DESIGN AND CONSTRUCTION OF MINI SOLAR POWER PLANT

A Project Report Submitted to the Daffodil International University in partial Contentment Of The Requirement For The Degree Of Bachelor Of Science

In

Electrical and Electronic Engineering

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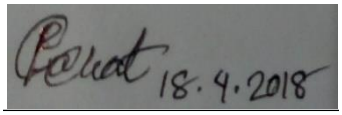
Certification

This is to verify that this project and thesis entitled "**Design And construction of Mini Solar Power Plant**" 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 complete contentment of the necessity for the degree of Bachelor of Science of Electrical And Electronic Engineering.

Signature of the candidates



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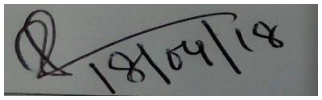

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DEDICATION

“*To Our Parents*” who sacrifice their life for us

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ABSTRACT

Solar Energy is the one of the best renewable Energy Presently. It is considering as total free and spotless energy source since the sun is assessed still able to happen for more 5 years. In calculation, some usual resources like fossil fuels is consider as short-term resources because it is valued will over in next 30 years. Based on this condition, renewable energy like solar energy is vital for human being after the natural implement is finish. The fact is, conventional solar panel power method is motionless, means the solar panel will not continuously be moving towards to the track of sun, this create the light precedence falling on the solar panel is not in greatest level so the solar panel will not always work in its greatest accomplishment. Vast quantity of energy is accessible with in the central of sun. The Power that is accepted from sun in an hour is more than that is eroded by us in a annum. If human rivalry able to catch even 2% of total vigor which sun given, then we can create the need of our rivalry for certain period.

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List of principal Symbols Abbreviations

PV	Photovoltaic
MPP	Maximum Power Point
MPPT	Maximum Power Point Tracker
I_L	Photo generated Current
STC	Standard Test Conditions
I_{sc}	Short Circuit Current
V_{oc}	Open Circuit Voltage
Q	Electron Charge
I_{pv}	Photodiode Current
Vpv	Photodiode Voltage
N	Diode Quality Factor
K	Boltzmann Constant
T	Temperature
C	Capacitor
V	Voltage
I	Current
L	Inductor
R	Resistor
I_D	Diode Current
R_S	Series Resistance
R_{SH}	Shunt Resistance
D	Diode
R_{Load}	Load Resistance

I_0	Saturation Current
G	Irradiant
DC	Direct Current
AC	Alternating Current
GIO	Gate Turn Off Thyristor
PWM	Pulse Width Modulated
K	Duty Cycle
V_S	Supply Voltage
V_L	Inductor Across Voltage
V_o	Output Voltage
PLL	Phase Locked Loop
CB	Circuit Breaker
V_g	Diode Band gap Voltage

Chapter 1

INTRODUCTION

1.1 Introduction

The main anxieties in the power sector is the day-by-day increasing power demand but the unobtainability of sufficient resources to meet the power demand using the conventional energy sources. " Demand has been enlarged for renewable sources of energy to be operated along with conventional structures to meet the energy demand. Renewable genesis like wind energy, thermal energy and solar energy are the prime energy genesis which are being utilized in this consideration. The nonstop use of fossil fuels has produced the fossil fuel deposit to be condensed and has radically affected the environment reducing the environment and cumulatively adding to global heating. Solar energy is plentifully available that has made it possible to produce it and apply it properly. Solar energy can be a impartial producing unit or can be a grid linked producing unit depending on the accessibility of a grid proximate. Thus it can be rummage-sale to power rural areas where the obtainability of grids is very low. Another benefit of using solar energy is the moveable operation whenever wherever essential. In order to outbreak the present energy crisis one has to improve an effectual method in which power has to be haul out from the arriving solar radiation. The power adaptation instruments have been greatly abridged in size in the previous few years.

The expansion in power electronics and material science has facilitated engineers to come up very small but authoritative systems to endure the high power demand. But the drawback of these systems is the augmented power compactness. Trend has set in for the use of multi-input converter components that can excellently manage the voltage variations. But due to high manufacture cost and the low productivity of these systems they can hardly contest in the competitive markets as a major power generation foundation. The continuous increase in the expansion of the solar cells developing technology would absolutely make the use of these machineries possible on a broader basis than what the situation is currently. There are a number of means available to increase solar panel output and efficiency. The best adaptation efficiency of most commercially obtainable solar cells is in the assortment 10- 20 %". Though recent innovation in the technology of solar cells indications significant enhancement but the fact that the all-out solar cell capability still falls in the fewer than 20 % range shows there are enormous room for development.

One of such room is arrangement mounting and tracking "mechanism that moves or positions solar array to absorbing extended solar irradiance for maximum power output. Another such room is researching different types of solar cells from past to present and the future trend and identifies the sources of losses and how to mitigate them". Lastly, some critical components that are essential for efficient operation of solar power inverter system are explored.

1.2 Statement of the Problem

Bangladesh is currently faced with challenges arising inadequate energy. "Electricity is the most convenient form of energy and a key factor for economic growth in any country. It cannot be swapped by other methods of energy. The energy situation is in challenged since the key power stations are trip on natural gas, whose reserves are now on the border of diminution. At present-day, the country is facing a acute electricity disaster due to growth of almost each and every sector. According to the Bangladesh Power Development Board, the present peak hour lack of electricity is around 15-20% of generation. Due to the deficiency of fossil fuels, the government has focused on the renewable energy technology - mainly solar energy". Among entirely the renewable energy technologies in over-all, and the solar energy adaptation pathways in precise, the solar photovoltaic (PV) metamorphosis pathway is the most attractive and capable to produce electricity in large scale in Bangladesh.

1.3 Renewable energy

"Renewable energy is usually defined as energy that comes from possessions which are naturally refilled on a human timetable such as sunlight, wind, rain, tides, waves and geothermal heat. Renewable energy swaps conventional fuels in four different areas: electricity generation, hot water/space heating, motor fuels, and rural (off grid) energy services. About 16% of universal final energy consumption currently comes from renewable resources, with 10% of all energy from outdated biomass, mainly used for heating, and 3.4% from hydroelectricity. New renewable interpretation for another 3% and are growing promptly. At the national level, at least 30 nations around the world even now have renewable energy subsidizing more than 20% of energy supply. National renewable energy marketplaces are predictable to continue to grow powerfully in the coming decade and beyond. Wind power for example, is flourishing at the rate of 30% yearly, with a universal installed capacity of 282,482 megawatts (MW) at the finish of 2012".

Renewable energy properties exist over extensive geographical zones, in difference to other energy sources, which are focused in a limited number of countries. Rapid expansion of renewable energy and energy proficiency is subsequent in significant energy security, climate change mollification and financial benefits.

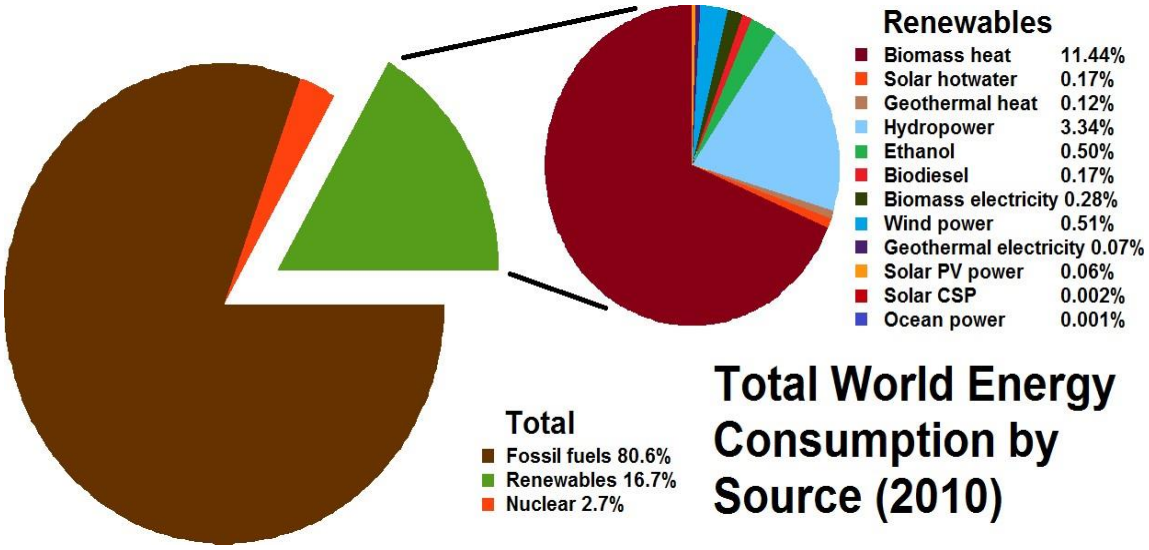

Figure 1.1: Total world Energy Consumption

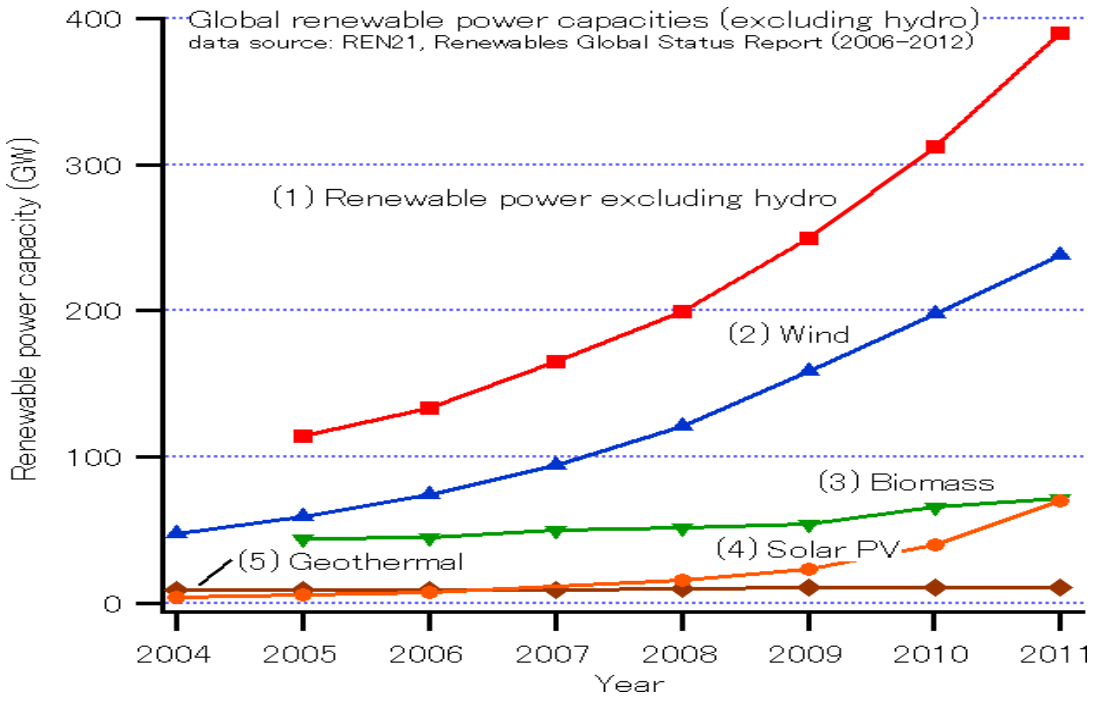

Figure 1.2: global renewable power capacity excluding hydro

1.4 Solar Energy

Solar energy is effulgent light and heat from the Sun that is joined using a range of ever-evolving technologies such as solar heating, "photovoltaics, solar thermal energy, solar architecture, molten salt power plants and non-natural photosynthesis. It is an significant source of renewable energy and its technologies are largely distinguished as either passive solar or active solar contingent on how they internment and allocate solar energy or transform it into solar power. Active solar methods include the use of photovoltaic systems, concentrated solar power and solar water heating to effulgent the energy. Passive solar techniques include familiarizing a constructing to the Sun, selecting resources with favorable thermal mass or light-dispersing chattels, and designing spaces that naturally circulate air". The large magnitude of solar energy accessible makes it a highly tempting source of electricity. The United Nations Development Programmed in its 2000 World Energy Assessment found that the annual potential of solar energy was 1,575–49,837 oxyjoules (EJ). This is numerous times larger than the total world energy consumption, which was 559.8 EJ in 2012.In 2011, the International Energy Agency said that "the development of affordable, inexhaustible and clean solar energy technologies will have huge longer- term benefits. It will increase countries' energy security through reliance on an indigenous, inexhaustible and mostly import-independent resource, enhance sustainability, reduce pollution, lower the costs of mitigating global warming, and keep fossil fuel prices lower than otherwise. These advantages are global. Hence the additional costs of the incentives for early deployment should be considered learning investments; they must be wisely spent and need to be widely shared".

1.5 Objective

The primary objective of the solar energy research enclave will be two-fold

a) Founding of a solar power station that can produce power

b) Outline the investigation areas that will be explored for supportable solar energy generation, storage and distribution. The solar power station will be constructed in modular fashion such that different technologies can be used for generating power. The modules will be designed not only as a demonstrate of current technologies but also to explore laceration edge research technologies that have potential for financial durability.

1.6 How could we get electricity from the sun

When particular semiconducting material such as particular kinds of silicon are exposed to sunlight they release small manifested of electricity. "This process is recognized as the photoelectric effect. The photoelectric effect refers to the release of electrons from the superficial of a metal in backwash to light. It is the basic physical process in which a solar electric or photovoltaic (PV) cell converts sunlight to electricity. Sunlight is made up of photons, or particles of solar energy. Photons contain different amounts of energy similar to the various wavelengths of the solar spectrum. When photons strike a PV cell they may be reflected or absorbed, or they may pass right through. Only the absorbed photons generate electricity. When this happens, the energy of the photon is transferred to an electron in an atom of the PV cell. With its newfound energy the electron escapes from its normal locus in an atom of the semiconductor material and becomes part of the current in an electrical circuit". By leaving its position, the electron causes a hole to form. Special electrical properties of the PV cell a built-in electric field provide the voltage needed to drive the current through an external load.

1.7 Problems in the industry

In current year photovoltaic production retention has surged far ahead of demand, "which has led to an intense price war and a wave of bankruptcy of high profile PV companies together with former market leader Sun tech. Technological innovation is being squeezed by the need of companies to focus on survival. A profound industry shakeout and consolidation is underway. The winners will arise into a trillion dollar per year industry. The future of the solar PV industry is driven by the essential equation that PV is little constrained by environmental deliberations, material supply, land requirements, security considerations or indeed anything other than price and price is now competitive closely everywhere". The yearly global radiation varies from 1500 to 2100 kWh/sq.m. which is equivalent with radiation received in the tropical and subtropical areas.

1.8 Scope of Study

The possibility of our project - Home Automation System is huge. The future insinuations of the project are very great considering the amount of time and resources it keep back. The "project we have assumed can be used as a reference or as a base for realizing a scheme to be executed in other projects of

greater level such as weather forecasting, temperature updates, device synchronization, etc. The project itself can be modified to achieve a complete Home Automation system" which will then make a platform for the operator to interface between himself and the domiciliary.

1.9 Introduction of Project Outline

The work presented in this project is organized in five main chapters. These five chapters are structured as follows:

Chapter 1: is entitled ―Introduction". It introduces background, problem statement, objective and scope of study of this project.

Chapter 2: is entitled ―Literature Review". It introduces Impressions of the Current Power System, Energy Position, significant of solar energy.

Chapter 3: is entitled ―. Utility Grid of Solar System

Chapter 4: is entitled "construction of thermal power plant ". It introduces block diagram, circuit diagram, operation, testing and result of this project.

Chapter 5:is named "Advantages, Disadvantages & Application". This chapter is focused on the Advantages, Disadvantages and Application of this project.

Chapter 6: is entitled "Recommendation and Conclusion ", all achievements are summarized and appropriate conclusions are drawn. ". This chapter is focused on the further development of the project. Limitations of this project are discussed and different methods for improving the main drawbacks are introduced.

Chapter 2

LITERATURE REVIEWS

2.1 Introduction

Bangladesh is syntactic with spacious supply of renewable cornerstone of energy. So energy is not a problem at all if substitute sources are used properly. " Consequent to Khalequzzaman solar power use sun's energy to propagate electricity. Solar energy is immense in Bangladesh. Generation of electricity using solar power is environmentally practicable. Promotion of solar power should be a top importance for Bangladesh in the 21st centenary. At present the national grid is providing only 55% of the closely 10,000 rustic markets and commercial centers in the country which are outstanding market for centralized solar photovoltaic plants. Presently private diesel operators are paternoster in most of the off-grid rustic markets and it has been found that 80% of them are also attracted in marketing SHS in neighboring areas. if some sorts of promising financing arrangements are available. Islam and Islam supposed to their research that through the country, different government administrative offices, NGO offices, health centers, schools, banks, police stations etc are operative. In the off-grid sites these offices are moreover using traditional means or functioning their own diesel genets. These offices have detached budgets for electricity and they can be easily enforced with solar photovoltaic applications. On the other hand Islam has alluded in his research article that Bangladesh holds the probable to cost-effectively meet a momentous fraction of its future electricity need through the use of renewable propagation technologies probably adding as much renewable retention as the current overall electric power receptivity of the country. Various parts of the country have prejudiced solar conditions and there are lots of potentially cost-effective applications. Islam also supposed in his article that Bangladesh must develop a policy framework that allows and inspires private investors to develop renewable energy projects in order to realize the ample probable of renewable. Bangladesh has got spacious solar internment throughout the country. Day-to-day average solar radiation change between 4.5 to 6.5 kWh/m2. Extreme amount of radiation is available on the month of March to April and least on December to January". There is bright panorama for applications of solar thermal and photovoltaic systems in the country.

2.2 Overview of the Present Power System:

Whereas energy plays an "significant role in socio-economic development the Government of Bangladesh is giving importance in overall development of the energy sector. Around 25% of the total public sector investment was unrepaid for the energy sector prosperity during the last one era. The main energy source is natural gas and the electricity" procreation significantly relies on natural gas in Bangladesh.

2.3 Energy Status

Around 70% of the settled electricity generation receptivity is based on natural gas. "In the year 2005 to 2006 the natural gas manufacture was 13,785 MWh and the total installed electricity generation retention was 4990 MW. In the same economic year the total electricity production was 22,000 million kWh and about 88.85% of the total production used natural gas as major fuel. In spite of government initiative the per capita commercial energy was 215 kg of oil identical. Consequent to a published data of the BPDP on June, 2006, 42.08% of the population has the access of grid electricity and per capita electricity outlay is 162.90 kWh in Bangladesh". The per capita commercial energy and electricity expense in Bangladesh is one of the lowest among the developing countries.

2.3.1 Important uses of solar energy

The principle sources of world energy production are the petrification fuels (gas, oil, coal) and nuclear power plants. Due to the usage of petrification "fuels greenhouse gases (CFC, CH_4, O_3, but mainly CO_2) release into the atmosphere. From the nuclear power plant, carbon is unconfined in a small amount But the radioactive waste remain active over thousand years which is a probable source of environmental contamination. There is a increasing demand on the energy sector for speedy industrialization, urbanization, high population growth, increasing food manufacture, increasing standard of living etc. Solar energy could be a principle source of power Generation in Bangladesh. we are able to produce only 80% of our total electricity need. Owing to this shortage of electricity not only we are facing load shedding across the country but also the industrial sector is critically oppressed. On the other hand, there is an alarming energy exigence worldwide as petrification fuel reserves reduction and the ageing power plants are going to close in neighboring future". From the spectacle of global warming and lack of natural gas scientists and engineers are looking for clean renewable energies.

There is a increasing demand on the energy sector for speedy industrialization, urbanization, high population growth, increasing food production.

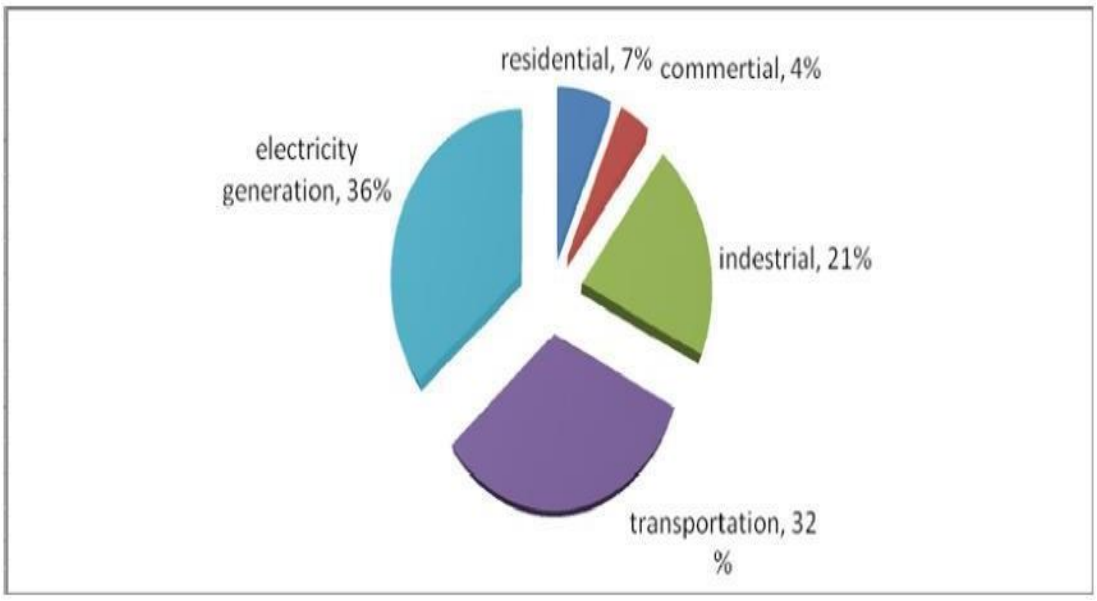

Figure 2.1: Sources of carbon dioxide releases

Figure: shows that electricity production is source of the highest emission of carbon dioxide. So generation of this clean energy is actually contributing the highest towards global warming. "Global warming as well as the environmental contamination is in our times the greatest environmental danger to human being. On the other hand there is an minacious energy quandary worldwide as petrification fuel reserves decrease and the ageing power plants are going to close in near future. From the aspect of global warming and lack of natural gas scientists and engineers are looking for clean renewable energies. Solar energy is the One of the best choices. Because the earth obtains 3.8 YJ [1YJ = 1024 J] of energy which is 6000 times larger than the worlds ingesting. Bangladesh is facing an intense lake of energy. Natural gas is the prime source of electricity production in Bangladesh. But the limited gas storage cannot fulfill the requirements of both domestic requirements and industrial and commercial needs especially needs for electricity production for long. Our present power generation retention is only around 4300 MW whereas the total power requirement is 6000 MW. So we are able to provide only 70% of our total electricity requirement. Owing to this insufficiency of electricity not only we are facing load shedding across the country but also the industrial sector is seriously affected". Resulting in reduced industrial output and shortened export earnings. "There is a increasing demand on the energy sector

for speedy industrialization, urbanization, high population growth, increasing food production, increasing standard of living etc. Solar energy could be a prime source of power Generation in Bangladesh. Bangladesh government plans to make it obligatory to install solar panel on rooftops of every multistoried and hi-rise building". As solar energy is one of the cleanest and simplest forms of energy. Solar energy is smoothly obtainable anywhere and everywhere in the earth. It can be used it to generate electricity at the point of consumption. Solar powered building is based on this concept. As finally we can say that for use of solar energy:

1. Source of Conventional Energy is Limited.
2. Production of power from conventional Energy causes CO Emission.
3. Easy to install and use.
4. Noise free.
5. Source is unlimited
6. There is no moving part, so its life is long

2.3.2 Basic Commercial Energy Properties

The naturalistic properties of Bangladesh comprise of natural gas, coal, peat, limestone, hard rock, lignite, silica sand, white clay etc. "Bangladesh has substantial amount of natural gas storage and in that way among other commercial energy sources natural gas plays the vital role. The natural gas donates about 75% of the overall commercial energy sources and the rest comes from imported oil, coal and hydropower generation. Bangladesh has natural gas storage of around 14.608 TCF total coal and peat savings are nearby 1760 million tons and 170 million tons correspondingly. In 2003 the local generation of natural gas meets the country's need but the coal and petroleum products essential to be imported from other countries in order to meet the local requirement. In the pecuniary year 2004 to 2005 the expense of natural gas, petroleum and coal was 455, 466 and 2 trillion BTU correspondingly".

2.3.3 Status of thermal Energy

"The solar thermal energy is used in operable ways for absorbing of cleansed clothes, food grains, fish, vegetable, raw jute etc for centuries in Bangladesh. Locally this energy is also used for volatilization of saline water for salt making in the coastal region. The long term regular sunshine data designates that

the bright sunlight is obtainable for 3 to 12 hours daily in the littoral area of Bangladesh. The solar radiation alter from 3.9 kWh/m²/day to 6.5 kWh/m²/day ubique the country. Following to these data Bangladesh has high dynamic of solar thermal and photovoltaic applications. This inestimable potential of solar energy gives an opportunity for off-grid rustic electrification through utilization of photovoltaic technology. The operable solar thermal applications are cooking, drying, hot water fabrication and others. Bangladesh is syntactic with rich solar potential and sunshine is accessible throughout the year. Bangladesh accepts 900 X 1018 joules of solar energy yearly and the obtainability of solar energy per square meter is 192 W whereas the expense per square meter is only 0.17 W". This implies the adequacy of solar energy in Bangladesh. The monthly solar radiation in various locations of Bangladesh is given in table 1.

Table 1: Monthly Solar isolation at various locations of Bangladesh (in kWh/m²/day)

Month	Dhaka	Rajshahi	Sylhet	Bogra	Barisal	Jessore
January	4.03	3.96	4	4.01	4.17	4.25
February	4.78	4.47	4.63	4.69	4.81	4.85
March	5.33	5.88	5.2	5.68	5.3	4.5
April	5.71	6.24	5.24	5.87	5.94	6.23
May	5.71	6.17	5.37	6.02	5.75	6.09
June	4.8	5.25	4.53	5.26	4.39	5.12
July	4.41	4.79	4.14	4.34	4.2	4.81
August	4.82	5.16	4.56	4.84	4.42	4.93
September	4.41	4.96	4.07	4.67	4.48	4.57
October	4.61	4.88	4.61	4.65	4.71	4.68
November	4.27	4.42	4.32	4.35	4.35	4.24
December	3.92	3.82	3.85	3.87	3.95	3.97
Average	4.73	5	4.54	4.85	4.71	4.85

In Bangladesh the applicability of standalone SHS is more than others. The remote and sporadic clusters of rustic households make the SHS more suitable for electrification.

2.4 Government Initiative

Government strategy strengthen endorsing off-grid options in zones that are inappropriate for grid propagation. It has made a good start by eliminating import duty on SHS in April 2001. "The technique

Strengthen the central role of well-functioning rustic systems for the Government's off grid promotion strategy and endorses the approach to use well-functioning rustic community based organizations (CBOs) to leverage grass-roots reach and establish trustworthiness to improve electricity provision suggestively. The motive of this Clean Development Mechanism (CDM) project is to donate to sustainable development through the dispensation of renewable solar electricity to households not linked to the electricity grid and thereby reduce the Greenhouse Gas (GHG) emissions by sack kerosene and diesel use for lighting and off-grid electricity propagation. The project will contribute to the sustainable development of Bangladesh with a specific importance on the rustic population which is usually impoverished. In addition to decrease GHG emissions. the project would have momentous other social, economic and environmental convenience. Bank's participation in supporting this project is therefore considered highly adequate. The project envisages establishing 929,170 SHSs all across Bangladesh within 2007 and 2015. The SHS will provide conveniences for illumination TV and radio and comprise of: (a) a Solar Module (b) battery (c) Charge Controller (d) fluorescent tube lights with special electronic ballasts (e) mounting construction (f) installation kit and (g) cables and connecting devices. The capacity of individual SHS will vary consequent to consumer choice and requirement. The cost of SHS would be invigorated through monthly installments over a period of up to 4 years which will be within the reasonable receptivity of the targeted consumers. Upon full implementation in year 2015 the project movement will replace 20,076 kiloliters per annum of kerosene usage equiponderant to an emissions reduction of 48,380.76 tones CO2 per annum and 16,600,501 KWh/ year of electricity production using diesel generators. The project will be implemented by Grameen Shakti (GS) which exhibit introduces and popularizes renewable energy technologies for bearable energy solutions, particularly Solar PV systems, aiming to decrease poverty, improve living standards and protect the environment. Over the last decade GS has installed about 77,000 SHS with combined capacities of 15.9 MW and more than 1,651 SHSs are installed each month. It has also set up 130 offices for service delivery and performance monitoring and has a research unit for development of the overall efficiency of the system and ancillaries". GS is currently providing more than 275,000 beneficiaries through its 120 offices spread over 58 districts of Bangladesh.

2.5 Marketplace in Bangladesh

The approximation of market potential is based on functioning experience of other developing countries like "India Sri Lanka where PV technology is techno-economically fascinating for different applications

regardless of high original cost of solar connections. This market probable is determined on short to midterm base however the definite market potential is dependent on the price of the solar PV system. The commercialization and extensive application of solar electrification depend on the dynamic of the market in the context of socio-economic salvo outlook and preference of people and above all the energy usage pattern in the rustic zone".

2.6 Summary Of This Chapter

"This investigation is directed from operational point of view. Several aspects such as technical financial and social aspects of the subject are deliberated as subordinate concern for the report. From declaration of problem section it is meanwhile mentioned that rustic zones are not totally electrified although urban areas have already come under the currency of electricity. More over there is no actual time line when remote rustic zones are going to come under the supply of electricity. So rustic zones are the principal concern of this experiment. Diversified reason of choosing rustic zone is that the idea of solar energy is yet recent and most of the people in electrified zones will not be interested in using solar energy in additional to their prime source of power". Now a days some discourse are going on to considering solar PV in city zones also.

Chapter 3

UTILITY GRID OF SOLAR SYSTEM

3.1 Introduction

Photo voltaic solar power is one of the verdant energy sources which can play vital role in the program of decreasing greenhouse gas releases. "Though the PV technology is luxurious it is getting strong inspiration through different incentive programs globally. As a result large scale of solar farms are being linked with the grid. Transmission grids worldwide are currently facing challenges in integrating such bulky scale renewable systems and Solar Farms owing to their limited power transmission capacity. To enhancement the attainable power transfer capacity of subsist transmission line series indemnification and different flexible AC Transmission System devices are being raised. In an dangerous situation new lines may need to be created at a very high expense. Cost effective techniques therefore need to be explored to increase transmission retention. A novel exploration has been reported on the night time usage of a PV solar farm where a PV solar farm is utilized as a Static Compensator a FACTS device for performing voltage monitoring thereby progressing system performance and thriving grid connectivity of neighboring solar farms. It is known that voltage control can assist in improving transient stability and power transmission limits, several shunt connected FACTS devices, such as, Static Var. Compensator and stationary compensator are utilized worldwide for progressing transmission capacity. This project presents a novel night-time application of a PV solar farm by which the solar farm inverter is employed as a stationary compensator for voltage control in order to improve power transmission capacity during nights. During day time also the solar farm while providing real power output is still made to operate as a static compensator and provide voltage control using its remaining inverter MVA capacity". This day time voltage regulation is also shown to substantially increase stability and power transfer limits.

3.2 Synchronizing Theory

When collapse a circuit breaker between two energized virtues of the power system it is critical to match voltages on both sides of the circuit breaker before closing. If this matching or "synchronizing" process

is not done properly a power system inconvenience will result and equipment can be damaged. In order to synchronize correctly three different aspects of the voltage across the circuit breaker must be closely monitored. The three aspects of the voltage are called the synchronizing variables and are:

√ The voltage magnitudes

√The frequency of the voltages

√ The phase Sequence

3.3 Synchronizing Method

Modem power plants typically utilize automatic synchronizers. The consideration of synchronizing cannot be exaggerated. All system operators should know the theory and contemplation of synchronizing. If two power systems are synchronized via an open circuit breaker and the synchronizing process is not done properly solar system can be severely damaged.

3.3.1 Two Islands Synchronizing

The first situation assumes that two islands are about to be "linked together using the open circuit breaker as shown in Figure 3.1. The two islands meanwhile they are self-governing electrical systems will have different frequencies so all three of the synchronizing variables must be monetarized to ensure they are within adoptable lines formally to closing the open circuit breaker.

The system operators for the two islands will probable have to adjust generator MW output levels in one or both islands to achieve the desired adjustment in frequencies and phase angles". Voltage control equipment (reactors, capacitors) may also be used as essential to change voltage magnitudes to within satisfactory level.

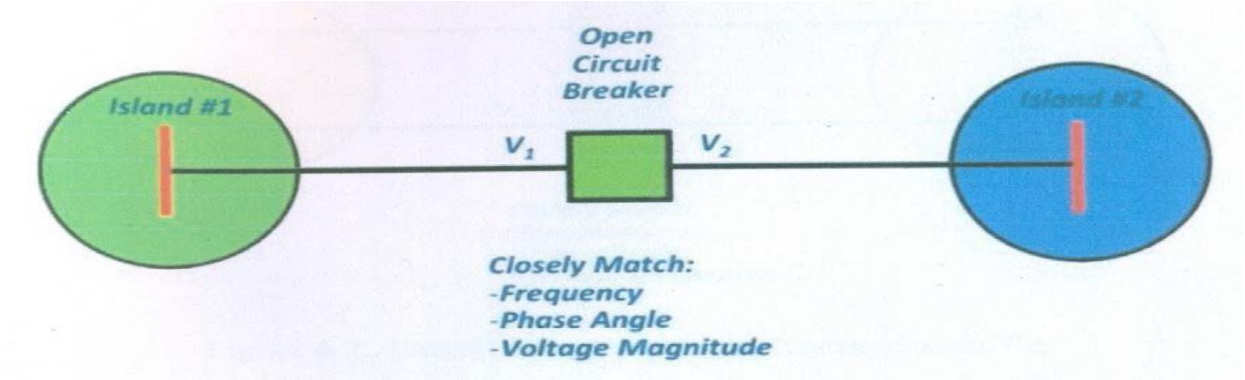

Figure 3.1: Synchronizing Two Islands

3.3.2 The Second Tie Establishing

At one time the first transmission line is closed interconnecting the two islands the frequency will be the same in the two regions. "So one of the three synchronizing variables is no lengthier a factor. However as illustrated in Figure 3.2 the others two synchronizing variables must still be observed. Generation and voltage governance equipment may be to be utilized to assure the phase angle and voltage magnitude alterations are within satisfactory limits prior to closing the second circuit breaker". This process should be easier than closing the first transmission line as frequency is no longer factor.

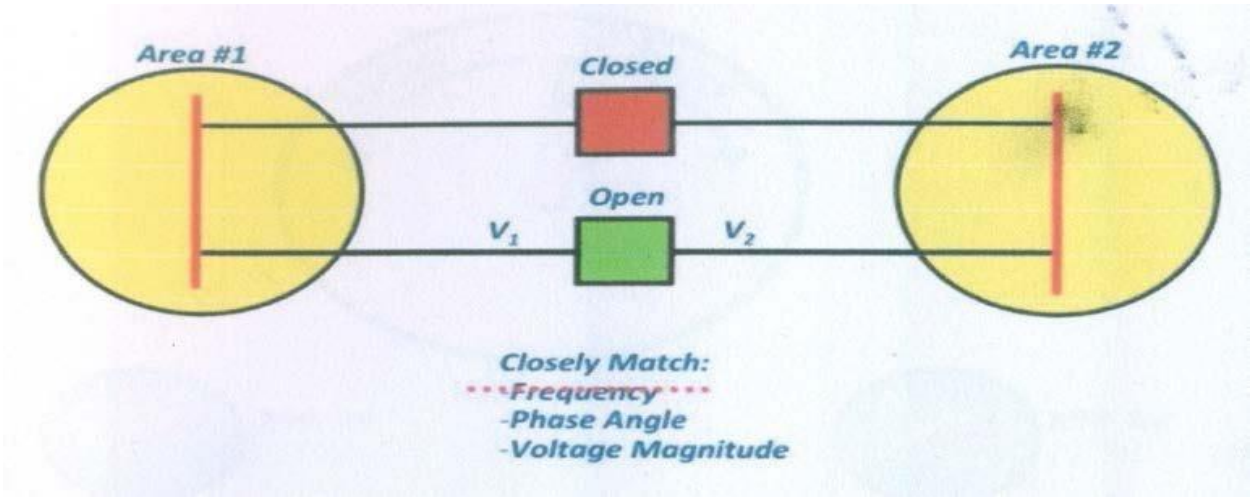

Figure 3.2: Establishing the Second Transmission Tie

3.4 Synchro scope

A scynchroscope is a simple portion of equipment that is used to observe the three synchronizing variables. "A basic synchroscope inputs voltage waveforms from the two edges of the open circuit breaker. If the voltage waveforms are at the same frequency the synchroscope does not alternate. If the voltage waveforms are at a different frequency the synchroscope revolve in ratio to the frequency difference. The synchroscope awl always points to the voltage phase angle distinction. A synchroscope is a manual device in that an operator must be watching the scope to assure they close the circuit breaker at the right time. The synchroscope is usually mounted above eye level on a synch panel. The synch panel also contains two voltmeters so that the voltage magnitudes can be at one time compared. The scynchroscope in Figure 3.3gleams a slight voltage magnitude mismatch

and a motionless synchro scope with a phase angle of approximately 36°". The fact that the synchro scope pointer is not revolving indicates frequency is the same on other side of the circuit breaker.

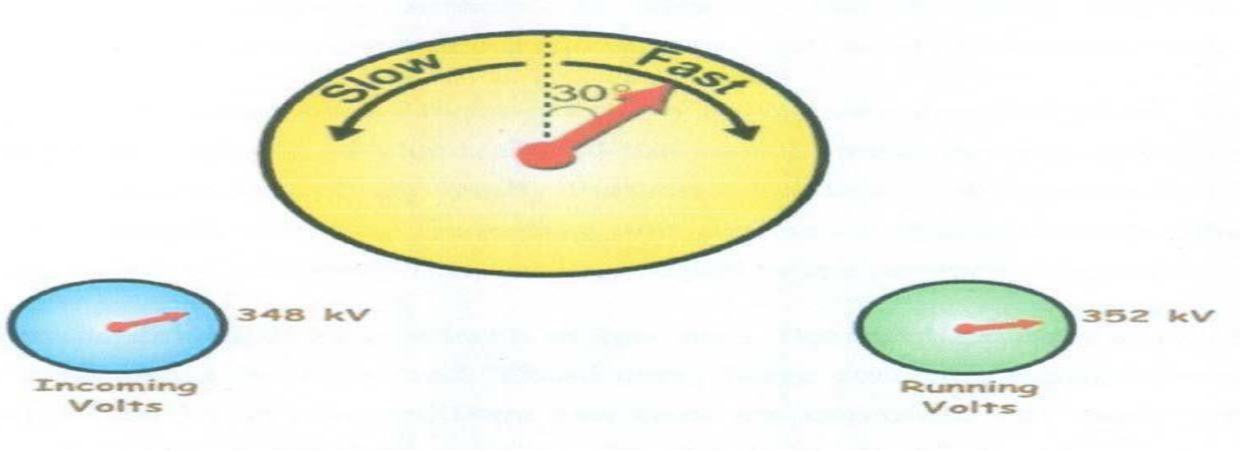

Figure 3.3: Synchro scope in a Synch Panel

3.4.1 Distribution Board

A ordination board is a component of an electricity supply system which divides an electrical power feed into auxiliary circuits while providing a defensive fuse or circuit breaker for each circuit in a mutual enclosure. Normally a key switch and in recent boards one or more 'Residual-current devices (RCD) or Residual Current Breakers with Over current protection (RCBO) will also be incorporated.

3.4.2 Busbar

In electrical power allocation a "bus bar (also spelled bus bar or sometimes erroneously as buss bar or bus bar with the term bus being a reduction of the Latin omnibus meaning for all) is a strip or bar of copper brass or aluminum that conducts electricity within a switchboard, distribution board, substation, battery bank or other electrical machinery". It is major motive is to conduct electricity not to operation as a structural member.

3.4.3 Electricity Meter

An electricity meter or energy meter is a instrument "that metering the amount of electric energy eroded by a residence, business, or an electrically powered instruments.

Electricity meters are typically calibrated in billing units the most ordinary one being the kilowatt hour [kWh]. Periodical readings of electricity meters recognized billing cycles and energy used during a cycle.

In settings when energy savings during certain periods are wished" for meters may measure requirement the supreme use of power in some interval. "Time of day" metering permits electric rates to" be changed during a day to record usage during peak high-cost periods and off-peak lower-cost periods". Also in some zones meters have relays for request response load shedding during peak load periods.

3.5 Summary

"The unavoidable transformation of the electrical grid to a more distributed production configuration needs solar system capabilities well beyond facile net-metered grid-connected methods. Time of use and peak demand rate formation will require more sophisticated systems designs that complete energy management or energy storage into the system construction. Systematizing power movement into and from the utility grid will be requisite to assure grid reliability and power quality. Another protection statistic will also be requisite to atone large numbers of distributed energy sources".

Chapter 4

CONSTRUCTION OF THERMAL POWER PLANT

4.1 Introduction

The solar Power plant generate electricity from the heat of sun's rays. It's an workable source of large scale energy erection. "Initially a solar farm is made up of heliostats. These are computer controlled mirrors which track the movement of the sun in order to best reflect its rays unto a central point throughout the day. A solar farm can comprise from various hundred to diverse thousand heliostats which communicate with each other over Wi-Fi in order to optimize their yield. These heliostats gleam and condense sunlight onto a large heat exchanger called receiver that sits on top of a tower which situated in the center of the solar granary. Within the earpiece fluid moves through the piping that forms the peripheral walls". This unsolidified absorbs the heat from the beetling sunshine.

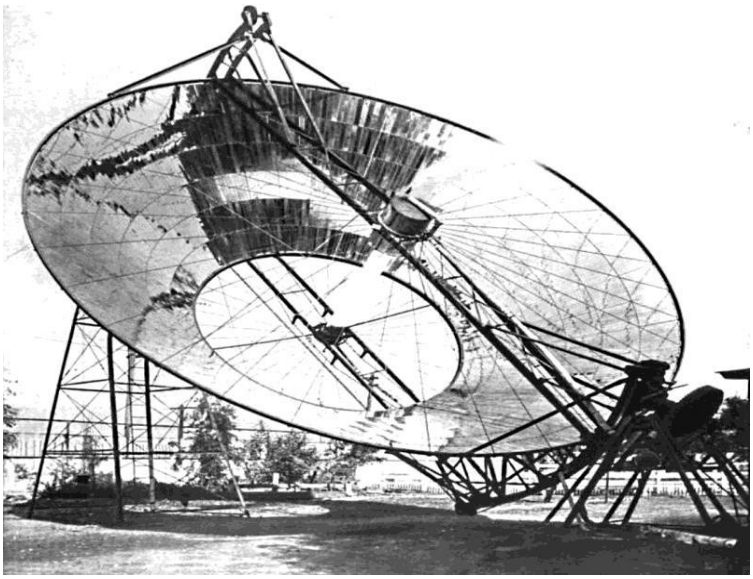

Figure 4.1: Burning Glass

A fairytale has it that Archimedes used a "burning glass" to concentrate sunlight on the attacking Roman width and prevention them from Syracuse. "In 1973 a Greek scientist Dr. Ioannis Sakkas curious about whether Archimedes could really have destroyed the Roman fleet in 212 BC lined up nearly 60 Greek sailors each holding an oblong mirror tipped to catch the sun's rays and direct them at a tar-covered plywood silhouette 49 m away. The ship caught fire after a few minutes however historians continue to doubt the Archimedes story. In 1866 August Mouchout used a parabolic trough to produce steam for the first solar steam engine. The first patent for a solar collector was obtained by the Italian Alessandro Battalion in Genoa, Italy, in 1886. Over the following years, inventors such as John Ericsson and Frank Shuman developed concentrating solar-powered devices for irrigation, refrigeration, and locomotion. In 1913 Shuman finished a 55 HP parabolic solar thermal energy station in Maadi, Egypt for irrigation. The first solar-power system using a mirror dish was built by Dr. R.H. Goddard, who was already well known for his research on liquid-fueled rockets and wrote an article in 1929 in which he asserted that all the previous obstacles had been addressed. Professor Giovanni Francie designed and built the first concentrated-solar plant, which entered into operation in Sant'Ilario near Genoa Italy in 1968. This plant had the architecture of today's concentrated solar plants with a solar receiver in the center of a field of solar collectors. The plant was able to produce 2 MW with superheated steam at 100 bar and 500 °C. The 10 MW Solar One power tower was developed in Southern California in 1981 but the parabolic trough technology of the nearby Solar Energy Generating Systems (SEGS) begun in 1984 was more workable. The 355 MW SEGS was the largest solar power plant in the world until the 395 MW Ivanpah power tower project reached full power. CSP was originally treated as a competitor to photovoltaics and was built without energy storage. By 2016 PV commercial power was selling for recent CSP contracts .However increasingly by 2016 CSP was being bid with 3 to 11 hours of thermal energy storage making CSP the dispatch able form of solar energy. As such, it is increasingly seen as competing with natural gas for flexible dispatch able power. With storage included CSP is the cheapest form of dispatch able solar at utility scale about ten times cheaper than combining PV with battery for storage".

4.2 Present technology

CSP is used to provide electricity. Concentrated solar technology systems usage mirrors or lenses with following systems to focus a large zone of sunshine onto a little zone. "The concentrated sun light is then used as heat or as a heat source

for a aspect power plant. The solar concentrators used in CSP systems can hourly also be used to produce industrial action heating or cooling such as in solar air conditioning. Concentrating technologies remain in four optical types, namely parabolic trough, dish, concentrating linear Fresnel reflector, and solar power tower. Although simple these solar concentrators are fairly far from the theoretical supreme concentration. For example the parabolic trough concentration provide about 1⁄3 of the theoretical highest for the design acceptance angle that is for the same overall tolerances for the system. Approaching the theoretical supreme may be gain by using more elaborate concentrators based on nominating optics. Different types of concentrators produce different peak temperatures and correspondingly changing thermodynamic proficiency owing to alterations in the way that they flow the sun and focus light". New innovations in CSP technology are foremost systems to become more and more cost-effective.

4.2.1 Parabolic-trough

A parabolic-trough construct of a linear parabolic reflector that concentrates light onto a receiver placed along the reflector's focal line. "The receiver is a tube positioned directly above the middle of the parabolic mirror and filled with a working fluid. The reflector monitors the sun during the sunshine hours by following along a single axis. A working softened as it flows through the recipient and is then used as a heat source for a power production system. Aqueduct systems are the most developed CSP technology. The Solar Energy Generating Systems (SEGS) plants in California the world's first commercial parabolic trough plants Acciona's Nevada Solar One near Boulder City Nevada and Andosol Europe's first commercial parabolic trough plant are illustrative along with Platform Solar de Almeria's SSPS-DCS test facilities. Parabolic-trough shaped mirrors collect and reflect the solar energy onto receiver tubes positioned along the focal line of parabolic mirrors. The troughs are typically designed to monitor the Sun along one axis mainly north to south. Heat transfer fluids like as synthetic thermal oil suitable for temperatures up to 400 °C circulating through the tubes are used to produce steam through heat exchangers and steam generators and drive turbine to produce electricity through a steam cycle. This is a well-established and proven CSP technology. The parabolic shaped dish pathways the sun through a two axis movement onto a updraft receiver mounted at the focal point. The concentrated beam radiation is absorbed into a receiver to heat a fluid or gas to approximately 750°C. This fluid or gas is then used to generate electricity in a small Sterling engine or a micro turbine". Dish technology

provide relatively small of electricity likened to other CSP technologies typically in the range of 15 to 25 kW which results in high investment costs.

Figure 4.2: Parabolic Trough Model

4.2.2 Enclosed-trough

The model encapsulates the solar power system within a greenhouse like glasshouse. "The glasshouse creates a endangered environment to bear the elements that can harmfully impact reliability and capability of the solar power system. Insubstantial crank solar-reflecting mirrors are postponed from the ceiling of the glasshouse by wires. A single axis following system positions the mirrors to retrieve the optimal quantity of sunlight. The mirrors distillate the sunlight and focus it on a network of motionless steel pipes also suspended from the glasshouse construction. Water is carried through the length of the pipe which is boiled to generate steam when intense solar radiation is applied. Hiding the mirrors from the wind allows them to achieve higher temperature rates and avoids dust from building up on the mirrors. Glass Point Solar the company that build the Enclosed Trough design states its technology can provide heat for Enhanced Oil Recovery(EOR) for around $6 per million British thermal units in sunny areas likened to between $11and $13 for other usual solar thermal. Use indicators made of several slices of mirrors with small curving resembling a parabola. Mirrors are mounted on trailers and arranged to reflect sunshine onto raised linear reflectors. Water flows throughout the receivers and is converted into steam and the middle heat transfer fluid is not

required. This systems have lower conjecture costs and also lower optical recurrence as compared to parabolic-trough gatherers". This technology is still in the developing stage.

Figure 4.3: Enclosed Trough Model

4.2.3 Solar power tower

A solar power tower involves of an array of dual-axis following reflectors that concentrate sunlight on a vital receiver on a tower the receiver contains a fluid commitment which can form of molten salt. "Optically a solar power tower is the same as a circular Fresnel pointer. The working melted in the receiver is heated 500 to 1000 °C and then used as a heat function for a power generation system. An advantage of the solar tower is the reflectors can be adjusted instead of the whole tower. Power-tower growth is less advanced than trough systems but they offer higher efficiency and better energy storage caliber. The Solar Two in California and the CESA-1 in Platform Solar de Almeria Almeria Spain are the most illustrative demonstration plants. The Planta Solar 10 in Sambuca la Mayor, Spain is the first profitable utility-scale solar power tower in the world. The 378 MW Ivanpah Solar Power Ability located in the Mojave Desert is the largest CSP facility in the world and uses three power towers".

in Albuquerque New Mexico, is an investigational solar thermal test facility with a heliostat field capable of constructing 6 MW.

Figure 4.4: Solar power tower model

4.3 How to Make Mini Solar Power Plant

Figure 4.5: Concentrated solar thermal power model

"The solar power plant yields electricity from the heat of sun’sray. It’s an actual font of large-gauge energy generation. Initially a solar farm is made up of heliostats. These are

computer meticulous echoes which track the crusade of the sun in order to best reflect its rays towards a central point through the day. A solar farm can include from numerous hundred to several thousand heliostats which connect with each other over Wi-Fi in order to optimize their yield. These heliostats gleam and concentrate sunshine onto a large heat exchanger called receiver that sits on top of a tower which situated in the midpoint of the solar farm. Within the receiver molted flows through the piping that forms the outside walls. This watery absorbs the heat from the rigorous sunlight. In this technology the fluid utilized is molten salt comprising chemical mechanisms whose thermal properties are of specific interest. It's an perfect heat detention medium because it maintains a wider functioning infection range in the liquid state permitting the system to operate at low pressure for superior and safe energy capture and storage".

4.4 How to Make Solar Power Model

Heliostats are the construction chunks of a solar technology. Learn how we created a heliostats model from gleaner pieces Aluminum chuddar and mirror fragment. Be careful while handling Glass fragment.

Step 1:

- Chopping small fragment of reaper
- Fix plugs to one end of both fragment
- Join two parts by screws
- Now it become flexible to move in two dimension.

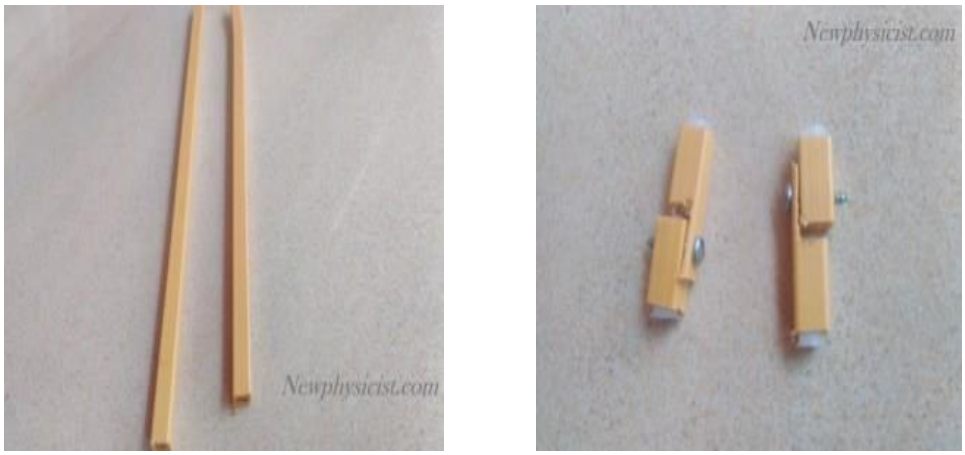

Figure 4.6: Reeper

Step 2:

- Chopping little pieces of Aluminium leaf sizes 2”*0.5”
- Chopped minor pieces of glass by means of glass cutter
- Be careful while handling Glass.
- To connect all the mechanisms together.

Figure 4.7: Pieces of glass

Step 3:

- Attach Aluminium fragments on the reaper
- Prudently attach glass fragment on the reaper Aluminium preparation.

Figure 4.8: reeper-aluminium arrangemen**t**

"Step 4

- Even In a real power plant heliostats doesn't require any considerable element work. In our project we can use Hard boards ACP sheet etc to fix heliostats everywhere the tower.
- Take in 3*3F piece of ACP sheet
- Mark 3 loops with passable displacement between heliostats.
- Use a handrail to create 4mm holes
- Use Drill Prudently.
- Connect all 100 heliostats on a 3*3 feet ACP Sheet"

Figure 4.9: ACP Sheet

"Step 5:

- Now hypothesis the tower, receiver, and other necessary lighting systems.
- Buy strip leds having different colors- red, green, white, blue
- Red for hot melted salt
- Green for cold liquefied brackish
- White for vapor
- Azure for Water
- Stick all the strips on the project components.

- Connect wires using Soldering Iron
- Diminutive solar power plant is Prepared

Figure 4.10: Solar Thermal Model"

Step 6

- Buy a novel effervescent water drinks
- Do not exposed it
- In its place, make a little bit hole
- Take in a cycle conduit stopcock
- Cut the culmination
- Then supplement the footstep side in the jug

Figure 4.11 Heat Absorber

step 7

- Take a piece of aluminum sheet
- Have to Connect the propeller with the dynamo
- "Make the dynamo fixed on the heat absorber
- The ends of propeller leaves should be near to the Valve nozzle
- Attach 1F PVC pipe at the central of ACP sheet
- The steam generator place on the tower
- The mini solar power plant Placed outdoor in a bright day
- Amend all the heliostats so that sunshine provide together the heat absorber
- Await at least 50 minutes
- Heat Drier will fascinate sunshine and will generate steam
- Those high-burden vapor turns the turbine connected to dynamo produce electricity"

Figure 4:12 Turbine Propeller

4.4.1 How Thermal Power Technology Works

Figure 4.13: Solar Thermal Model Internal Structure

"The cold liquefied salt stored in a tank at the improper of the tower have driven up to the top where they are heated to very high infection. Then they go depressed to a second thermal stowage tank, where the energy is stowed in the form of high-infection melted salt until the power is desirable. This updraft storage tank can store this energy to preserve electricity manufacture for several hours after sundown. This technology up-down fluid molten salt as both the energy gathering and the storing apparatus which permits it to distinct energy recruitment from electricity outfit".

4.4.2 When the electricity is required by the utility day or night

"When the electricity is needed by the utility day or night the high temperature melted salt flowing from the thermal storing tank to the steam generator as water is piped in from the water storing tank to produce the steam.

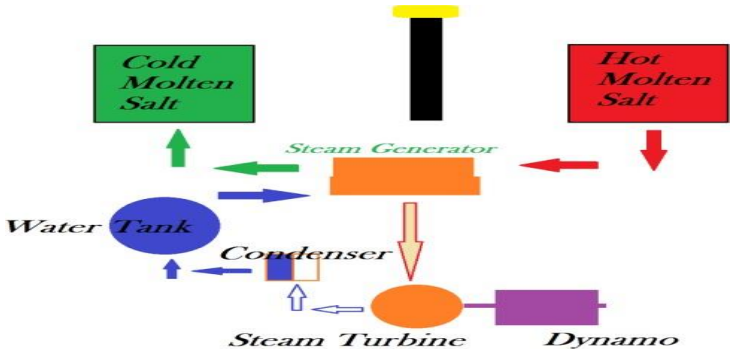

Figure 4.14 Thermal circulation system

When the hot melted salt is used to produce the steam the cool melted salt is then piped back into the cold storing tank wherever it will drift back up the receiver to be warmed as the procedure

continues. After the vapor is used to drive the steam turbine it is concise back to water and repaid to the water staying tank from wherever it will be pumped back into the steam producer when needed. The result is a high quality super heated steam to drive the norm vapor turbine at supreme efficiency to generate dependable non-intermittent electricity during peak needed hours. The Melted salt makes it possible to store heat and therefore energy. This makes the plant working day and night up to 24 hours a day. The vapor cohort procedure is uniform to the procedure used in usual gas coal or nuclear power plants except that is 100% renewable with zero damaging releases or waste". These plants provide on-demand reliable electricity from a renewable source of Sun.

4.6 Relation to heat and interior energy

Heat is energy shifted spontaneously from a warmer to a soothing system. "Heat is energy in transfer not a property of the system it is not contained among the boundary of the system. Instead internal energy is a property of a system. In an norm gas the interior energy is the creatively mean of the moving energy of the gas particles and it is kinetic motion that is the source and the effect of the transfer of heat across a system boundary. The internal energy of an ideal gas can in this sense be regarded as "thermal energy". In this case whatever thermal energy and interior energy are identical. Systems that are more complex than perfect gases can sustain phase changes. Phase transitions can alteration the internal energy of the system without changing its temperature. So the fervid energy cannot be defined only by the temperature. Fervent energy also can’t be defined by the distinction between the interior energy and the net heat allocation in or out of the system because it is easy to build thermodynamic cycles where the system begins and ends in exactly the same state but there is a net movement of heat in or out during the cycle. These cycles could be persuaded upon rather little producers thus making a rotor to spin and making electricity. This is mentioned to as a generating electricity. For these cause the idea of the thermal energy of a system is ill-defined and is not used in thermodynamics".

4.7 summary of this chapter

"Solar energy provide clean power. It does not current the risk of a atomic spill but it is in fact a salvation of radiation sole some of which is noticeable light. It can be scaled to any bulk or perplexity from heating a room through a windows to powering a utility grid".

Chapter 5

ADVANTAGE DISSADVANTAGE AND APPLICATIONS

5.1 Introduction

While the solar PV power plants use the light from the sunlight for photoelectric effect to produce electricity the warmth from the sunlight can also be used to produce power this time through a plentiful more common process of boiling water to produce vapor which turns a turbine. In order to generate superheated steam at high pressure that can run a turbine we will not be able to use ordinary thermal collectors that are used for products such as water heaters as these can heat water only up to a infection of about 70°C. To generate such temperatures, mirrors or lenses that can concentrate the sunlight are required. This avenue of concentrating the sunlight to generate high temperatures and subsequently superheated steam is called Concentrating Solar Power (CSP). The approach of CSP is similar to that of concentrating solar thermal, except that the temperatures reached in this case are even higher than that for CST.

5.2 Advantages and Disadvantages of Solar Energy

Figure 5.1: Solar Model

Solar thermal energy has been losing out in the last couple of years to solar photovoltaic energy which is seeing a huge increase in demand amidst very low prices. "Some of the major solar thermal energy projects in the globe have been converted into solar PV installations due to its lower costs. Some of the major solar thermal energy companies like Solar Millennium have sold their solar thermal portfolios to other companies while Sterling Power Systems has gone bankrupt. Teaser has sold its solar thermal plants which had gotten DOE Loan Guarantees in California to Solar Developers who have made these solar thermal plants into solar panel ones. However, there are some companies like astral and Bright cradle which are driving ahead with their technologies and projects with backing from big industrial MNC conglomerates like GE and Area". Their Power Tower Technologies are supposedly more efficient than the mainstream parabolic toughs that are used.

5.2.1 Advantages of Solar Thermal Energy

1) "**No Fuel Cost:** Solar Thermal Energy does not require any fuel like most other sources of renewable energy. This is a huge advantage over other fossil fuels whose costs are increasing at a drastic rate every year". Price shocks due to high fuel costs are a big risk with fossil fuel energy these days.

2) Predictable 24/7 Power: Solar Energy can produce power 24 hours a day. "This is made possible as solar power plants supply the energy in the form of molten salts etc. Other forms of Renewable Energy like Solar PV and Wind Energy are intermittent in nature. The power supply is much more unvarying and consistent".

3) No Pollution and Global Warming Effects: "Solar Thermal Energy does not cause pollution which is one of the biggest advantages. Note there are costs related with the tackle used to build and transport Solar Energy Equipment".

4) Using Existing Industrial Base: Solar Energy uses tackle like "solar glasses and turbines which is made in large scale at low cost by the present Industrial Base and requires no major changes in equipment" and materials unlike new technologies such as CIGs Panels.

5.2.2 Disadvantages of Solar Thermal Energy

1) High Cost : Solar Thermal Energy prices at "slightest 4 watt and has not weakened too much in the last 3-4 years. However, these costs are too high as Solar PV already costs Euro 3 watt and even on a conservative basis will have its costs reduced by 6% in the next 10 years making it attain" half the cost of Solar Technology by 2020.

2) Future Technology has a high probability of making CSP Obsolete : Solar Energy has become a "Hotbed of Innovation with daily news of some new breakthrough in materials and process in PV Technology. Oerlikon has come out with a radial new a-Si Technology while CIGs player are touting increased efficiencies. Chinese Solar Companies have captured large chunks of the Solar Market through low cost leadership while number of Global Heavyweights like Pasco, Samsung, Hyundai, Sharp, GE, TSMC" promise to further decrease these costs.

3) Water Issue: Solar Thermal Plants use lots of Water which is Major Problem in Desert Areas. "Using non-water cooling raises the cost of CSP projects too much. While using Sea Water has been proposed it remains to be seen if it possible to implement this solution as this would imply building Plants very near the Coastline".

4) Environmental and Social Questions: The Usage of "Massive Arrays of Mirrors is noted to heavily impact the Desert Wildlife endangering the endangered species. California has already seen a massive fight on this issue with Project Developers curtailing the size of their Plants and spending money" to move the wildlife.

5) Limited Locations and Size Limitations: "Solar Thermal Energy can only be built in places which have the high amount of solar radiation. They can be built in deserts mostly and require a large land area. Solar Thermal Energy also can only be built in large sizes which are at least 55 MW in size to be economical. This contrasts to Solar PV which is sold in sizes as low as 6 Watts".

6) Long Gestation Time Leading to Cost Overruns: The Gestation Time for permitting, "financing, drilling etc. can easily take 6-8 years to develop a concentrated solar thermal power plan"t. Compare this to 6 months for a small wind farm or 4 months for a Solar photo voltaic plant.

7) Bankrolling: is the biggest problem in emerging projects predominantly for small solar designers in this industry.

5.3 Applications

A. Solar photovoltaic
B. Absorbed solar power
C. Solar purification
D. Solar powered conveyance
E. Solar heating
F. Solar refrigeration

G. Solar structure technologies
H. Solar thermal electricity
I. Off-grid solar system application
J. Solar energy storage
K. Solar finances
L. Solar cross renewable energy scheme

Types of Concentrating Solar Power Plants

a) Small Scale CSP
b) Medium Scale CSP
c) Large Scale CSP
d) CSP Technology

Types

a) Power Tower
b) Fresnel Reflectors
c) Parabolic Dish
d) Dish Sterling

5.4 Summary of this chapter

"The squalor of solar units with temperature and time gives meaningfully to the final outcome from the panel. As the output decreases each year so does the revenue from sale of power and therefore precise data must be obtainable at the outset to protection that the power plant design is careful and not over or under the compulsory outcome. Lifetime of the unit is one of the four issues except system value; system yield and wealth interest defeat which resolves the charge of electricity shaped from the unit and this lifetime is definite by the squalor rate".

Chapter 6

RECOMMENDATION AND CONCLUSION

6.1 Recommendation

In recent years the extensive anxiety about global heating and detrimental releases from carbon fuels have caused in an emergent interest in the growth of renewable energy applications. Solar energy with a reputation for being inexhaustible and environmentally benign, is one of the most important parts of renewable energies and has been widely used in residential, industrial, remote, and transportation areas. Generally solar power can be used in two ways electricity and warmth. Solar technology uses the solar warmth power to boiled water or air for applications like as space heating, water heating, and cooling for homes and businesses. Solar thermal energy can also be harvested for power generation such as concentrating solar power plant. Solar photovoltaic technology converts solar energy into electricity using semiconducting material solar cell. This special issue in the Journal of Renewable Energy aims to call for papers on up-to-date research on various solar energy technologies and applications such as solar photovoltaic, concentrating solar power, solar desalination, solar powered transportation, solar heating, solar cooling, solar building technologies, solar thermal electricity, off-grid solar system application, solar energy storage, solar hybrid renewable energy system, solar energy economics, and other novel applications of solar energy. Specific studies on novel system, modelling and simulation, sizing and optimization, operation and management, and performance evaluation are also of interest for this special issue

6.2 Limitation of work

a) The fuel (coal) needed may be exhausted by gradual use.
b) Efficiency of the plant decreases with time.
c) It cannot be used as peak load plant, as its part load efficiency decreases with load.

d) Conduction of fuel is one of the prime problems for the plants located far from coal fields.
e) Power production price is considerably high compared with hydro plant.
f) Air contamination causing smoke in the surrounding atmosphere is a major problem for plant.
g) Lifecycle of the plant is barely 3 to 4 eras compared with hydro-plant.

6.3 Future scope

Exploration in solar technology "continues to enhance proficiency size and cost, making it more diffusive throughout society. The trend is partial toward incorporating solar into more buildings beyond panels placed upon the roof. Cool applications include: solar shingles, solar film, solar roadways, and solar windows. Other innovations being explored are: the solar orb, solar cars solar balloons, nanowires, and working with the infrared spectrum. As the manager of the Green Mountain Energy Sun Club, I'm excited about these advances in solar technology and the growing part this pollution-free resource will provide in our lives".

6.4 Conclusion

Bangladesh is one of the most densely populated countries. But supreme of our people do not have the access of electricity. With the time the diagram of electricity needs is strong rising. "For a developing country as like Bangladesh it is economically very much thistly to electrify residences throughout the augmentation of the distribution grids. So here renewable energy can be an efficient solution. The prime energy sources of Bangladesh are biomass and natural gas. People relay on usual energy sources such as fire wood, cow dung, agricultural residues for their energy demand. Therefore solar energy is most atmosphere saving project. Sunshine combines with two types of energy light and heat. To increase production of electricity we can understand the importance of SHS. Solar home system is planned to meet the required of electricity to single household. Operators training has great influence as the users can do trouble shooting of minor problems like substituting fuse, addition distilled water, changing bulbs etc. This may avoid technician call and rise system dependability. Solar systems with various options should be obtainable to the consumers so that they can choose themselves according to their need. Technician training is vital for safeguarding the local technical support as well as to make the project sustainable. Females also should be invited for training, as they are the main users of the systems". They can correspondingly to wage attention for maintenance.

REFARENCES

[1] Solar Energy, *Renewable Energy and the Environment* by Robert foster Alma Cota.

[2] R. R. King et al., 24th *European Photovoltaic Solar Energy* Conf., Hamburg Germany

[3] http://en.wikipedia.org/wiki/world_energy_resources_and_consumption.

[4] http://www.energybangla.com

[5] http://www.spectrolab.com/DataSheets/PV/pv_tech/Evolution%20of%20Multi

[6] junction%20Technology.pdf

[7] http://en.wikipedia.org/wiki/Azimuth

[8] http://www.soldist.com/products/racking/wattsun

[9] http://www.eecis.udel.edu/~honsberg/Eleg620/04_pn%20junctions.pdf

[10] Ilinois.edu Engineering portal web site:

[11] https://wiki.engr.illinois.edu/download/attachments/220434772/CH4SolarCell

[12] OperationalPrinciples.pdf?version=1&modification

[13] http://en.wikipedia.org

[14] http://www.psim-europe.com

[15] http://www.scribd.com

[16] http://www.powere.dynamictopway.com

[17] http://protorit.blogspot.com

[18] http://nptel.ac.in