ZB 10kW grid tie inverter

2.18 Combiner box selection

The model of selected combiner box is SMA SCCB-10 [19]

- The no of input circuit: 12
- Maximum input fuse rating: 20 A, 600V DC
- Maximum output current: 240 A DC



Figure 2.18: The SMA SCCB-10 combiner box

CHAPTER-3

METHODOLOGY & SYSTEM DESIGN

3.1 Introduction

This particular research is made to discover the actual effects associated with SHS within remote control non-urban regions of Bangladesh. The research is dependant on main information. Supplementary resources will also be utilized. Because of technology-based interpersonal investigation, a combination of qualitative as well as quantitative methodological methods tend to be used. Common info concerning the SHS dissemination developers as well as socio-economic effects associated with photo voltaic electrical power is actually gathered through supplementary supply as well as selection interviews along with nearby specialists. Main information from the research tend to be gathered with an considerable home study technique utilizing a set of questions.

3.2 Flow chart of the working procedure

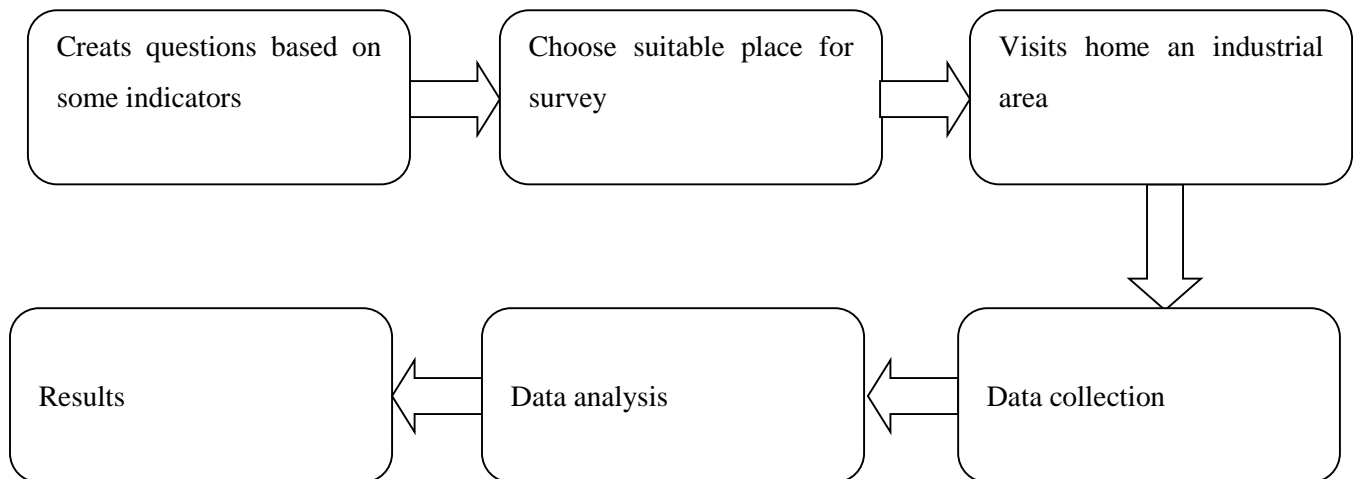


Figure 3.2: Flow chart of the working procedure

3.3 Site Selection

All of us study with regard to photo voltaic roof program (SRS) under(DPDC) website choice of narayangonj group. We're 2 team split with regard to study narayangonj western as well as narayangonj Eastern. We as well as my personal team fellow member go to narayangonj western a few house as well as business, All of us inform regarding photo voltaic person customer as well as gather information. All of us perform a few queries photo voltaic roof program for that customer.

With this the main style, the place that the program could be constructed, the actual accessibility to sunshine, these types of problems tend to be nicely examined. Since the whole worth from the program is determined by sunshine. With respect to the dimension from the solar panel, just how much room it'll need is set. Theperformance from the program is definitely great for the actual PHOTO VOLTAIC solar panel.

3.4 Site Selection map

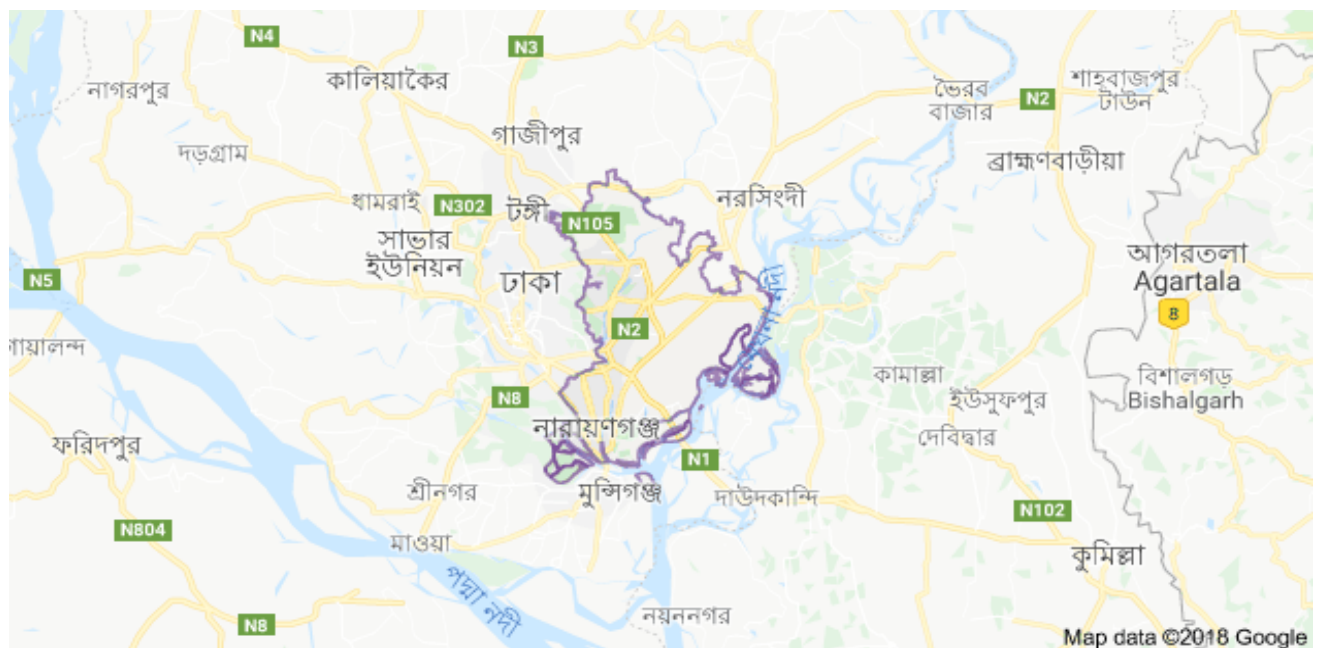


Figure 3.4: Site selection Narayangonj

We're study with regard to photo voltaic roof program (SRS) under(DPDC) website choice of narayangonj group. We're 2 team split with regard to study narayangonj western as well as narayangonj Eastern. Me personally as well as my personal

group member visit narayangonj west some home and industry, We tell about solar user consumer and collect data. We do some questions solar rooftop system for consumer.

3.5 Survey Questionnaires for (SRS) under DPDC

Table 3.5: Table for Survey Questionnaires for (SRS) under DPDC

1	Consumer information	<ul style="list-style-type: none"> ➤ Owner Name ➤ Name of the NOCS ➤ Address ➤ Phone No ➤ Does your organization rent or own the property? 	In this question section, we have just collected basic information about consumers
2	Information of installation	<ul style="list-style-type: none"> ➤ What kind of solar rooftop system (SRS) are you installed? ➤ Why do you install this SRS? ➤ From where you bought SRS? 	We asked the consumer about the installation date, some consumer installed on the grid and some are off-grid SRS.
3	SRS Operation	<ul style="list-style-type: none"> ➤ What kind of solar rooftop system are you using? ➤ Is your SRS in operation? ➤ Do you get any training for SRS operation? 	We asked the consumer about the operation of SRS
4	Maintainance	<ul style="list-style-type: none"> ➤ Do you ever clean your SRS? ➤ How often it is done? ➤ Do you test the regular basis? ➤ How many days ago? 	We asked the consumer about SRS clean and monitoring
5	Cost analysis	<ul style="list-style-type: none"> ➤ What is the total cost of SRS? ➤ Do you think it is a waste of money? 	We asked some question about cost analysis of SRS

6	Consumer satisfaction	<ul style="list-style-type: none"> ➤ Are you fed your solar electricity to the grid? ➤ Is there any support from govt? ➤ Are you satisfied using solar rooftop system and Further increase the capacity of your SRS? ➤ Do you think this SRS is useful? ➤ Do you use the electricity from your system? In which purpose? 	We asked some question consumer about the satisfaction of solar rooftop system
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CHAPTER-4

RESULTS AND DISCUSSIONS

4.1 Introduction

The actual worldwide heating because of green house gasoline emission and also the power shortage globally tend to be compelling just about all the actual nations on the planet to consider option causes of power for example nuclear as well as renewables for example photo voltaic, blowing wind, geothermal as well as influx powers, that don't trigger co2 emission. While created nations may make use of nuclear power, the building nation such as Bangladesh isn't luckily enough to possess which choice obtainable. As a result, the only real choice that's available to Bangladesh right now is actually green power for example photo voltaic as well as hydro-electric. Bangladesh is really a semi-tropical area laying within northeastern a part of Southern Asian countries will get plentiful sunshine all year round. We're performing to go to narayangonj photo voltaic roof system(under DPDC). Therefore the complete customers associated with narayangonj tend to be eighty six. All of us nearly gather all the information.

4.2 List of total Consumer

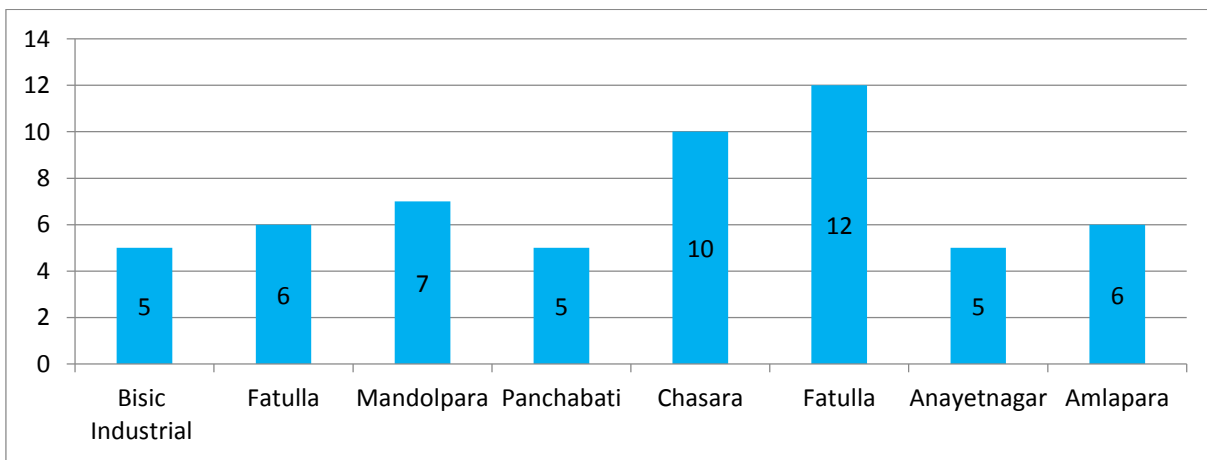


Figure 4.2: Figure for List of total Consumer

We are doing to visit narayangonj solar rooftop system (under DPDC). we do survey West Zone consumer. So the visit of West Zone is basic industrial area 5, fatulla 6,mandolpara 7 and panchabati 5. We almost

collect all of the data. we do survey East Zone consumer. So the visit of East Zone is chasara 10, fatulla 12, anayetnagar 5 and amlapaer 6. We almost collect all of the data.

4.3 Information of installation

There are in the information of installation.

- Using of on grid and off the grid
- Provider of SRS
- Installation proces

➤ Using of on grid and off grid

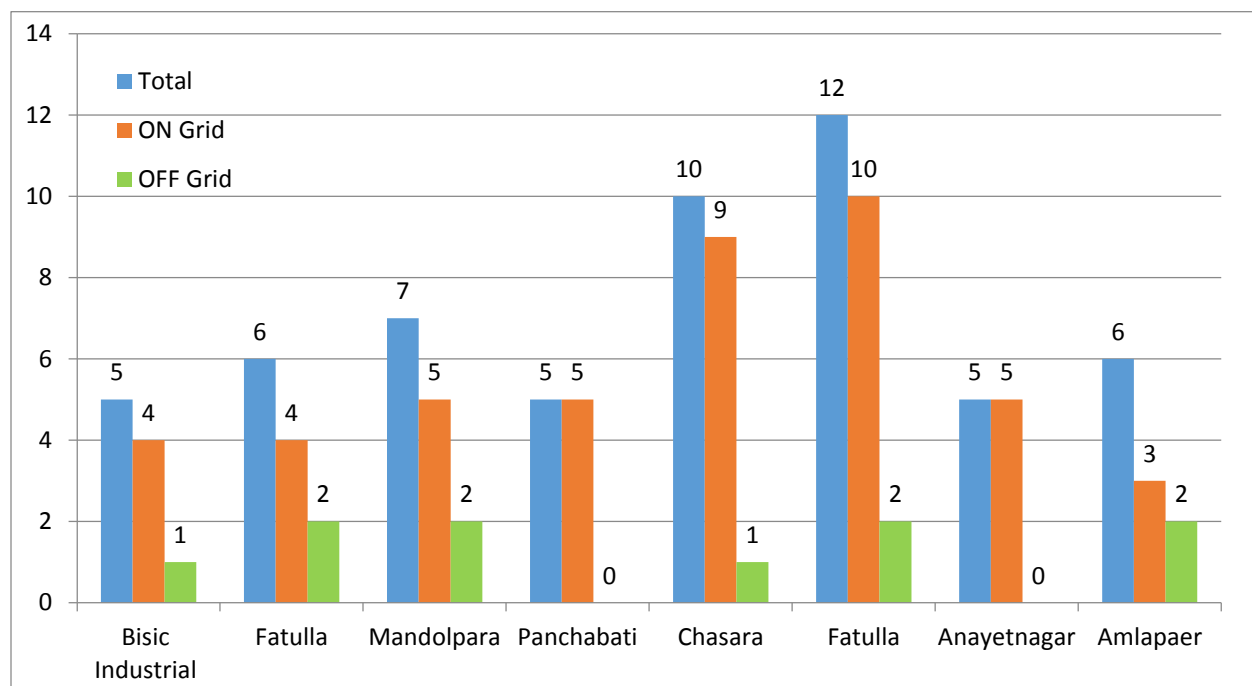


Figure 4.3.a: Figure for Using of on grid and off grid

In this figure represents eight areas. In the area of Basic industrial, there are total 5 consumers in which 4 are ON Grid and 1 is OFF Grid. Therefore most of the consumers are ON Grid. Now in Fatulla, there are total 6 consumers in which 4 are ON Grid and 2 is OFF Grid. Therefore most of the consumers are ON Grid. Again in Mandolpara, there are total 7 consumers in which 5 are ON Grid and 2 OFF Grid. Therefore most of the consumers are ON Grid. In the area of Panchabati,

there are total 5 consumers in which 5 are ON Grid and no OFF Grid. Therefore most of the consumers are ON Grid. In the area of Chasara, there are total 10 consumers in which 9 are ON Grid and 1 is OFF Grid. Therefore most of the consumers are ON Grid. Now in Fatulla, there are total 12 consumers in which 10 are ON Grid and 2 is OFF Grid. Therefore most of the consumers are ON Grid. Again in Anayetnagar, there are total 5 consumers in which 5 are ON Grid and no OFF Grid. Therefore most of the consumers are ON Grid. At last in Amlapara there are total 6 consumers in which 3 are ON Grid and 2 OFF Grid and another consumer is disabled. Therefore most of the consumers are ON Grid.

➤ **Provider of SRS**

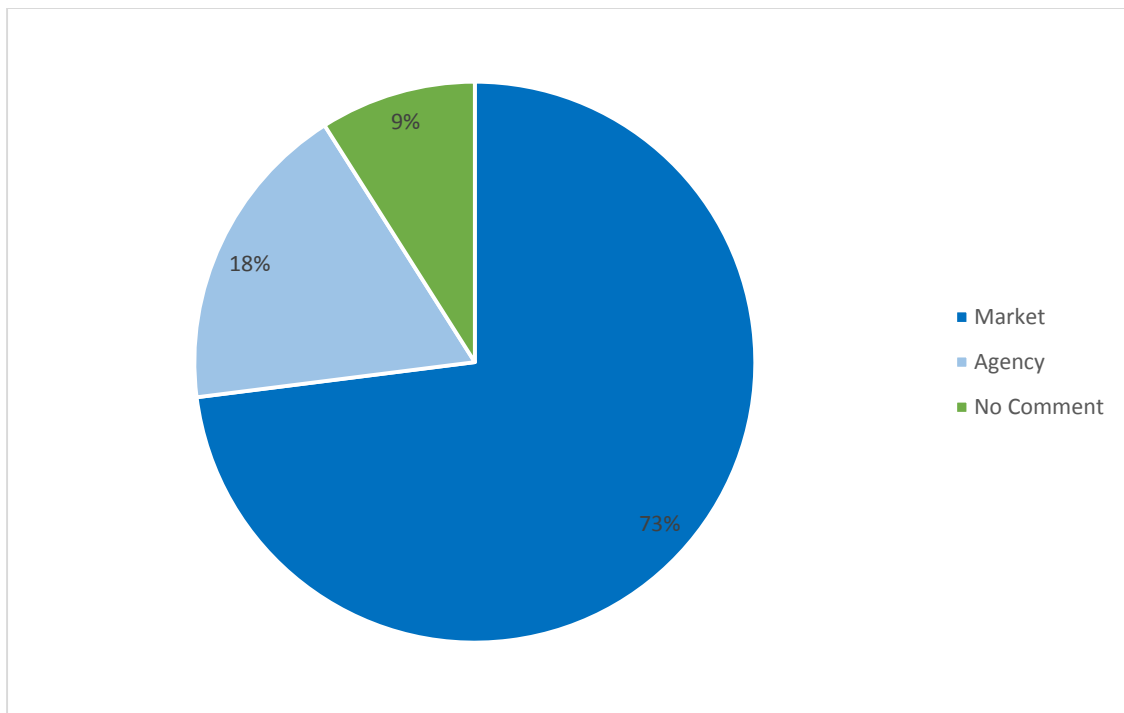


Figure 4.3.b: Figure for Provide of SRS

In this figure represents a provider of SRS. In the area of Market, there are 73% consumers in which provider of SRS. Next, in the area of Agency, there are 18% consumers in which provider of SRS. Again in the area of No Comment, there are 9% consumers in which provider of SRS. Therefore most of the consumers are Market is the provider of SRS.

➤ **Installation process**

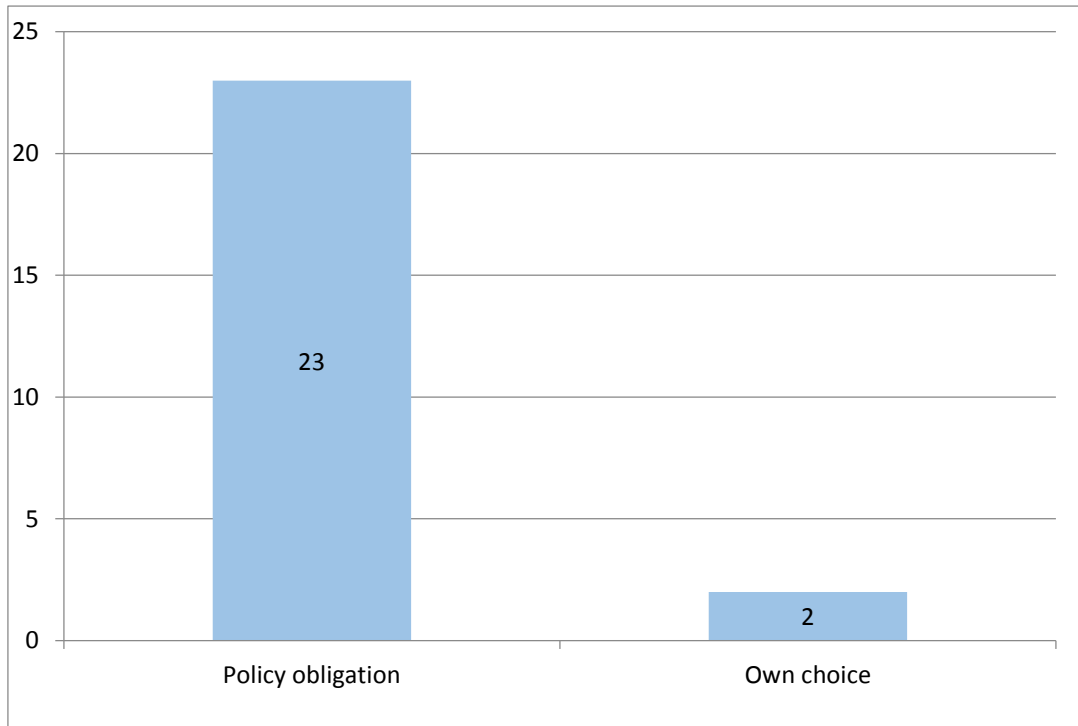


Figure 4.3.c: Figure for Installation process

Figure 4.3.c provides information that 23 consumers have installed SRS for the policy obligation. That means they have no interest to install the solar system. Other 2 consumers are interested to install the SRS system. That's why they installed SRS for their own choice.

4.4 Operation of SRS

In this figure represents five areas. In the area of House, there are total 15 consumers in which 12 are on and 3 is damage. Therefore most of the consumers are on for Operation of SRS. In the area of College, there are total 3 consumers in which 2 are on and 1 is damage. Therefore most of the consumers are on for Operation of SRS. In the area of Industry, there is a total of 4 consumers in which 2 are on and 2 is damage. Therefore most of the consumers are on for Operation of SRS. In the area of Hospital, there is total 3 consumers in which 3 are on and no damage. Therefore most

of the consumers are on for Operation of SRS. In the area of Market, there are total 4 consumers in which 2 are on and 2 is damage. Therefore most of the consumers are on for Operation of SRS.

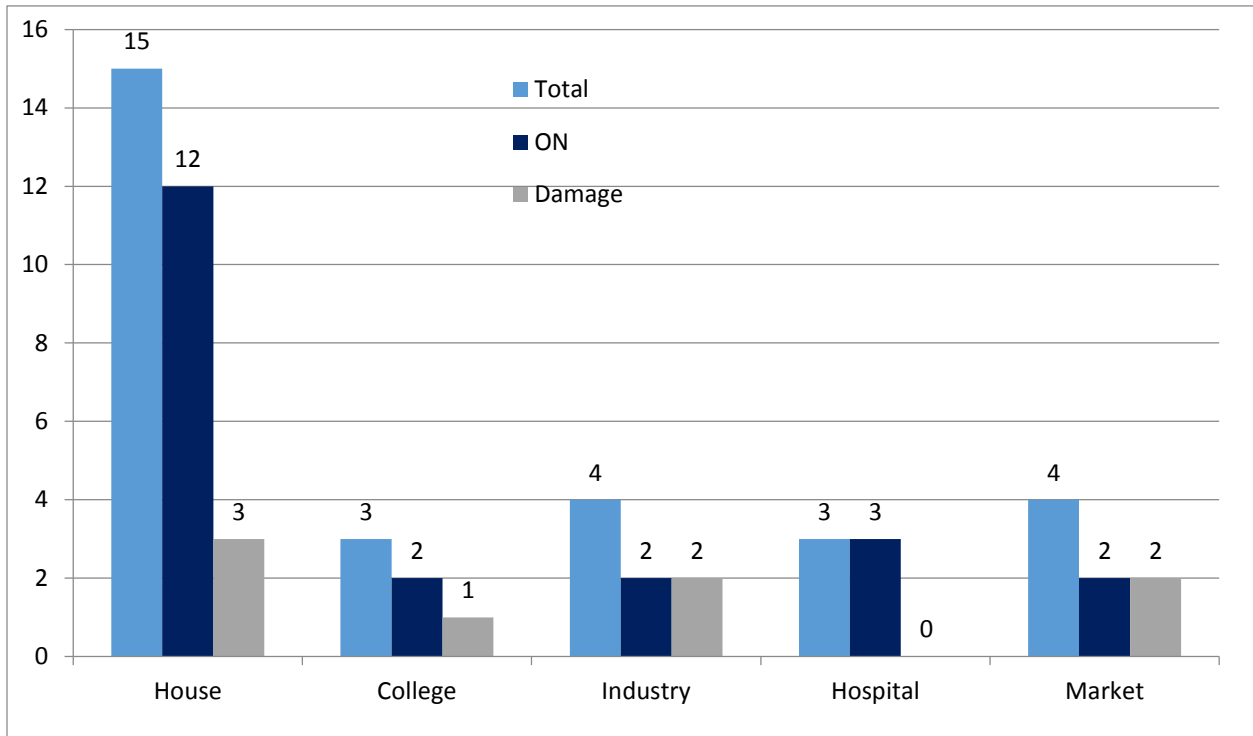


Figure 4.4: Figure for Operation of SRS

4.5 Maintainance of SRS

In this figure represents five areas. In the area of House, there are total 15 consumers in which 12 are on and 3 is damage. Therefore most of the consumers are on for Operation of SRS. In the area of College, there are total 3 consumers in which 2 are on and 1 is damage. Therefore most of the consumers are on for Operation of SRS. In the area of Industry, there is a total of 4 consumers in which 2 are on and 2 is damage. Therefore most of the consumers are on for Operation of SRS. In the area of Hospital, there is total 3 consumers in which 3 are on and no damage. Therefore most of the consumers are on for Operation of SRS. In the area of Market, there are total 4 consumers in which 2 are on and 2 is damage. Therefore most of the consumers are on for Operation of SRS.

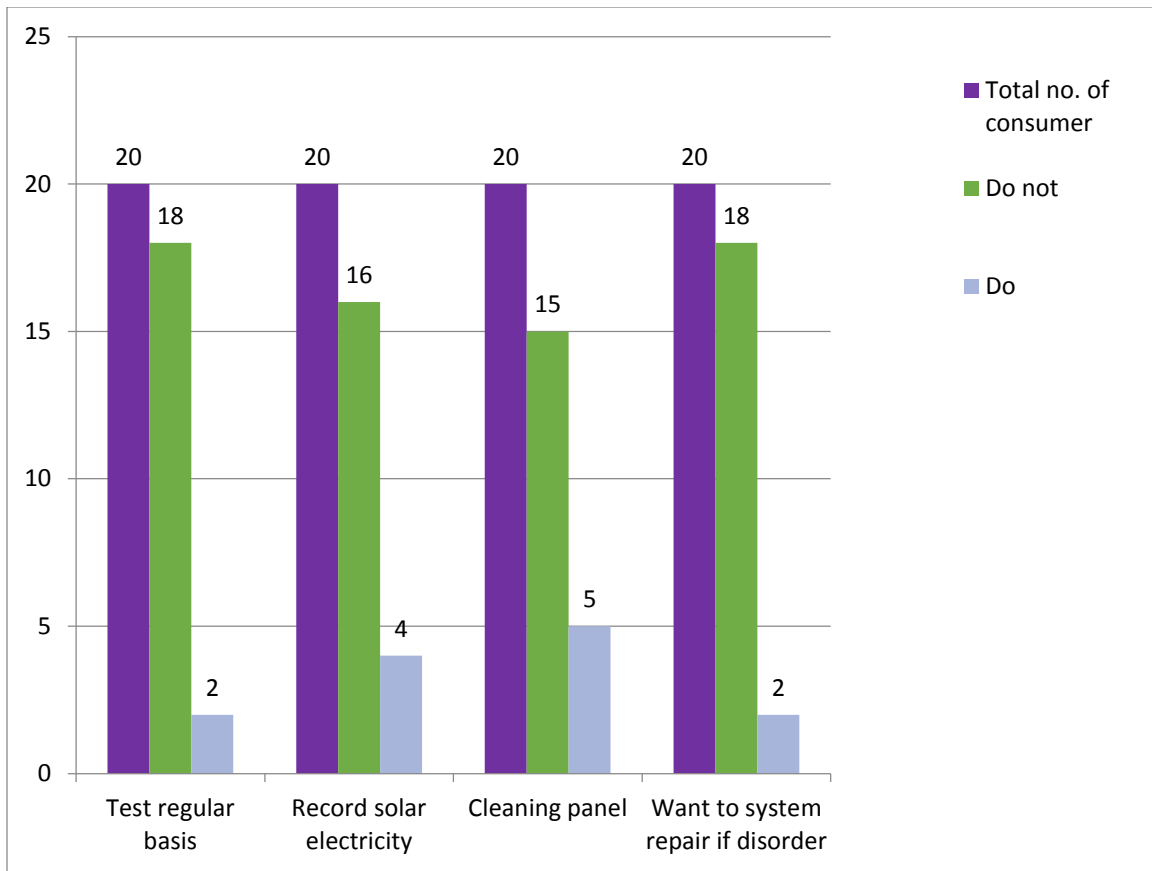


Figure 4.5: Figure for Maintainance of SRS

4.6 Checking meter reading of SRS

In this figure represents five areas. In the area of the house, there are 41% consumers in which Checking meter reading of SRS. In the area of College, there are 14% consumers in which meter reading of SRS. There is industry only 11% of consumers have the record of the meter reading of SRS. In the area of the hospital, there are 16% consumers in which meter reading of SRS. The last on market, only 18 % of consumers have got the record of the meter reading of SRS. Therefore most of the consumers are house record of the meter reading of SRS. Therefore most of the consumers are industry no record of the meter reading of SRS.

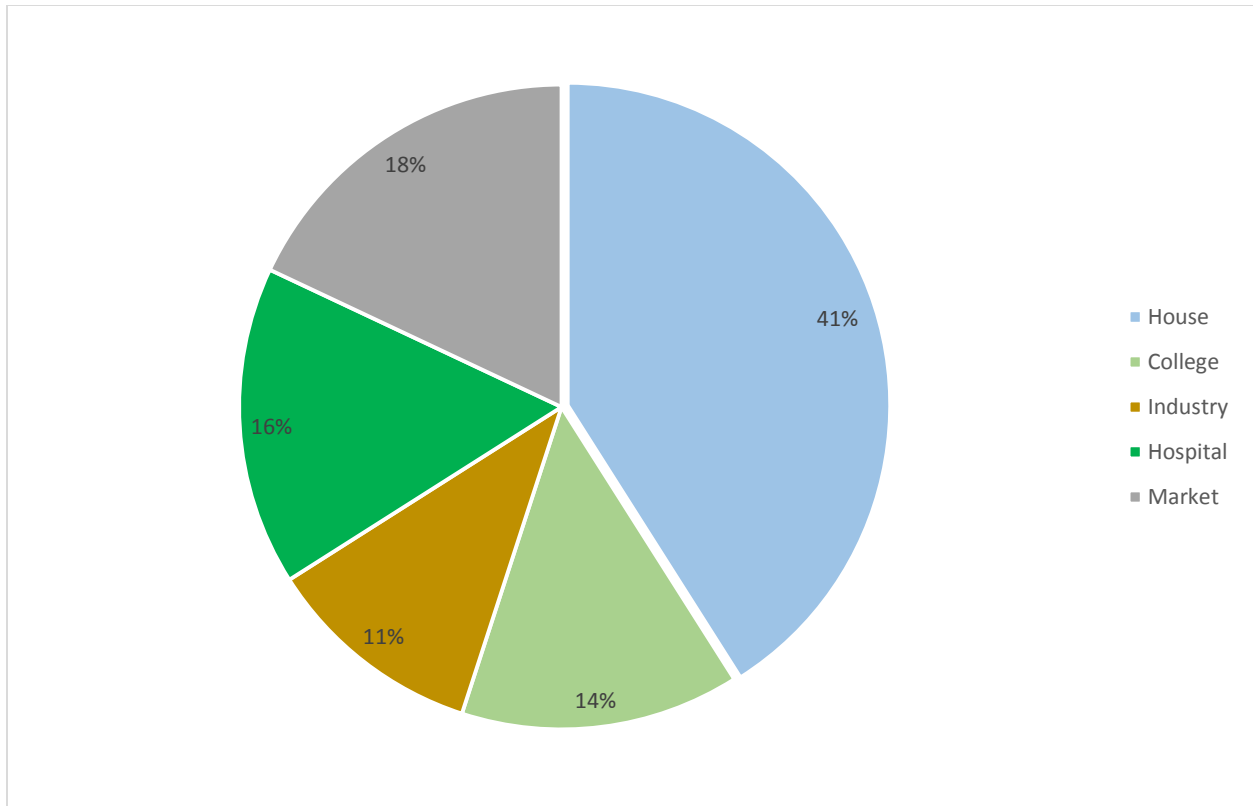


Figure 4.6: Figure for Checking meter reading of SRS

4.7 Cost analysis of SRS

Consumer name : Md. Motaher Islam

Address : amlapara, Narayangonj

Installed by : Grameen shakti

Installation date : 01-12-2016

Capacity : 2 KW

Price : 1,00,000 BDT

Energy generated = 1800 KWh

Total enwrgy generated per month = $1800/25 = 72$ KWh

Energy generated per year = $72*12 = 864$ KWh

Life time energy generated = $864*20 = 17,280$ KWh

Cost per unit = $1,00,000/17,280 = 5.79$ BDT

4.8 Consumer satisfaction

In the following chart, the comparison of how many consumers accept the system as a waste of money and how many of them find it useful. The comparison shows that 28 consumers are judged totally. According to the result, 13 consumers think that the installed system has just been waste of their money, 5 consumers found the system useful, 2 consumers did not either make any no comment this question and 8 consumers and want to increase the capacity of the SRS.

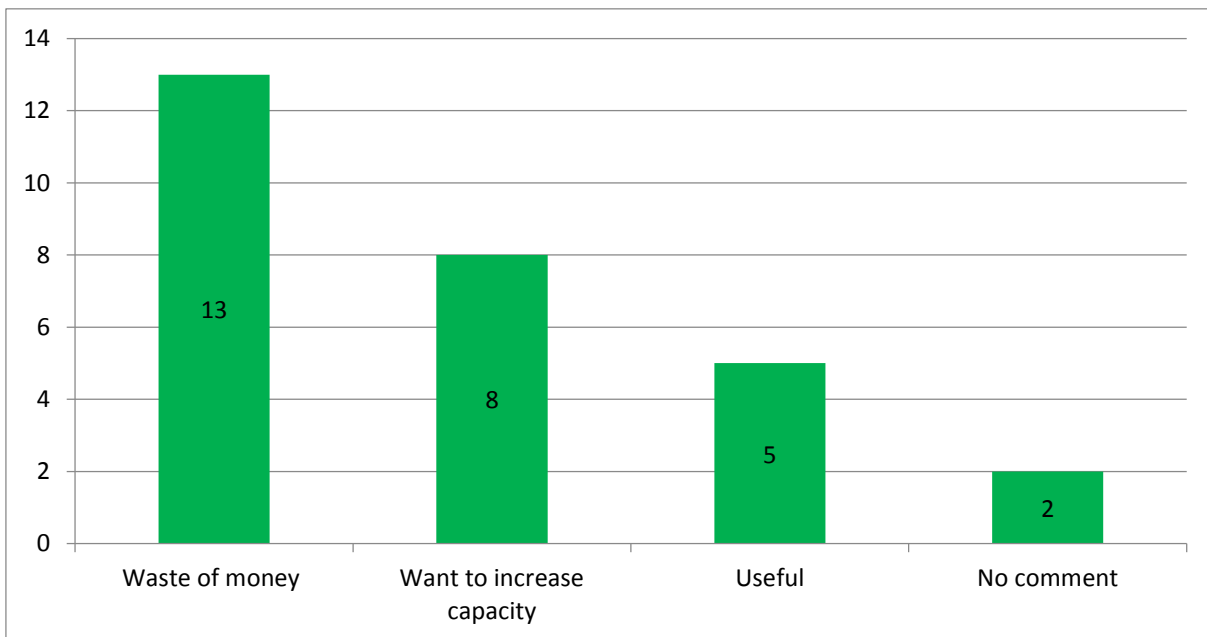


Figure 4.8: Figure for Consumer satisfaction

4.9 Finding

- Some customers possess don't thoroughly clean their own cell. Simply because they didn't learn about the actual cleansing associated with SRS.
- Some customers absolutely no connection with solar power taken care of. These people didn't learn about how you can sustaining SRS.
- Consumers Don't make use of correct method of solar power. These people simply set up SRS don't learn about the proper way associated with utilizing SRS.

- Connection issue associated with solar power. these people don't understand how to do the repair.
- Electrical terminations not really completely stiffened. these people don't understand how to the actual electric fatal is actually linked. therefore the expert may discovering their own issue as well as resolve this.

4.10 Recommendations

- All exposed cables or conduits should be sunlight resistant
- All required over current protection should be included in system and should be accessible for maintenance
- All electrical terminations should be fully tightened, secured, and strain relieved as appropriate
- All roof penetrations should be sealed with an acceptable sealing method that does not adversely impact the roof warranty
- Integral roofing products should be properly rated (e.g. class A roofing materials)
- All cables, conduit, exposed conductors and electrical boxes should be secured and supported according to code requirements
- PV Array should be free of shade between 9.00 am and 4.00 pm. This requirement includes even small obstructions such as vent pipes and chimneys. A small amount of shade can have a disproportionately high impact on system performance
- Inverters should be IEC/UL certified and warranted for a minimum of 5 years

CHAPTER 5

CONCLUSION AND RECOMENDATIONS

5.1 Conclusion

The sun's rays is really a effective supply that will help our world giving all of us thoroughly clean, reusable power in order to energy the world. Using this particular power is actually free of charge, doesn't produce air pollution, and when utilized sensibly might help all of us turn out to be much less determined by additional more expensive as well as harmful types of energy. Following taking part in this particular Internet Mission I really hope you'll be able to observe the advantages of this unique source as well as assist alter the near future with regard to power make use of, in the event that photo voltaic energy would be to turn out to be an essential supply of power within our long term, the must interact within additional to create this inexpensive for everybody, decreasing expenses.

Now-a-days the actual impetus, character as well as durability of the the world rely on power. Therefore, the nation can be viewed as because civil 1 in the event that it's adequate use of power because necessary for the actual commercial, farming as well as financial development. There are numerous industries to make use of photo voltaic electrical power within non-urban section of Bangladesh. Utilization of photo voltaic electrical power within home effective function, neighborhood wellness treatment centers, colleges, union-information facilities as well as flood/cyclone center within the remote control as well as difficult to achieve places, wouldn't just improve standard of living as well as efficiency within the non-urban places but additionally bring about quicker accomplish the actual Environmentally friendly Improvement Objectives (SDGs). Within study, it's discovered which mini funding program boosts the cost to buy the photo voltaic program within non-urban places. The actual part associated with SHS upon home earnings is actually noticed to become very restricted, because SHS electrical power is actually seldom utilized successfully. Insufficient understanding & instruction upon effective utilization of SHS and also the non-availability associated with photo voltaic electrical home appliances are simply to become the primary causes of this case. The actual SHS part upon interpersonal improvement is actually much more spectacular when compared with help upon financial improvement. Obvious home illumination as well as outdoors enhance training, wellness, allows for within use of info, conversation, amusement, as well as improve belief upon security. These types of elements provide revolutionary modifications within the conventional interpersonal

existence associated with non-urban individuals. Even though using SHS electrical product is quite restricted, way of life offers considerably enhanced because of the accessibility to photo voltaic electrical power.

We're perform study Eastern Area fifty eight customer as well as Western Area twenty-eight customer. Therefore the complete customer associated with narayanganj is actually eighty six. All of us nearly gather all information. Therefore the go to associated with Eastern Area is actually chasara 10, fatulla 12, anayetnagar 5 as well as amlapara 6. All of us nearly gather all information. we're perform study Western Area customer. Therefore the go to associated with Western Area is actually basic commercial region 5, fatulla 6, mandolpara 7 as well as panchabati four. 5. All of us nearly gather all information. In the region associated with Fatulla you will find greatest customers by which UPON Grid as well as In the region associated with Amlapara you will find reduce customers by which UPON Grid. In the region associated with Amlapara as well as Mondolpara you will find greatest customers by which AWAY Grid as well as In the region associated with Panchabati you will find absolutely no customers by which AWAY Grid. In the region associated with Fatulla you will find greatest customers by which Marketplace within purchased associated with SRS. Consequently the majority of the individuals are Marketplace within purchased associated with SRS. Consequently the majority of the customer cell tend to be upon functioning associated with SRS. In the region associated with home you will find greatest customers by which thoroughly clean the actual cell. In the region associated with Business you will find reduce customers by which thoroughly clean the actual cell. In the region associated with home you will find greatest customers by which Testthe normal foundation. In the region associated with business you will find reduce customers by which Testthe normal foundation. Consequently the majority of the customer tend to be absolutely no encounter any type of study. Consequently the majority of the customer tend to be absolutely no examine meter reading through associated with SRS. Consequently the majority of the customer tend to be absolutely no fulfillment associated with SRS program.

5.2 Future Scopes of the work

Along with decreased expenses as well as enhanced systems, the actual solar power guarantees the actual decreased power bills, raises countries' power protection via dependence with an local, endless source, improved durability, decreased air pollution, reduce the expense associated with mitigating worldwide heating, as well as retains fossil energy costs less than or else. It's environment-friendly as well as anybody may use this. The benefits tend to be worldwide. Therefore the extra expenses from the bonuses with regard

to earlier deployment should be thought about understanding opportunities; they have to end up being sensibly invested as well as have to be broadly discussed.

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