BACHELOR OF SCIENCE IN ELECTRICAL AND ELECTRONIC ENGINEERING

Study on Present Renewable Energy Status of Bangladesh.

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LIST OF SYMBOLS AND ABBREVIATIONS

PDB = Power Distribution Board.

PPP =Public-private partnership.

UCS = unified computing system.

NREL = National Renewable Energy Laboratory.

NGO = Non-governmental organization.

BRAC = Building Resources Across Communities.

IDCOL = Infrastructure Development Company Limited

SHS =Hollow Structural Section

BDT = Bangladesh Taka

RET = Resolution Enhancement Technology

BCSIR = Bangladesh Council of Scientific and Industrial Research

LGED = Local Government Engineering Department

DFID = Department for International Development

BCAS = Bureau of Civil Aviation Security

MSL = Mean Sea Level

IEC = International Electro technical Commission

SREDA = Sacaton Regional Economic Development Authority

STC = Society for Technical Communication

IPP = Integrated Performance Primitives

DESCO = Dhaka Electric Supply Company Limited

BAEC = Bangladesh Atomic Energy Commission

ADB = Asian Development Bank, LGED = Local Government and Engineering Department

ETSU = Energy Technology and Services Unit

SREDA = Sustainable and Renewable Energy Development Authority

IDCOL = Infrastructure Development Company Limited

GEF = Global Environmental Facility

WECS = Wind Energy Conversion Systems

BCSIR = Bangladesh Council of Scientific and Industrial Research

BPDB = Bangladesh Power Development Board

LGED = Local Government Engineering Department

BUET = Bangladesh University of Engineering and Technology

CWET = Center for Wind Energy Technology

HAWT = hub wind turbines

WT = wind turbines

VAWT = vertical pivot wind turbines

CSP = concentrated sun-oriented power

MPPT = might incorporate a greatest power point tracker

REB = Rural Electrification Board

HDI = Human Development Index

ACKNOWLEDGEMENT

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We also thank our parents for the unceasing encouragement, support and attention.

Abstract

This paper reports the renewable energy resources and technology practices in Bangladesh. It also presents the present energy scenario, renewable energy resources and future prospect in Bangladesh. For achieving growth and progress in a developing country like Bangladesh, utilization of the available energy sources is of more importance. Bangladesh is possessing with vast renewable energy resources such as solar energy, wind energy, biomass energy etc.

People all over the world have been using solar energy mainly for drying from the very beginning of the human race. Use of solar energy more efficiently also started a

The wind farms beside the wind farms are capable of generating 1855.25 megawatt of electricity in the range of 7500 meters, wind speed of 5104 horizontal axis and wind speed of 100 meters in height of 7 meters / second. This could reduce energy deficit by 2016, 55.93 percent. Renewable energy sources can provide 11.25% of the total electricity demand by 2020.

People all over the world have been using solar energy mainly for drying from the very beginning of the human race. Use of Solar energy more efficiently also started a long time ago. more recently, concern about the environment and possible shortage of conventional fuels prompted researcher all over the world to look for sustainable and renewable resources. Solar Energy is one of the best among a score of other renewable resources.

This thesis present the most up-to- data scenario of solar energy and the solar energy based project across the country, Bangladesh and finally, authors try to analyze solar home system per unit cost by a case study.

Chapter-1

Introduction

1.1 Background

Renewable energy is energy collected from renewable resources, which are usually renewed in humans, for example, sunlight, wind, rain, tides, waves and geological warmth. [34] Renewable energy powers the four energies, wind and water, heating / cooling, transportation, and provincial (closed network) energy.

Adequate power supply and progress of a country's predominant social and financial progress. Measuring the record of renewable energy sources, measuring the records of renewable energy sources, exploring the company's renewable strategies, rapid growth of population, population growth, urbanization and global financial development. Annual renewal of the Global Status Report says that the renewable power age limit in 2017 has grown at its largest growth rate, of which there are 178 GB limit. [36]

In 2017, the new sunlight-based photovoltaic range was 98 gigabytes, 29% more than the previous year, while the new wind was 52 gigabytes, 4 percent less than the renewable electricity limit, hydroelectricity in 2012 was 2,195 gw compared to last year 2017 gw.

The world includes renewable limits beyond the age of the new petroleum derivatives. In 2013, renewables accounted for 100 percent of net growth in global production, the report said. The renewed interest in renewable electricity and refueling was about ৯ 299 billion (৯ 209.05 billion), more than double the 2016 2.4 billion per 2016-2016 and the limit for new petroleum derivatives and nuclear power. Be that as it may, energy request and energy-related carbon dioxide CO_2emanations ascended without precedent for a long time a year ago. Worldwide energy request was 2.1 % higher and CO_2 emanations were 1.4 percent higher because of monetary development in rising economies and populace rise.
Renewable energy take-up isn't keeping pace with this expanding energy request and the persistent interest in fossil and atomic limit, REN21 said in an announcement. The warming, cooling and transport parts which together record for around four-fifths of worldwide last energy request keep on behind the power division. Around 92 % of transport energy request keeps on being met by oil and just 42 nations have national focuses for the utilization of renewable energy in transport. We might race down the pathway towards a 100 percent renewable power future yet with regards to warming cooling and transport we are drifting along as though we had all the time on the planet. Tragically, we don't state Randi Abed official secretary of REN21[1][35].

1.2Literature Review

Since the 1960s, sustainability and environmental responsibility have attracted academic research. Voluntary publication studies have tried to examine the nature and design of sustainability, and enough. Exposure, and the results of this publication are explored in terms of size, profit, and industry.

Identification of sustainability and environmental practices in developed and developing countries among the countries of the literature. Also, status and environmental manifestations vary between nature and patterns. Sustainability and environmental disclosure practices in Western developed countries show that firms emphasize the number and number of employees, equal opportunities, employee share ownership, disability policy, and employee training and human resource disclosure. Solar pumps, mini-grids and biogas plants can be promoted with the identity of village-based small and medium entrepreneurs who can then invest in technology and make a profit by renting to others. The government can encourage women entrepreneurs to create village-based businesses and promote improved cooking stoves that help reduce house fumes and will also be responsible for providing collection, repair and sales services for solar accessories. [43].
The Government of Bangladesh will need to attain an effective power generation capacity of 17000 MW to reach the very ambitious national goal of providing electricity to every citizen by 2020. They also mentioned that this target seemed impossible with the increase of only 500 MW from 2001 to 2006. Ahmed et al. (2013) mentioned in their study that the main reasons behind Bangladesh lagging behind in the use of renewable energy are the main reasons for the initial investment cost of RET, infrastructural deficit and lack of awareness [44].

The main barriers to renewable energy in their paper are economic, financial, political and technological. Overcoming barriers to renewable energy use, policies in favor of renewable energy, as well as proper investment in RETs are essential. It will help reduce the country's energy crisis. Current problems with renewable energy policy can be addressed by developing a comprehensive energy strategy that includes expert and neutral policies [44]. Bangladesh needs to take appropriate steps to develop sustainable energy.

Detailed and accurate techniques and machinery are required to reap real benefits from the introduction of new technologies. However, we are still lagging behind in the scientific use of this renewable energy due to lack of technology and efficiency in this field. [45] According to [44], in order to achieve the ambitious national goal of supplying electricity to every citizen by 2020, the Government of Bangladesh will have to achieve an efficient power generation capacity of 1,17,000 MW. They also mention that this goal seems quite impossible since there had been an increase of only 500 MW of electricity from 2001 to 2008. Ahmed et al. (2013) mentions in their study that the initial investment cost of RET, lack of infrastructure and lack of awareness are the main reasons behind why Bangladesh is still lagging behind from using renewable energy as the main contributor. The major constraints of renewable energy mentioned in their paper are economic, financial, political and technological. In order to overcome the barriers of using renewable energy, proper investment on RET is essential along with policies that favors renewable energy. This will help to reduce the country’s energy crisis. The current issues regarding renewable energy policies can be solved with the creation of a comprehensive energy strategy which would include expert and unbiased policies. Bangladesh needs suitable measures for sustainable energy development. Detailed and accurate strategies and instruments are necessary to obtain actual benefits from the

introduction of new technologies (Uddin and Taplin, 2006). However, we are still falling far behind in the scientific use of this renewable energy due to reasons such as lack of technology and expertise in this field.

In addition to the expectation of disclosing information related to environmental and social performance, it has been demanded for quality information that allows readers to compare the performance of the organization. Widely recognized standards, especially in the field of sustainability and environmental disclosure, include GRI Stability Reporting Guidelines, Liability Standards 1000 and 1000S and ISO 14001 Series Certificates.
Focus on the issues that should be reported in the GRI Guidelines GRI uses a worldwide sens minimization-based search process to develop reporting guidelines by reporting organizations such as readers and employees, investors and private companies. The first guidelines in GRI 2000, the second in 2002 and the third in late 2006.Due to the focus of the processes and especially the involvement of the partners in the conversation, an organization may be forced to withdraw, instead of following the list of items publicly [40].

1.3 Motivation

Bangladesh's electricity demand is projected to reach 34,000 MW (MW) by 2030. The country generates electricity mainly from natural gas. Only two-thirds of Bangladesh's population is connected to the electricity grid. This indicates an unplanned potential market of 60 million people connected to the national grid in the coming years as Bangladesh continues its growth trajectory.Bangladesh is nearing one of the biggest tears in the power sector. Due to fuel shortages, the thermal power plant solves this problem and Bangladesh moves to renewable sources to solve the roaring power problem. If we set up the solar base project in our roaring region, we can overcome the power problem in our country [41]

1.4 Objective

To condition the relationship between renewable energy and economic growth.

To provide strength to the society. The purpose is to allow everyone to use electricity. Replacing energy sources that emit 〖CO〗 _2, other pollutants). The purpose is to keep our place livable and pleasant. Energy sources that need to be imported are being replaced. The goal is to be less dependent on other people (such as oil countries). To verify the possible contribution of renewable energy in power supply of Bangladesh. Identification of sustainable development energy for Bangladesh power sector [40].
Set up a Solar Home System (SHS) to provide power supply to the affected areas. To reduce the pressure of the national power grade. To provide strength to the society. The purpose is to allow everyone to use electricity. Replaces energy sources that accumulate emissions (CO2, other contaminants). The purpose is to keep our place livable and pleasant. Energy sources that need tobe imported are being replaced. The goal is to be less dependent on other people.

Chapter-2

Renewable Energy in Bangladesh

2.1 Energy Situation in Bangladesh

The Utility Power Zone of Bangladesh has a national structure starting from July 2018 with a point of limiting 16 048 MW. Bangladesh's power sector is growing. 2.4-Gigawat Rooppur Nuclear Power Plant Predicts Bangladesh as Late in 2023, In July 2013, Bangladesh controlled 90 percent of Bangladesh's electricity. Bangladesh is rarely seen [38] The intensity of a large part of the country's financial practice requires control. In January 2012, Bangladesh had 15,121 MW (control) under control. As of 2012, 92% of the city's population and 67% of the country's population have access to electricity. 97.9.9% of the general population controls the majority. To keep the cash-related progress at more than one percent by 2030, Bangladesh needs 34,000 MW of capacity. [39] Among the components of the impact of electricity in Bangladesh are the maintenance of inequality for the recognition of new plants, low plant compatibility, great impact supply control, theft control capabilities, and high-rise infrastructure. The race-age plants do not doubt that the structure of the last decade cannot be requested.

After a long power outage in the country, on November 2, 2014, a power transmission line from India exploded, leading to frustration with the input of the national power structure and the old system infrastructure and poor administration. Any type of investor cluster in the original test report reports that the error is due to poor infiltration and transport infrastructure resulting in immediate results of power administration and power consumption requirements. Over the next four-and-a-half years, the Department of Intelligence and Energy spent 000 5,000 billion and 8 5.88 billion on the stadium for four-and-a-half years. Under this arrangement, PDB of Bangladesh Control Board will provide stack shedding in December and 500 MW from July to December 2009.. PDB will use intense oil from 1000 meters from January 2010. The chamber will be set up in 2011. Plant-based heating oil will be used in the 600-meter blueprint. PDB experts would like to see the appropriate place for the Padma bridge. Also, other diesel or hot oil-based power plants will be purchased in 2012, including 70,000 MW of broken points, to bring the graduation level down to a fragile level. In Rajshahi and Chittagong regions, the administration considers the situation to be the four most remote coal-fired power plants generating 500 MW power, including open and private PPPPP.

According to administrative sources, strategic sources said that initially an attempt is being made to make value1 billion worth of billion 60 billion. Trying to use the promise of budget budget tickets. Thus PPP has 20 billion sources. On June 29, 2009, [2] Alamgir Kabir told the new state that the idea of securing bill 400 billion under the PPP would be acceptable to PDB officials for passing 5,000 MW. Intensity in four and a half years [37]

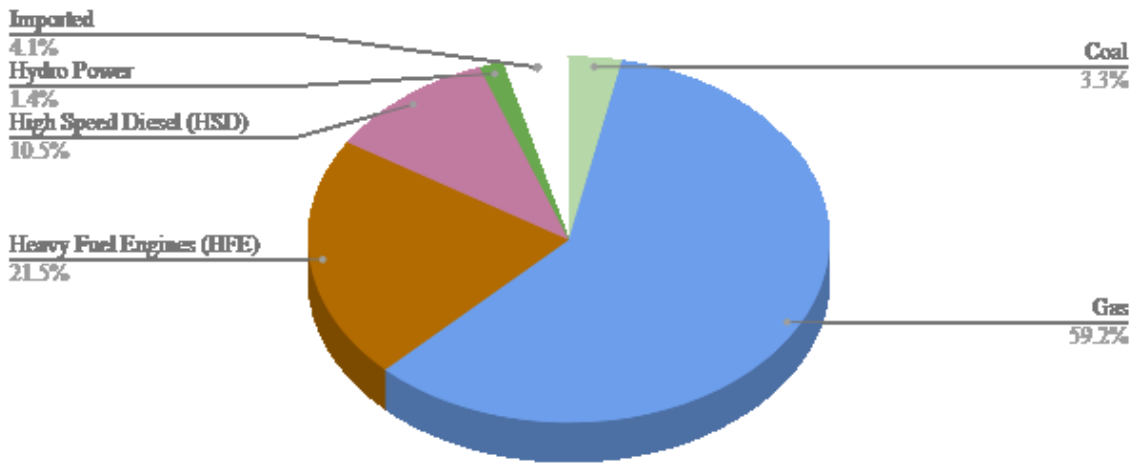


Figure 2.1: Energy Situation in Bangladesh

2.2 Reasons of use renewable Energy

Rapid urbanization driven by stable financial development has requested an extraordinary force in Bangladesh. It is remarkable that energy shortages, economic development, economic structural progress and the assurance of a country's security take a necessary action. Energy is the most commonly used energy in Bangladesh. Future financial development depends entirely on the accessibility of power. Currently, about 72% of the total population has access to electricity and the power supply is not reliable enough. Bangladesh has been starving for energy for decades as its affordability age depends on imported non-renewable energy sources and petroleum gas.

The current government has effectively extended the age of electricity, yet matrix electricity cannot reach remote areas of the country due to lack of foundation and long-term scattered offices. Towards the end, green energy continues to age to reduce the flow of ozone harmful substances to reduce global carbon-dioxide (〖CO〗). Conventional power generation is an essential source of ozone depleting emissions (29%) . The reverse and advancement of petroleum products, which is usually done in the commercial, serious and renewable energy industries between motorbikes and capital. People on sunlight-based boards will introduce them;

Specialists need assistance for air wrenches. This means that more energy is generated for each unit of electricity generated from renewable sources than petroleum products.

Renewable energy is now under huge employment in the United States. In 2001, the wind power industry employed 100,000 full-time-proportional workers, including directly productive, enterprise advancement, development and turbine processing, operation and support, transportation and coordination, and range, legal and consulting. Administrators. In the US, more than 500 industry facilities make parts for wind turbines, and in 2016, only 13.0 billion dollars are part of the air control initiative. More renewable energy use innovation In 2016, sun-based industries employ more than 26 million people, including employment in the sun-based organization, which include 25% more consolidation and agreements since 2015. About 66,000 hydropower generation was used by 2017. Geothermal business uses 5,800 people

Extensive help for renewable energy can be achieved more. In 2009, the Central Science Researchers tested 2025 renewable energy standards in 25 percent and found that this method

created more than 200,000 jobs (more than 200,000) compared to the amount of petroleum derived from derivatives. Interestingly, the entire coal industry used 160,000 people in 2012.

Regardless of the specially designed activities in the renewable energy industry, the development of clean energy can positively create financially costly effects. For example, the initiatives of renewable energy saving networks will benefit and minors will also benefit from additional family units and business ventures.

Renewable energy is giving strong energy to the country at the moment and can help adjust energy expenditures later. While renewable offices need simple ideas to assemble, they will be able to work with clean fuel, the easiest to release fuel. After that, the cost of renewable energy may persist for sometime to come.
In addition, the cost of renewable energy discoveries has steadily declined, and is significantly worse than expected. For example, anywhere in 2010 and 2017, sunlight-based normal spending exceeded 70 percent. Between 2009 and 2016, the use of electricity from wind decreased by 66 percent. Expenses will probably be significantly reduced. Business sector development and organizations use a growing scale economy.
On the contrary, the cost of non-renewable energy sources can significantly vary and lean towards liberal prices. For example, since 2008, the cost of US coal has increased rapidly, with global requests decreased since 2008. Similarly, the cost of petroleum gas has changed significantly since 2000.

By using renewable energy, increasing competition and increasing our electricity supply can reduce fuel costs and fuel costs. Also, an extended dependence on renewable energy can help the safe buyers while spike petroleum derivatives cost.

Human movement is comparing our climate with carbon dioxide and other global mental changes. This gas is a sweeping, attractive warm-up demonstration. As a result, there is a huge, damaging storm, dry season, rise of the ocean and the end of the huge and harmful effects.

In the United States, about 29 percent of the world's temperature is rising from our electricity sector. Most of them are derived from renewable energy sources such as coal and natural gas. [3].

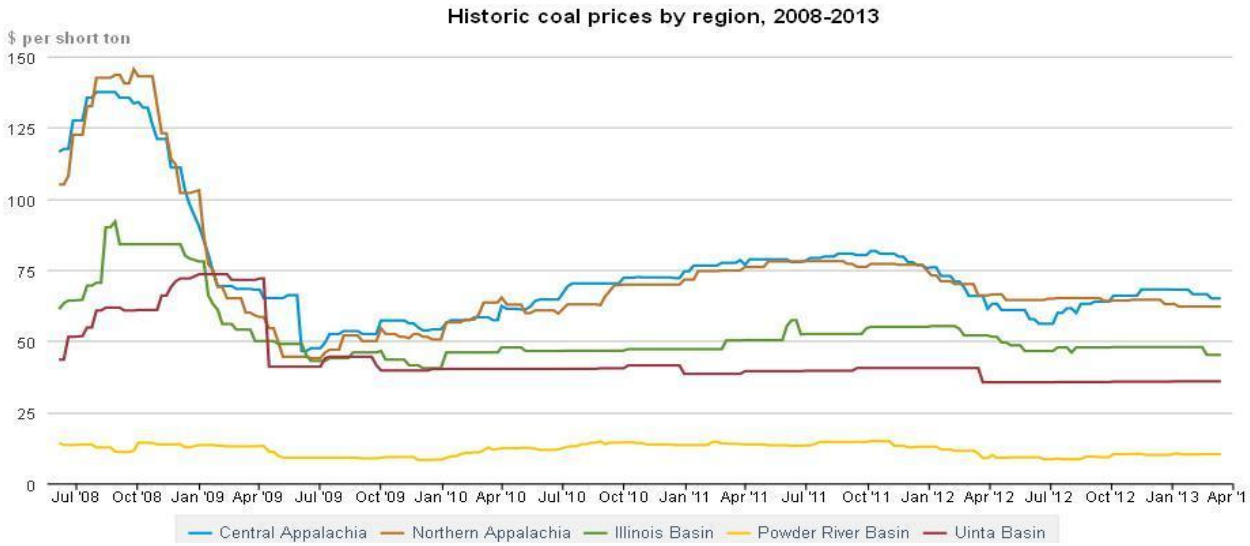


Figure 2.2:Reasons of use renewable Energy

What is CO_2e?

Carbon dioxide is the most abundant ozone depleting substance, yet other air toxins, for example, methane cause similarly dangerous atmospheric emissions. Different living sources provide specific steps for these toxins. To make the correlation less demanding, we use a carbon dioxide as a uniform, or measure the carbon dioxide needed to measure the ratio of temperature. Conversely, most sustainable energy sources create a dangerous atmospheric deviation flow next to zero. Yet the emergence of each episode of the clean life cycle involving the discharge of the life cycle (i.e. the fabrication, installation, operation, decomposing of the life of an innovation), a dangerous atm spheric fidelity extrinsic relation to a sustainable energy source is not insignificant.

The correlation turns out to be clear when you take a gander at the numbers. Consuming gaseous petrol for power discharges somewhere in the range of 0.6 and 2 pounds of carbon dioxide equal per kilowatt-hour CO_2E/kWh); coal produces somewhere in the range of 1.4 and 3.6 pounds of CO_2E/kWh. Twist, then again, is in charge of just 0.02 to 0.04 pounds of CO_2E/kWh on a real existence cycle premise; sunlight based 0.07 to 0.2; geothermal 0.1 to 0.2; and hydroelectric somewhere in the range of 0.1 and 0.5.
The irreversible energy from the biomass depends on the hazardous atmospheric deviation currents of different types of ages and it can remain economically inefficient and without harvesting.

Individual sources of vital energy create a diverse array of heat-absorbing gases. As revealed in this outline, sustainable energy sources tend to have much lower currents than different sources, for example, combustible gas or coal.

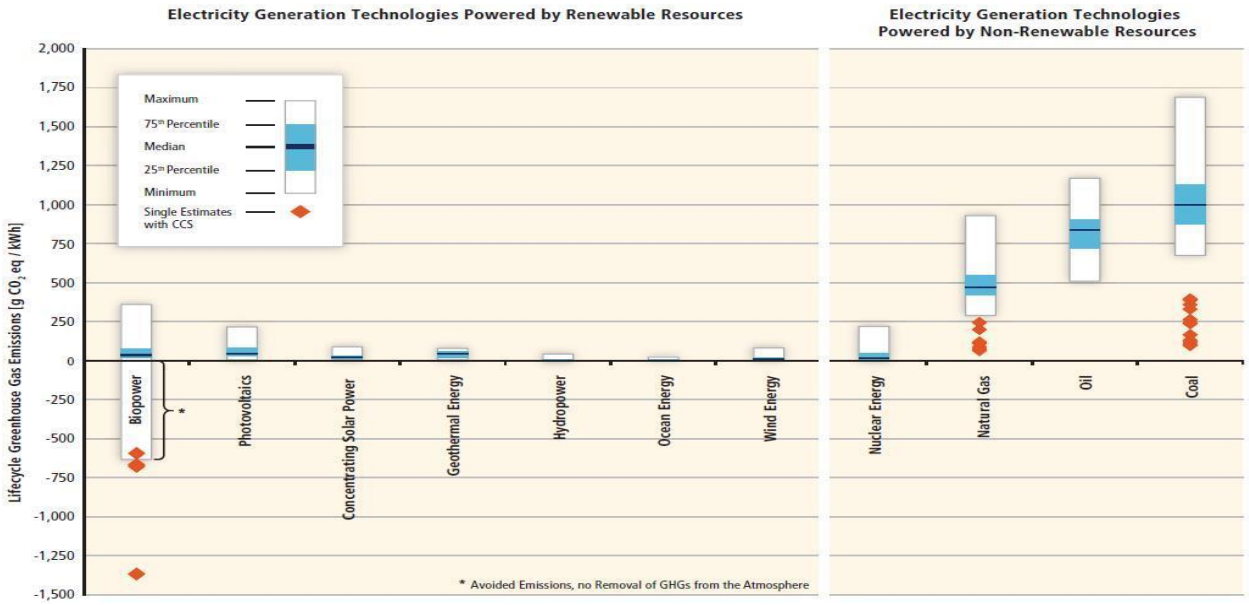


Figure 2.3:Electric generating graph

Expanding the supply of sustainable power source would enable us to supplant carbon-concentrated vitality sources and altogether diminish US an Earth-wide temperature boost outflows.

For example, in 2009, the UCS investigation found 2025 new coal plants in 2025. CO 2 _2 2525 per year 270 million metric tons per year, new coal plant (600 megawatt).

Moreover, a historic report from the National Energy Renewable Energy Laboratory (NREMEM) found that by 2050, more than 80 percent of the country's resources had been explored. They found that sustainable electricity sources could help reduce electricity costs by about 81 percent.

2.3 Renewable energy attractive Bangladesh

1. Bangladesh is situated between 20.30 – 26.38 degrees north latitude and 88.04 – 92.44 degrees east longitude.

2. Maximum amount of radiation is available on the month of March – April (7.6h) and minimum on December – January (4.7h).

Locations	Month												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Men

Barisal	2.90	2.57	2.57	3.56	3.32	2.90	2.71	2.65	2.57	2.11	2.07	2.05	2.66
Bogra	1.95	2.20	3.05	4.03	4.15	3.66	3.42	3.05	2.56	2.20	1.83	1.71	2.82
Chittagong	3.64	2.88	4.95	5.01	5.11	6.89	7.09	6.83	4.64	2.20	3.39	2.20	4.65
Comilla	2.26	2.70	2.57	5.45	3.83	3.20	2.88	2.95	1.82	2.38	1.63	1.70	2.78
Cox's Bazar	3.76	3.83	4.51	5.58	3.83	4.14	3.83	3.95	3.20	3.26	2.57	3.26	3.81
Dhaka	3.39	3.26	4.39	5.77	6.33	5.71	6.01	5.89	4.39	3.45	2.64	2.95	4.52
Dinajpur	2.68	2.44	4.88	2.44	2.93	2.68	2.56	2.44	2.44	3.54	2.44	2.44	2.83
Hatiya	3.04	2.64	4.16	3.97	4.82	6.47	5.75	2.64	2.96	2.77	3.06	2.57	3.74
Jessore	2.88	2.95	4.95	8.34	8.34	6.27	6.15	4.95	4.33	3.45	3.32	3.20	4.93
Khepupara	4.20	4.39	3.38	7.09	5.83	4.71	4.14	3.95	3.57	3.70	2.95	2.57	4.24
Khulna	2.96	1.65	3.04	3.05	4.16	3.89	3.31	2.44	2.51	1.98	3.31	2.38	2.89
Kutubdia	1.77	1.82	2.32	2.70	2.77	3.65	3.61	3.14	2.11	1.45	1.19	1.29	2.32
Mongla	1.07	1.25	1.72	2.51	2.92	2.63	2.48	2.35	1.83	1.27	1.02	1.01	2.20
Rangamati	1.45	1.65	4.42	3.10	2.11	3.23	1.72	2.24	1.45	1.45	1.39	1.59	2.15
Sandwip	2.32	3.01	3.20	4.83	2.44	3.83	3.39	2.70	2.32	1.63	1.70	1.70	2.75
Sylhet	2.20	2.93	3.29	3.17	2.44	3.68	3.44	2.71	2.71	1.95	1.89	1.83	2.76
Teknaf	3.70	4.01	4.39	4.01	3.32	3.89	3.43	2.88	2.44	2.20	1.57	1.76	3.17
Patenga	6.22	6.34	7.37	7.92	8.47	8.69	9.20	8.54	7.84	6.93	6.71	5.91	7.48
Satkhira	4.21	4.40	3.84	7.10	6.11	4.76	4.27	4.03	3.62	3.78	3.54	2.81	4.37
Thakurgaon	4.15	5.06	7.93	8.43	8.66	4.05	7.93	6.59	6.34	5.98	5.25	4.76	6.59

Table2.1: Renewable energy attractive

2.4 The Toper Country using renewable energy

Iceland

Iceland produces obvious energyless energy for the world, with approximately 100% of its energy coming from renewable sources, which takes advantage of its fascinating philosophy. Currently, most of its energy is for heating and cooling plants in geothermal and hydroelectric plants. The renewable power plants at the Blue Legion geothermal plant make a huge measure of the stage.

Sweden

Sweden really had a great environmental charter and in 2015, they declared war on the renewable use of renewable energy sources outside of it. They have left the world for a 100% renewable finish to the country's exams. They have developed their own interests in solar powered energy, wind control, energy storage, impressive fabrication and clean transport.

Costa Rica

Due to its small size (only 4.9 million people) and special sites (67 67 volcanoes), Costa Rica can generate a lot of energy from hydroelectric, geological, solar and wind sources. The country has planned a complete carbon-non-partition since 2021, and in the last two years it has achieved some remarkable results over 100% renewable energy for more than two months.

Nicaragua

Nicaragua is another country in the United States where renewable energy is developing significantly. There are geographic eruptions like Costa Rican, with the government's interest in

wind, solar and solar power due to geological power generation and 90% renewal problems by 2020 making it an achievable goal by all accounts.

United Kingdom

Using a mixture of networked wind farms and independent turbines, Twists produce more power than the United States coal control centers. For some time, 100% of the Scottish households could create enough wind power to supply the Scottish family unit. Inland Ireland has enough power to build more than 1.26 million homes in 2015 with just one flash day.

Germany

For a warm up, a bright event has been traced with the sunset of Bangladesh. The fact that the fact of renewal has been achieved since 1990 has been determined since 1990. Profit 78 %% Record of intercourse has been made.

Uruguay

This is exactly how Uruguay works. As a regular organization of regular associations and individual organizations and as a reason for a solid organization, wind and sunlight based electricity sponsorship or sponsorship has been widely used in the country. Also, later, it renewed 95% of the national electricity supply in less than 10 years.

Denmark

By 2050, 100% of Denmark's petroleum products will be free and he wants to use the package to fulfill that purpose. They officially set a world record in 2014, controlling 40% of their electricity demand, and kept the latest figures firmly on track to achieve the first goal of renewable energy in the 2020s.

China

They can be the world's largest pollutant; However, China is the world's largest financial expert with renewable energy levels abroad and abroad. Currently China: Five of the world's six largest sunlight-based modules; The largest wind turbine maker; The world's largest lithium particle producer; And the world's largest power utility China is fully committed to reducing renewable energy sources and as such it has every dynamism in its strongly corrupted city region.

Morocco

Morocco is a country that is full of days (up to 350 days a year), so it has come out loud in the creation of shiny sunlight-based energy energy. After the delay, the world's largest concentrated sun-based plants are expected to provide enough energy for more than a decade of Moroccan family units, including the opening of Morocco and their wind and water production office by 2018.

America

America has the largest solar-based PV range in the United States and China has the wind power limit for the second time. Yet, it is one of the world's largest fuel retailers, which oppose its renewable limits. However, if renewal related to petroleum derivatives is considered more, it has been evaluated that the subscriber may reduce 80% by 80% without affecting the cost of electricity.

Kenya

Previously, Kenya has been compelled to import power from neighboring nations, yet they are endeavoring to turn around this by putting intensely in geothermal energy creation, which represented the greater part their energy blend in 2015. They additionally have Africa's biggest breeze cultivate, giving another 20% of their introduced power producing limit [5].

2.5 Renewable Energy

Renewable energy is energy made from a source that does not dry out forever. Daylight, wind, flowing water, geothermal warmth and plants are examples of renewable energy resources. These can be made today without compromising their ability to distribute later. The use of renewable energy over the past decade has put an end to further needs for individuals, industries and governments. Why? Renewable energy resources are not extracted, they are moving towards more affordable prices and they have a mild natural effect.

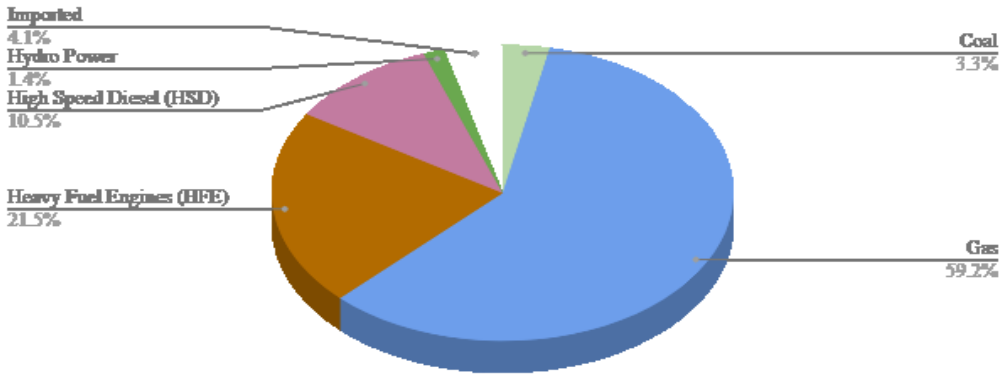


Figure 2.4:Energy in Bangladesh

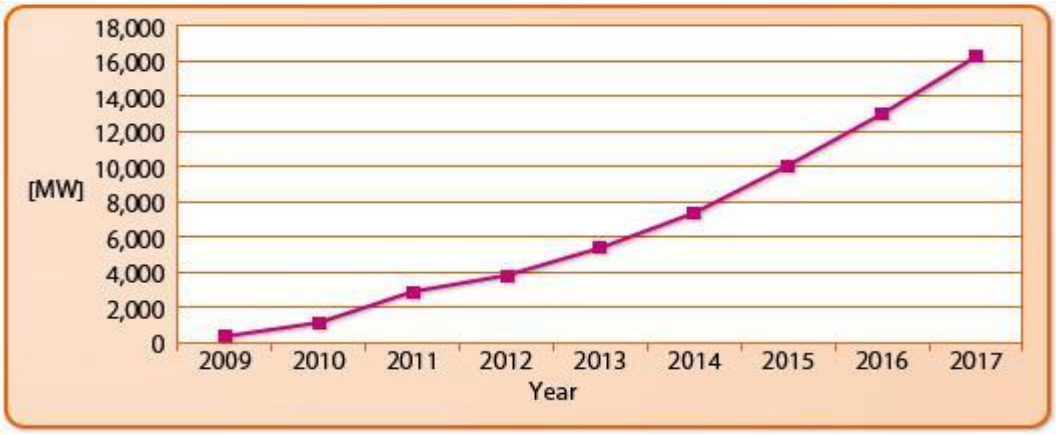


Figure 2.5:Total power in Bangladesh (MW)

2.5.1 Solar Energy

Despite the great power of the solar system in Bangladesh, the use of solar energy was limited to traditional therapeutic uses, for example, drying grains and fish in the open sun. Solar PVs are selected for recognition of family units and private enterprises in provincial regions. In 1988, the Bangladesh Atomic Energy Commission (BHC) introduced several pilot PV systems. Since 199, access to SHS (Solar Home Systems) has grown rapidly, thanks to the efforts of rural energy, through its extensive system, PV systems providing access to credit cards in their family units. For example, some new NGOs, CMES and BRAC PV are developing innovations as well. Note that the use of solar power decreased by 60% between 1991 and 2003 and by 47% from 2006 to 2010. It is very important to take a hole from IDCL to achieve reliance on small home-basic scale financing. More than 500,000 solar home systems have been introduced in provincial cities and the request is improving; And more than 20,000 solar cells are launched every month and it will double and double in the next few years. In our country solar energy is collected during the dry season for the production of solar energy, especially solar products, especially animals. Bangladesh has 11,000,000 shallow tube wells of which 903,000 are powered by diesel and the remaining 19 are powered by 197,000 electricity is carried out.

The ultimate goal is to supply water to the solar system in order to maintain the cost of Russian diesel and to keep the diesel deficit at bay. Then again solar pumps with solar pumps in the provincial areas of Bangladesh to facilitate the special capacity of SHS and quality development of administration.

B. On solar pumping systems, administrators can contact Russian financial bundles in exchange for fuel and energy for each single shallow draw.

C. Due to the high priority initiative of the PV network system, this area should have a standard approach. They must first establish an objective to send renewable energy and use tools to achieve such goals. Renewable power innovation sets up renewable energy facilities for input materials, customer credit plans, restrictions, and empowerment development.

Regardless of the suitability of the DSD Exercise solar heating gadget, these applications have not been discovered in the general category or in the personal section.

E. Such rational motivation applications are alluring basic. Reasonable systems and devices will be improved to increase the productivity of each product in different parts.

Fake charges are fundamental for financial development in Bangladesh. There are more than ৳ 87,000 cities in Bangladesh and most of them are not connected to the national network, the PV network power age system can be successful in expanding the framework association and accessible power for all. The PV matrix system feasibility analysis for a 500 kW aged plant has been done considering the cost of the system considering the cost of electricity per unit, which costs about 15-18 bd including diesel control. Because of the spotless progress, considered carbon assessment and rising oil prices, unit costs will be lower than diesel control age structures. Compared to the general matrix, the country's first solar small is now fully operational on a remote island in the sand dunes. This innovation of limitations and the district primary solar small network. The power plant installs a 100 kW solar stop with the help of an electronic inverter inverter system that allows 220 V AC control to be adjusted from the three-tier line of the small structure. A small solar network within the 25-kilowatt range will generate electricity for 4.5 hours and provide 113 kilowatts of electricity, which will be deducted from 82 gigawatts (gigawatts) of electricity for a long time from national astronomy. The administration also plans to operate a mega project to set up a 500-megawatt solar power plant funded by the Asian Development Bank (ADB). Solar Warm Advance Solar Heating System, Solar Dryer and Solar Cooker for Asia Encouragement. Solar water radiators can absorb electrical loads for insertion and healing centers, solar cookers can store biomass, and solar solids can be valuable for drying environmental effects such as wood, rice, leafy foods. This innovation has been further intensified by simply introducing the BRAC 260 hot box dog. NGOs aspire to introduce 5,000 hot box dogs across the country [Bangladesh has seven open technical universities and three extensive research centers, where feasibility and excellent experimental work can be done for RETs for renewal. Power resources do not really want human resources in the absence of proper quality assets. Some research and research practices in different universities are working in this university, focusing and focusing on some NGOs. Activities that take place could increase future solar power by 10%, deplete ozone-depleting substances, pose a danger, and risk recovery in the kitchen. The Energy Research and Development Foundation (IFRD) of the Bangladesh Council for Science and Industry Research (BCSIR) has completed several successful stove tests. Their extended family stoves are 40-60% in contrast to conventional types of fuel. There are practically about 0.2 million stoves but they are not used consistently. The increasing use of biomass by family, foundation and business reduces the use of items with fuel, faster handling, improved item quality and more timely use of item.

2.5.2 Wind energy

Air vitality can probably give mechanical vitality or energy without producing contaminants. Verifiably it was used as a source of mechanical vitality in numerous countries, especially the Netherlands, e.g. Corn or pumping water crushing. In Bangladesh, as in many other countries, wind power has been used to provide some reasonable energy Pontoons with sails of various plans. Tragically, very little research has been conducted in these areas, although towards the end of the

recovery conspiracy such as wind pumps and hydraulic crafts were made to use the vitality of the diversion. Twist power is now somewhat considered for decentralized structures or for applying half power using other life-sustaining sources in harmony with wind power, and may be suitable for limited little matrix frameworks or short wind administration for battery charging. For low wind speeds, air pumps can be a similarly practical option.

Bangladesh was arranged between 20o34'-26038 northeast latitude and 88001'-92041 'east longitude. The 2424 km long drift line of the country and numerous small islands in the Bay of Bengal, wind and breeze blow in the southwest in the spring months and northeast winds and land remain good in the winter months. . .

The minimum specific wind speed in Bangladesh has been considered. Data collected by the Meteorological Department is generally encouraged to intervene in the climate and there is a lack of speed in the air. In a preliminary investigation report in 1982, 30 years of weather-related data were considered from stations throughout the country. It was seen on the spot that wind speed was predominant in Chittagong and Cox's Bazar which is certain. Expansion, the concept of sustainable energy era windpipe regions and the air guarantee of the islands.

Finally, in 1995, in Pikganga (Chittagong), 20 years as a year, some beaches in front of the beach. Rahman has made some assumptions. It has been discovered that weather is faster than office air quality. As a team from the Department of Local Government and Engineering and the Department of Energy Technology in 1996-97, it can learn a seven-year wind on the coast of the ocean at a wind speed of 25 years. Advanced Studies (BCAS) and Service Unit (ETSU), UK, supported by the Daily British Government (DFID). A parallel report is similarly managed by another group (REVB1 GTZ).

The BCAS exam first examines accessible weather information and generates useful data along with:

1. Wind rate is higher in the coastal areas.

2. The point rate shows a regular clock, drops from September to February and stays low in the summer (March to August).

3. The dots show a daily cycle, with maximum crusting and weakening in the evening (comparatively West Bengal, India, comparison patterns).

4. The wind speed estimates of the BCAS group and the GTZ group confirm that the speed is significantly higher in the summer months than in the winter months. The actual wind speed obtained by GTZ was slightly higher than that of the BCAS group; However, repeat approvals were comparable. The daily diversity confirms the pattern shown by the weather department.

5. Twist Turbine PowerPoint is used to calculate the ages of two with two primary limitations from two separate manufacturers. Kutubdia and Kuakata have an annual livelihood of 133 MW and a 160 kg wind turbine of 160 MW. These spots vary from 250 kg to 250 MW and 250MW.

Some of the activities that can be undertaken are followed by attention from Western investigations:

An electric wind turbine plant could be set up and connected to the existing 250 kW diesel control center at Kutubdia, to consider the normal operation of the cross-breeding air diesel structure in a separate mesh.

A set of plant production can be set up in Kuakata and attached to existing structures such as structure and performance tests.

Water drainage (Kutubdia) can be done for water production (CTU) to conduct liquid pump production investigations. (Chittagong). Some air PV generators (remote areas can be charged from 100W to 2KB) have a battery structure for specific clients, current supervision, real life planning and current efforts to collect, manage and test fake data for almost three years. After all, other Czechs should be similarly selected for a legitimate assessment of the country's aviation administration. The proposed destination may include conditions for individual areas, including waterfall areas. As domestic advances, belly belt exhibitions and pilot plants may be established to see country-specific, activities and financial feasibility. It has been delayed, some small wind generators were introduced by BRAC (small air turbines at 11 marine frontal destinations) and Grameen Shakti (two wind generators, 300 W and cycle carroscope firm 1 KW). To improve meeting performance goals to improve their personal satisfaction, write this short DC activity. Almost all of their results are not reported. In the Barguna region (in front of the sea front) the village power started 4 small wind generators (3xl.5KW + ONE 10KW). These stations then seek diesel in a semi-structure for diesel and then consider solar-based PV, to increase yields and then financial costs. Their final quantitative results will be expected with extraordinary conspiracy.

Although it has not been possible to obtain large-scale wind mapping through wind observation, a research team from the Bangladesh University of Engineering and Technology (BUET) has begun research on wind speeds at an altitude of feet feet above Chandana (Dhaka) in Gazipur. , Apparently from the latest weather investigation, the speed is between 2-3 cm / view. Bacon is estimating the wind speed concept of BCSIR on St. Martin's Island. Perhaps for the Broad Test, cyclone pockets can be found in cyclone areas, especially in contrasting regions (e.g., mountainous regions) and sea islands.

The last two convocations worked with initiative from the air about mechanical power. The first LGED, Tangail, Costalia, Cox’s Bazar and various outposts have 27 feet high air pumps individually, the intensity of this unique air pump is 0.5 hp. (385W) 4m / wind speed. Pump outlets are limited and yields are considered at 25 liters / minute 3.2 m / s. Any quantitative result, it may be accessible, is. The second team from BCS started building the air-conditioned UK Intermediate Technology Group and created Karachi (Pakistan). The air pump (Chittagong) is located in an agricultural field. The length of the tower is 40 feet and the sharp edge of the rotor. Water production is increasing daily, and the normal water yield in November and January is about 8000 liters / day. It is an idea that climate areas with plenty of vegetables in winter can be used extensively in air pumps. Similarly, for ocean islands, new groundwater will be tasted

2.5.3 Hydro Energy

Karnafuli Hydropower Station is the only hydropower plant in Kopai, 50 km from the port city of Chittagong. This plan was formulated in 19262 as a major aspect of the 'Karnafuli Multipurpose Project' and is one of the largest water resources development initiatives in Bangladesh.

Once approved in 1962, the plant could survive on 80 megawatts of electricity. In the following years, the two-level level of 23 MW has increased. The plant does not take an essential task to take care of the electricity needs of the country, but the main flow control system is fundamental in the provincial areas.

Earth-filled Kaptai Earth is a filled dam, 45.7 m high (36 mm MSL or average sea level) and 670.6 m long. The maximum width is 7.6 m and the width of the foot is 45.7 m. The 16-gated spillway, each 12.2 meters by 11.3 meters, can simultaneously exceed 625,000 cusecs of flow.

The annual flow of reserves is about 15,646 mm. Wave range of 8.25 million feet at one and 33 meters. The area of MSL land is 77 777 sq km

After various reviews, the Kaptai site was selected for construction of the dam in mid-1952. The truth is, Kaptai is a bend that flows through the flow of water and the last flow of coastal Francia. According to the structure, the flow of water will be stopped due to the hardening of the solid energy, and thus the way of retaining water will create a huge amount of storage, but it will certainly create a way of making machines for production. In addition to this method of electricity, the Pakistani legislature came to the United States to fund the Capitai hydropower project. The proposal was accepted and the International Engineering Agency (IEC) was taken over in 1952 to build the dam. Another company, Utah International Inc., joined in 1957. This development was completed in late 1919 and the spillway was closed in 1919. The water level was formed during the maximum rains and hydropower plants were set up in the Chittagong region and electricity was supplied to the national network. Kaptai Lake is said to have provided a large pool of power due to the development of the Kaptai River Dam.

The store is suffering in an unusual area and thousands of homeowners and homeowners are missing. As soon as possible, the zamindars do not have all the land in the state property area from the mountain area manual. However, according to the people, proper administration is needed for wages and recovery. The task archive found that the lake would reach the 33.22 m MSL region. It covers about 665 sq km and floods about 777 sq km. Impressions of influential families cover 18,000, 28,870 hectares of arable land and 688.94 sq km of land. Law enforcement agencies have been fined Rs 41.5 million. However, not all of them paid the money received.

The atmospheric task zone is located towards the winds of intense submerged load storms. The monsoon season extends from July to November and contains about 80% of the annual rainfall this season. Annual rainfall in this region ranges from 2200 mm to 3600 mm. Despite a 35-45% finalization in the storm season from November to November, it is 80% or more submerged. Disappears in the driest season. Due to the natural extinction of about 500 mm, the wind is seen as mild due to intense thunderstorms and cyclones. Maximum wind speed 96.54 km / h.

Large floods usually occur from June to October. Higher surges last 4 to 5 days and are likely to occur in the high tide of spring. Storms spread with hurricanes, which increase tidal levels. Light flow of coordinate of cartridge wave waves due to extreme flooding in low flowing areas.

In mid-1962, three generators of the national power network started generating 80 MW of electricity. The 50th Generation began in January 1982 with a third generator under control. Initially, 25% of stores are considered the upper limit. Open source projections flow more than at the beginning of irradiation. After the abuse of this additional potential, each of the 50 megawatts of water introduced in 1988 has two generators. Karnafuli Hydro Control Station Current age limit is 230 MW

Figure 2.6: Karnaphuli hydroelectric power station

The ancillary power of this dam has accelerated the foundation and development of Bangladesh and made an important landing in long-distance trade for the import of finished goods. Likewise, the power board produced by the water pumping board allows the work to be completed. Asset hoarding has officially protected the city of Chittagong from the biggest losses of actual business. Kaptai Lake is suitable and necessary hotspot for fish production. In 2007, 74 species of watermelon species and two weed species were accessible in ongoing experiments. About 65050 metric tons of fish was supplied to Kaptai in 2007-2008.

Ideally, at the embankment, every possible angle in the CHH is easily dispersed by sending the winter uninterrupted explosives to the farthest Barakil Rapid to the east and to the Casalong tree shop to the north. Pantone and other features. Rangamati, east of Kaptai, all drilling cargo is transferred to the embankment by electric overhead trolley.

2.5.4 Biogas Energy

The main food is cooked with the help of wood burners in the provincial cities of Bangladesh, the quality has gradually changed in recent years. Many women are going to the biogas stove, which considers non-smoker cooking, and creates a helpful side effect: organic slurries that can be used for farming and animals. Some family units similarly reduce the organic odor by using conventional burners to supply raw materials to another person. Ashulia, 50 km from Dhaka, is a vibrant and vibrant city, while the image can be changed in the city, less than 50 union units, 35 biogas burner conditions have been changed for the use of milk and poultry.

For the first time, Akhtar's progress happened. Five years ago, he stopped using a burner and introduced the 3.2 cubic feet of refrigerated biogas chamber d. He uses Anunum's test materials from his three bovines.

First, I have to spend the entire structure, 28,770 (from 350) - as a cooking oven from the biogas chamber. Since then, I've been in a position to get my five of them spiritually cooked for the fifth time getting Akhtar's 150 witnesses for bio 150,000 (80 1.80 - 40 2.40) for a dry biomass powder.

Using biogas burners over the past two years, part of the Shahnaz Hills has been taking the result of fish-like organic smelling fish.

He left, after planting my children's biogas, I used fish feed in Heart Lake when my public observes 100,000 rupees (1, 1,123) per year

Met of Wright and Renewable Arnji ProfileVoltp Town (Shreda), Bangladesh City 711,966 B Biogas Plant, which has 8.52 images of carbon dioxide

19 In 1975, the position of successor Hessar Biogas in the Bangladesh biogas and medical worlds culminated in cooking, although it was included in the late 1990s. Located near the 44,000 biogas plant quota of the Government of Bangladesh's Infrastructure Profiler Print of Limited (IDCL), it has a final share of about 200,000 people.

More interested groups

Still not using other biogas burners, they want to set the green innovation. My family is trying to set up a plant because we believe that using a regular burner is a nasty and tedious one - anyone must have a burner under the control of a biomass stack. As it may be, no one should come there while cooking as a gas or electric burner because of the biogas burner. The main problem is the space it needs, he added. A large NGO in Bangladesh is setting up a biogas plant under the Rural Energy City Eco Village Development Project. "Despite the conspiracy, the third section of the rural force said that due to lack of space or lack of poultry or cattle farms, the family's own unit could not be invented for their own unit.

Plans ahead

By 2030, Bangladesh wants to increase sustainable power generation by 10% and organize year-round measures to achieve this goal. Mapping of air companies is underway in 13 locations, and some air-conditioning initiatives are dependent on starting from the end of the year. Biogas and biomass based housing structure and energy research. Shreda Joar, a Shrida official, told Thunderpol: "We plan to build a biogas plant in the coming years, as we need to expand our potential for use in provincial Bangladesh. [6]

2.5.5 Biomass Energy

Has Bangladesh's state-owned Infrastructure Development Company Limited (IDCL) supported a small biographical company called Dreams Power? Which launched today the best, decentralized biomass control center in the country's class in a joint effort with the World Bank and global environmental benefits. The office, located in the alleged town of Kapasia (Gazipur region), is part of a rural shaking initiative that plans to reach about 700,000,000 people through renewables.

The Green Power Station, the first of its kind in Bangladesh, is a 250 km biomass gasification office that generates incredible energy to generate large tracts of land, for example, rice sculptures. IDCL has received and been recognized by IDA and Global Environmental Benefit (GEF) for the combined income of বিশ্ব 25 million (€ 250,000) of the World Bank's 0% paid-up joint income. The power of dreams? Asluzzaman Manik is a poultry farmer who has run into incredible difficulties in running his business outside of electricity. Tired of the usual business, he has chosen to own a 'miniaturized scale biography company'.

A couple of years ago I moved to India and got experience of a planned small scale husk-le control plant. I thought it would be imaginable to grow these plants further as we have buds in all parts of the nation. These types of hostage control centers are accessible in India, but we are using our own network for business reasons which is being used as a novelty in South Asia. - Asaduzzaman Manik, overseeing the main Dreams Power Located in a shaky region, the plant is currently supplying waterproof quality mesh outside of blue to about 500 family units and business elements around the world. One type of plant in the city provides all the necessary vitality in a decentralized way without the need for reinforcement from various sources. A total of 220 buyers have joined the surrounding structure, with another 2,300 candidates expected by the association. The World Bank supports such activities in Bangladesh through the Rural Electrification and Renewable Energy Development Project, commonly known as RERED. Under this initiative, IDCL is launching a large number of sunflower home vitality and biogas frameworks. The Rural Electrification Board is currently in need of renewed efforts for biomass control centers.

According to Asaduzzaman Manik, the acting head of Dreams Power, only 38% of Bangladesh's population now has access to electricity. It is important to expand the domestic zap for the success and progress of the provincial regions: the development of electricity use is directly identified with the development of power, but additional charges are required to achieve the Millennium Development Goals: the 'Chile Chain' is expected to be maintained; The probability of having children due to five years is absolutely higher in the cities of electricity, than in outsiders; Energy similarly opens up new avenues for job creation and therefore expands the amount of wages.

The World Bank believes that IDCL will move Bangladesh's biomass control centers in the province to similar sunflower home frameworks. The exercises introduced to this plant can be effectively used when preparing various biomass plants. This will completely reduce the inconvenience for the following participants and bring in new business visionaries to introduce biomass control plants in Dehi Bangladesh to meet the demand for electricity. It will similarly start a business in rural Bangladesh. Apart from supporting the general network-based power sector, is Bangladesh's comparative priority in sustainable energy resources valuable and the World Bank? He says that if the administration requests, the part of its sustainable energy source will further

increase the future needs of Bangladesh. As Bangladesh does not have an adequate electricity age limit, moving to these decentralized sustainable energy source control centers will increase the nation's vitality security and take care of the vital energy demand. [9]

Figure 2.7:In Biomass

Chapter-3

Wind turbine

3.1 Power Generation Scenario In Bangladesh

Consumption of electricity in Bangladesh (per KWR HR) is very irrelevant. Between 2011 and 2015, Table 1 shows the use of electrical energy in different countries of the world. Bahrain is a country that is used for 17,325 kilowatt capacity across the country and Canada's position is 15,615 kilowatts per square meter per second. The maximum loss in Cape Town, Nepal is 119 kW.

Country	Electric Power Consumption (KW-hr per capita) (2011-2015)
Australia	10,398
Bahrain	17,395
Bangladesh	279
Canada	15,615
China	3,475
France	7,344
Germany	7,270
India	744
Japan	7,752
Malaysia	4,345
Myanmar	153
Nepal	119
Pakistan	452
Singapore	8,690
Sri Lanka	527
Sweden	14,290
Switzerland	7,886
United Arab Emirates	10,463
United Kingdom	5,452
United States	12,954

Table3.1: Electric power consumption (KW-hr per capita)

Bangladesh has only 2,266 kilograms of HR, only 59.60% of electricity. [10] There are more than 87,319 cities in Bangladesh and most of them are not of the national matrix. There are some problems in power generation, for example, lack of gas, dilapidated old power plants, population growth, etc. 633% depend on petroleum gas. This unreasonable dependence creates some problems. Lack of supply of fuel or petroleum gas will disrupt power generation. 23% intensity of control was created in plants older than 20 years. Figure 1 shows the power to set up a BPDB power plant in February 2016. The power to set up a BPDB power plant between April and April 2016 was 1,222 MW.

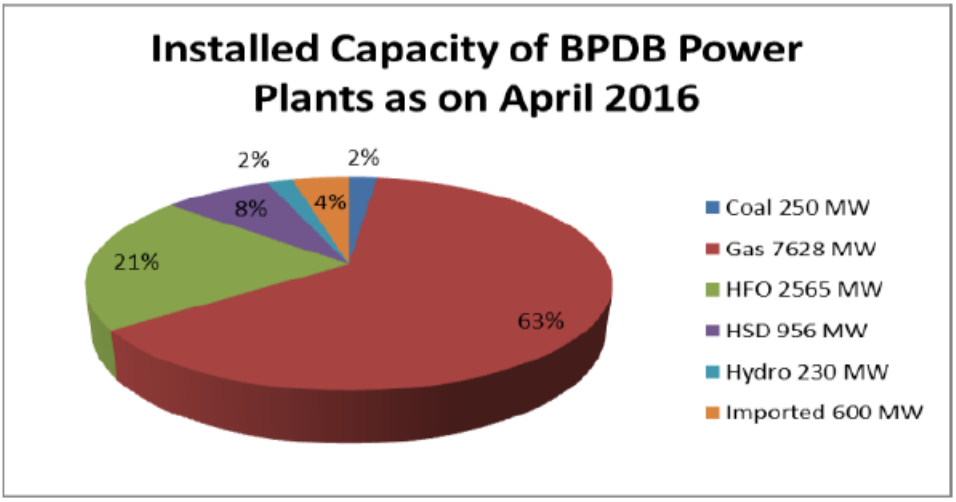


Figure 3. 1: Installed Capacity of BPDB Power Plants as on April 2016

3.2 Wind Energy Scenario

There is a small range of Kaptai hydropower plants in Chittagong. The 2400 MW nuclear power plant at Rooppur will be installed with two reactors, each with an intensity of 1,200 MW. Bangladesh is facing the challenge of living for its financial development. In 2016, the maximum demand for electricity in Bangladesh was 11,405 MW. The maximum age of 2016 is 8088 MW, with a deficit of 3317 MW. The government has set a target of constructing 1,900 MW by 2021. To achieve the goals, Bangladesh needs to focus on measuring sustainable energy sources. The provincial household has 15 MW of sun-based value and 1.9 MW of dense control of Kutubdia and Feni. By 2015, 5% of electricity and 5% of electricity will come from sustainable power sources such as wind, damage and solar-based livelihoods. [11].

Researchers and architects are doing a significant measure of extensive research for free contaminated energy sources. Due to mechanical wear, wind life in the United States, in the last 20 years, has dropped from 25 paise (19.5 bt) to 5 kg (3.9 bt) per kg-hour [12]. [12] , Widely used in the United Kingdom, the Netherlands, Russia and Australia. Countries in Asia, China, India, Indonesia, Japan, etc. are also using this progress. The figure shows ten countries with the highest wind control limits of 2014 in China [13].

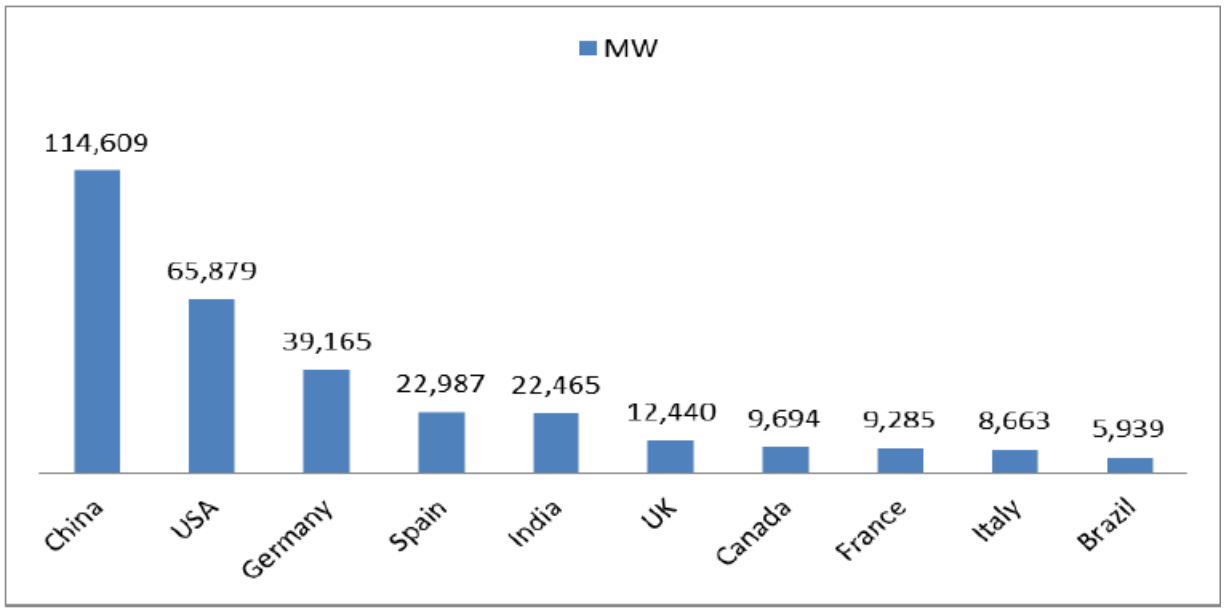


Figure 3.2(a): demonstrates the best ten nations with the most breeze control limit in 2014

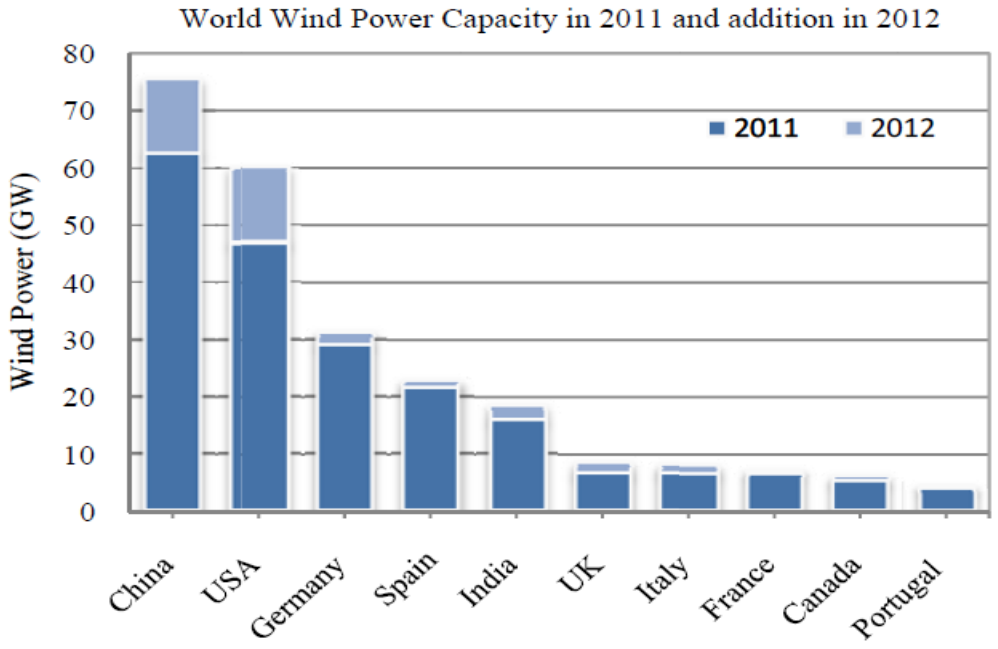


Fig3.2 (b): Contribution and growth of wind energy

3.2.1 Wind Energy Scenario in Bangladesh

At a glance, references show that 59.60% of the population of 146.6 million. Total power generation capacity is 12,229 MW [14] (2016) and total installed wind power is 1.9 MW. Wind power in Bangladesh is 20,000 MW [15], wind speed <7 m / s. In Bangladesh, the study of wind power started a few years ago, which shows that some districts in Bangladesh have very good wind power. The Government of Bangladesh for Advanced Studies (BCAS) has sought to collaborate with the Department of Local Government and Engineering (LGED) and the International Technology and Services Unit (ETSU), an international organization for funding from the Department of Foreign and International Development (DFID). . Observed wind conditions for one year at seven coastal locations in the UK in 1996-97. They measure 25 m air parameters [16]. At present Bangladesh Power Development Board (BPDB), Bangladesh Scientific and Industrial Research Council (BCSIR), Local Government Engineering Department (LGED) and Bangladesh University of Engineering and Technology (BUET) are working in different countries of Bangladesh. They have already started measuring wind speed at specific places in Bangladesh. Generating electricity for the first time from the Mukti Dam, Feni has a capacity of 0.9 MW (225 kW, 4 turbines) and Kutubia Island (20 kW, 50 turbines). A 100 MW wind power plant will be constructed at Patuakhali by Vesta Company of Denmark. It will be the largest wind power plant in Bangladesh. North latitude is 20.30 to 26.38 degrees east and 88.04-22.44 degrees east of Bengal. The Center for Wind Energy Technology's (CW) analysis of high atmospheric data analyzes that grid-connected resources (<7 m / s) due to grid winds are not sufficient to generate electricity in most parts of the country. This sector is mainly explored in coastal areas. There are 574 km long coastline of Bangladesh on the coast of Bengal. After traveling south by sea, the south / south-west monsoon season from the South Sea entered the coastal areas of Bangladesh. From March to October this trade wind hits the country. If the country changes to a coastal region, it will increase wind speeds. This wind hits the surface of Bangladesh, with an average speed of 3 m / s to 6 m / s. Wind speeds are relatively low from October to February. The maximum wind speed is achieved in June-July. In the coastal areas of Bangladesh, the average wind speed is 30 m / s. The wind speed in the north-east of Bangladesh is 4.5 m / s and in other parts of the country it is 3.5 m / s. For excellent power extraction, the site must have at least 7 m / s wind speed. For proper operation of wind turbines, the height of the hub is usually 20 to 40 m [17]. 30 m wind power to maintain power after correcting altitude, Potting, Cox's Bazar, Teknaf, Char Fascian, Kuakata, Kutubdia etc..

3.2.1.1 Wind Energy Study Project (West)

Una de las actividades del Gobierno de Bangladesh se denominó Proyecto de Investigación de Energía Eólica (Oeste). En 1996-97, aprendió [18] en siete destinos oceánicos, a aprender las velocidades del viento durante un año a 27 metros de altura. La Figura 3 (a) - 3 (f) se refiere a la velocidad del viento normal mensual del mes de 25 m de ancho de las seis estaciones occidentales Pattinga, Cox's Bazar, Teknaf, Char Fascian, Kuakata y Kutubdia.

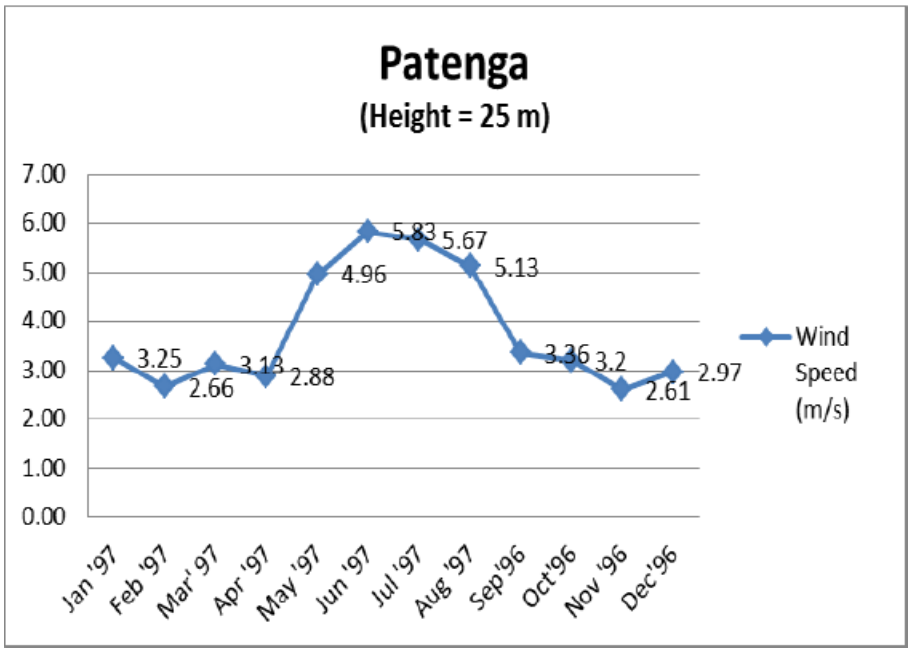


Figure 3.2.1.1(a): Monthly average wind speed at Patenga

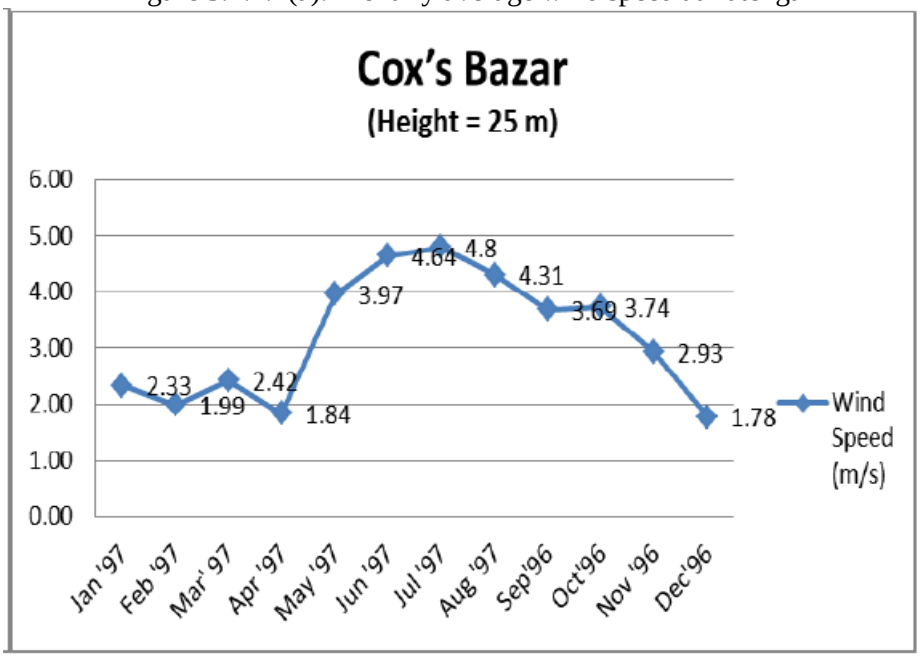


Figure 3.2.1.1 (b): Monthly average wind speed a Cox's Bazar

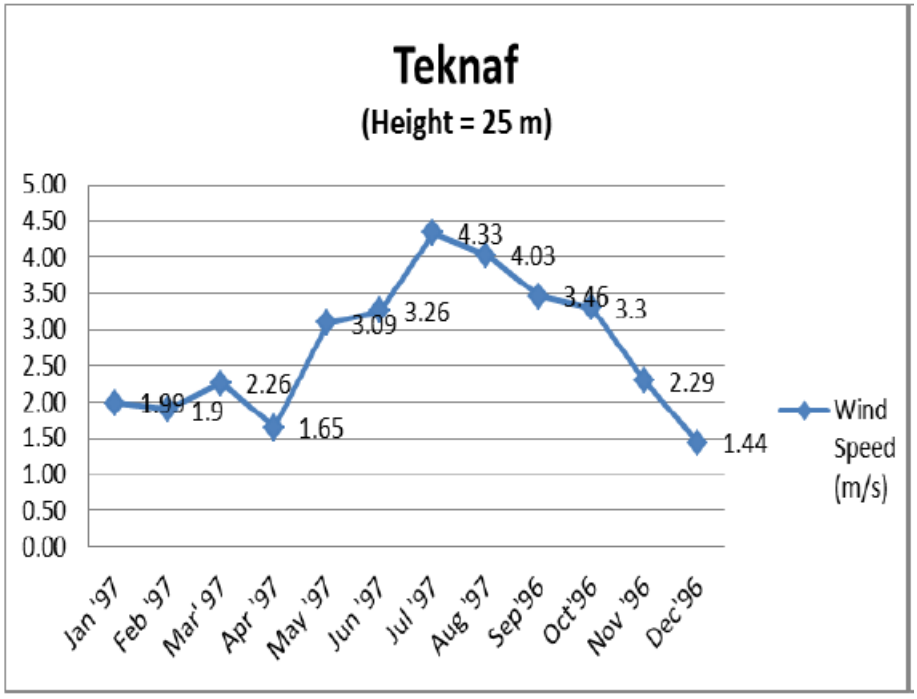


Figure 3.2.1.1 (c): Monthly average wind speed at Teknaf

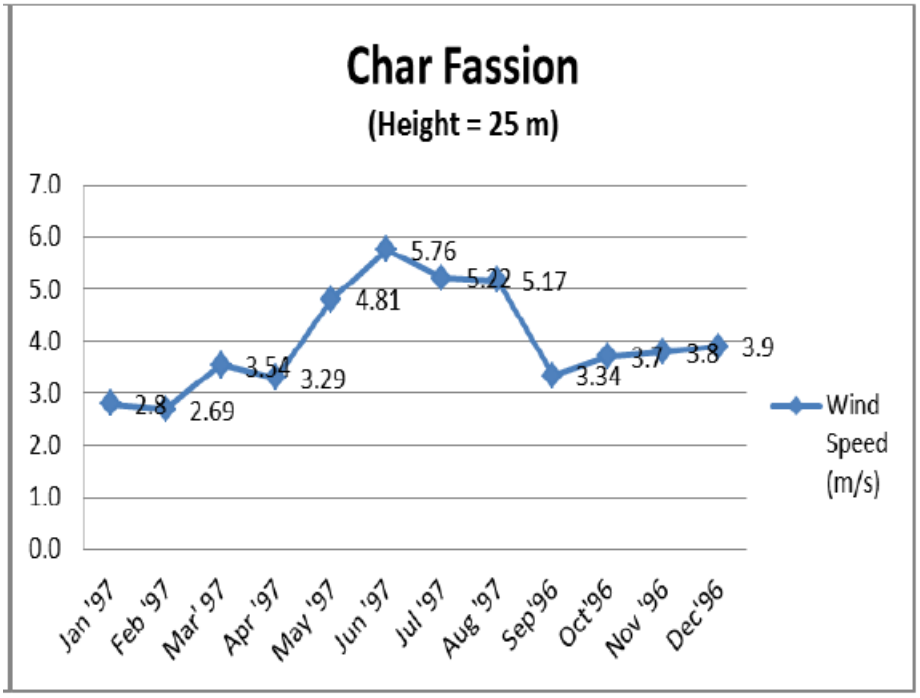


Figure 3.2.1.1 (d): Monthly average wind speed at Char Fassion

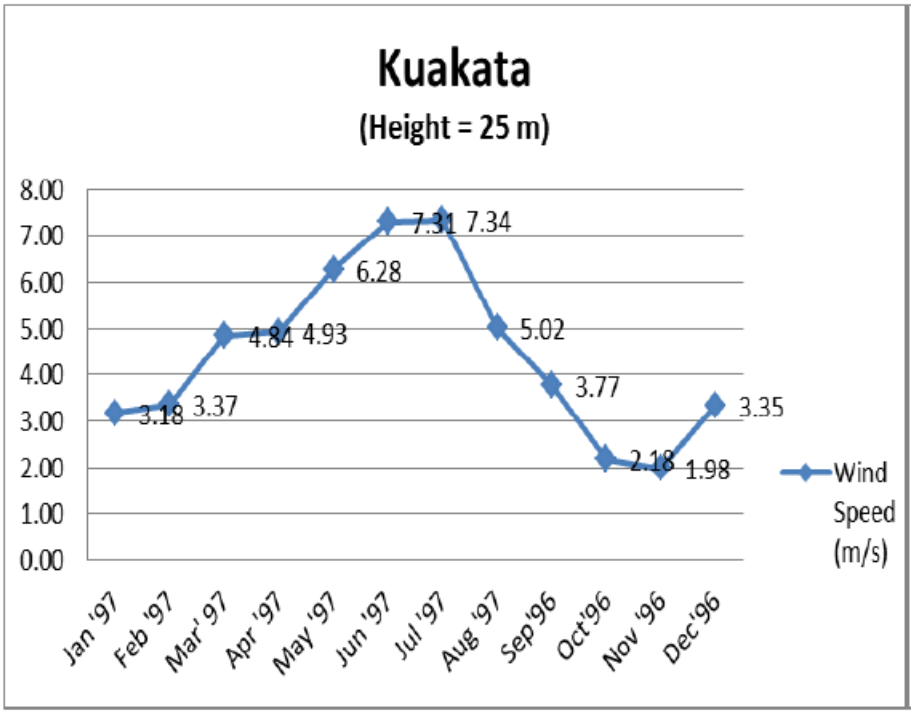


Figure 3.2.1.1 (e): Monthly average wind speed at Kuakata

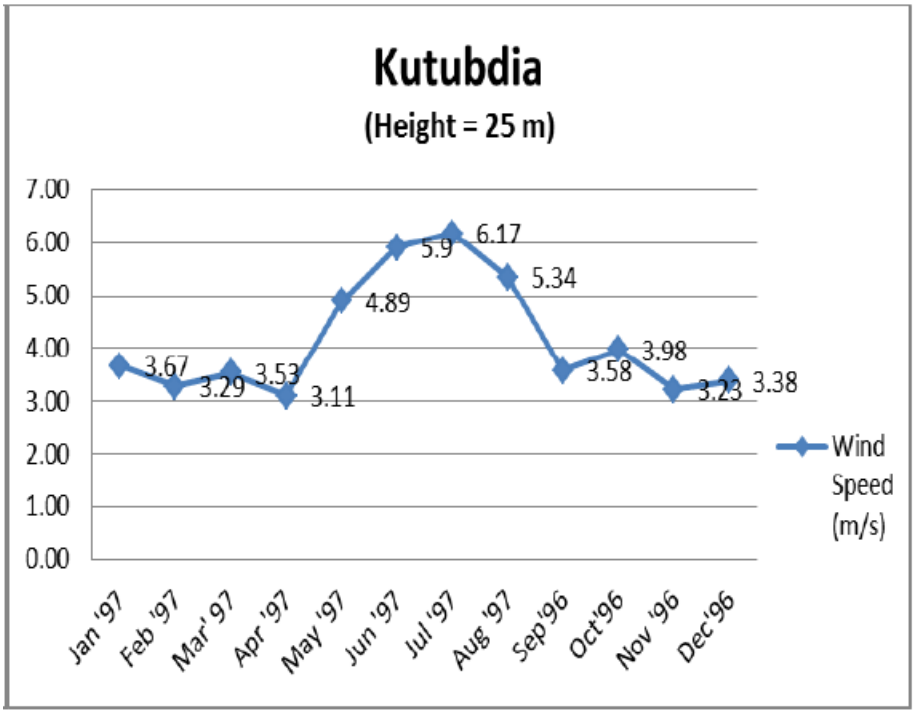


Figure 3.2.1.1 (f): Monthly average wind speed at Kutubdia

are the front part of the Bay of Bengal. According to this review, monthly wind speed varies from 3m / sec to 5m / sec. Teknaf has the best wind speed and minimum air speed. It could be that, in almost six places, the air vapor can be mixed in every place.

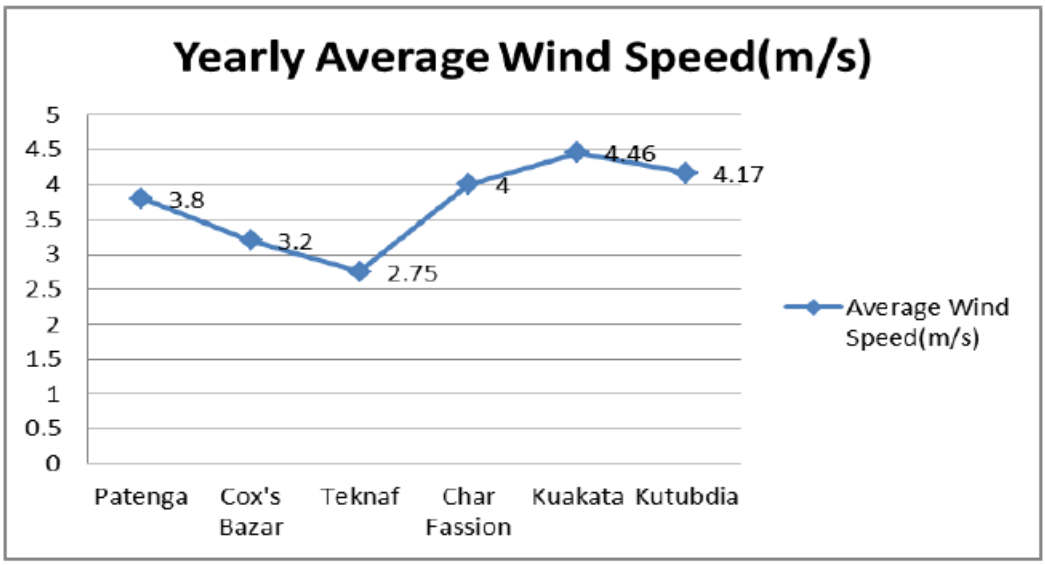


Figure 3.2.1.1(g)**:** Yearly Average Wind Speed at six WEST stations at 25 m height

3. 3 Working Principle of a Wind Turbine

The air is really a different kind of solar life. Abnormal warming of the climate causes the surface temperature of the earth to rise, resulting in air flow. Earth abnormalities and the effects of Earth abnormalities have affected the effects of wind and winter. Wind turbines modify motor resonance to produce electrical or mechanical speeds. The twist applied to the cut edge ignores the cutting edge. The sharp edges create a pole inside the neck, which goes into a gearbox. The gearbox increases the pivot speed of the generator which uses interesting fields to change the electric density rotating lifetime. The power output goes to the transformer, which is converted from the generator to the correct voltage in the electrical transmission structure [19]. In the unexpected method, the wind turbine operating rules are simply the opposite of a fan. Figure 5 shows the outline of the air turbine structure.

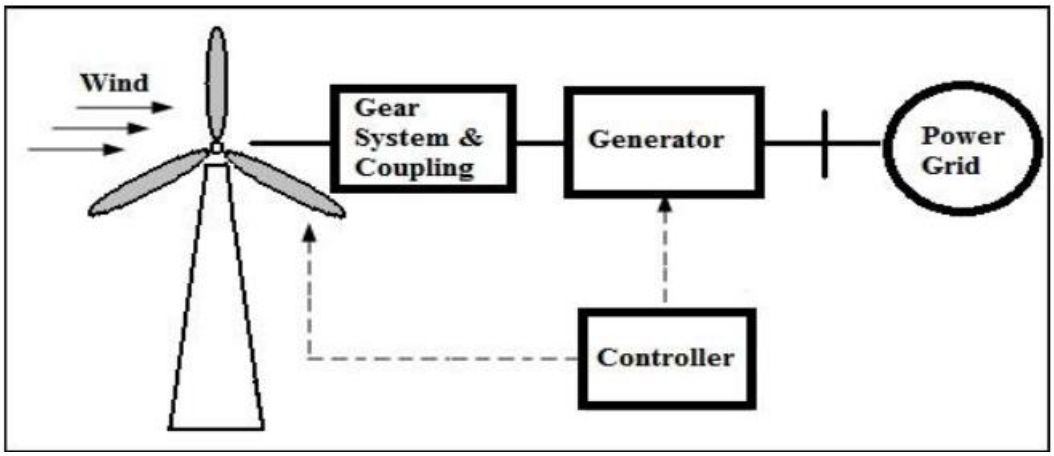


Figure 3.3: Flow Diagram of a Wind Turbine System

Here,

1)Turbine: Rolling Twist (Mechanical) in Biological Transformation.

2) Gear framework and coupling: it increases the speed and transmits the generator to the rotor

3) Generator: Rotating biological transformation in electrical biology.

4) Controller: Initiate the correct course signs for wind course, wind speed, generator yield and temperature sensitivity and control. There are two necessary types

5) Wind Turbine (WT): Even Hub Window Turbine (HAWT) and Vertical Pivot Wind Turbine (VAWT).

Figure 3.3 (a): HAWTFigure Figure 3.3 (b): VAWT

Figures 3(a) and 3(b) demonstrate HAWT and VAWT individually.

HAWT (more common) should be specifically specified in the air. In addition to these lines, they have a trail van that will point them in the wind. Its cables for VWT tasks moving in any wind require significantly more ground space than HAWT [20,21]. A WT subtle element with sections of Figure 7.

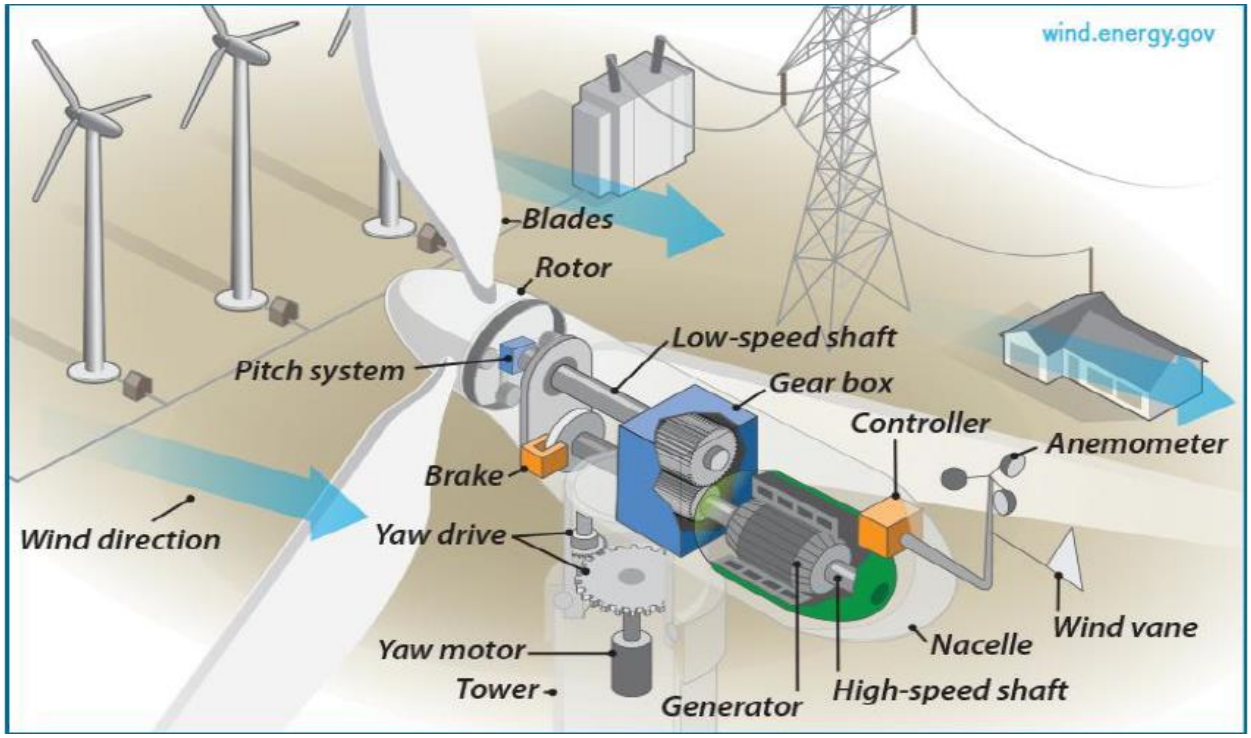


Figure 3.3(c): Components of a WT

3.4 Estimation of Monthly Extractable Energy

The strength of the monthly discharge at the six target locations was estimated in the following ways:

Wind power (ideal) = 1/2 × ρ × V ^ 3 watt-hours / m ^ 2

Where,

Wind speed = VM / s and air density = ρ = 1.20 kg / m ^ 3

Total loss = W x x generator loss x transmission loss co-efficient in performance

Typically, co-efficient with a performance of WT = 0.40

Generator loss = 0.85

Infection reduction = = 0.90

Thus, the total loss = 0.40 40 0.85 × 0.90

= 0.306

Actual Available Amount = 0.306 × 1/2 ρ ρ V ^ 3 watt-hours / m ^ 2

The average wind power at Patenga, Cox's Bazar, Teknaf, Char Fashion, Kuakata and Kutubdia W-HR / M2 is 13.235, 8.122, 5.138, 13.268, 24.124 and 16.115 respectively.

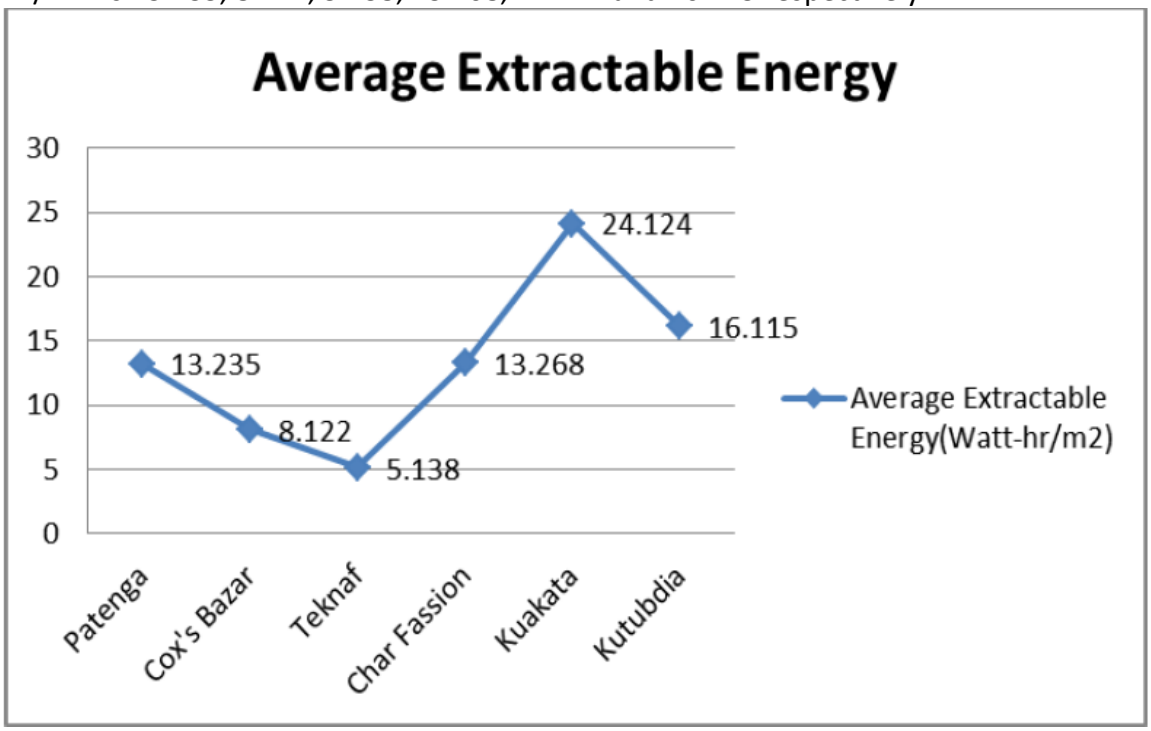


Figure 3.4: Average Extractable Wind Energy in Watt-hr/m^2at six WEST stations.

3.5 The Theory Of WT

WT works by changing the dynamic animated twist created in the electronic germ. Much depends on wind speed and varies depending on the clean area accessible to the turbine. Can be identified as strength

P = 1/2 V AV ^ 3 c_p

The Bits Restriction or Bits Act, 16/27 or 0.59 worldwide, according to the final energy efficiency of any structure that can be eliminated by the World Bank, does not survive 52%. Bits in the real world are limited to the regular 3.55-0.45 estimates per regular WTS. It varies with wind speed, barrier and functional trademarks. For our inspiration, an HWT has been considered. Shows an HWT body measurement.

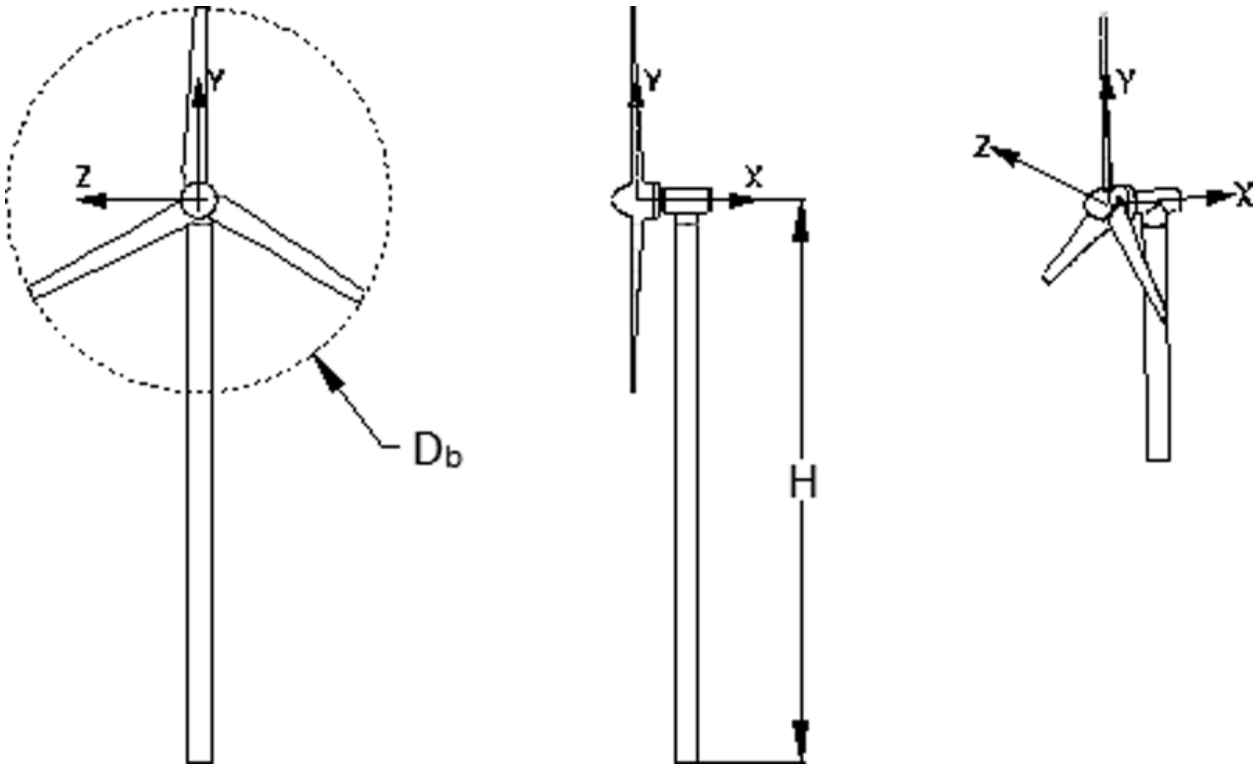


Figure 3.5(a): Dimensions of the Body of a HAWT

Here,

P = power generation (W)

ρ = Density of air (kg / m ◌ 3)

A = immobile region (m ^ 2)

r = radius (m)

V = wind speed (m / s)

CP = power coefficient

There is a sharp cultivation near the coast that wind turbines cover an area of about 3 km. By separating the weight of the wind in different ways, this region is valuable for aeronautics. these lines,can produce more energy. Figure 10 shows wind cultivation on a close shore.

Figure 3.5(b): Near Shore Wind Farm

To increase the intensity, the sea front parts, like our nearest wind farms, are considered to have two lines of water, two lines and two columns of HWW hope. The turbines divide the 7 DT into the overall wind course and separate the 3D in the opposite direction where the D-rotor distance is exceeded. Figure 11 W. The situation refers to wind farming near the coast.

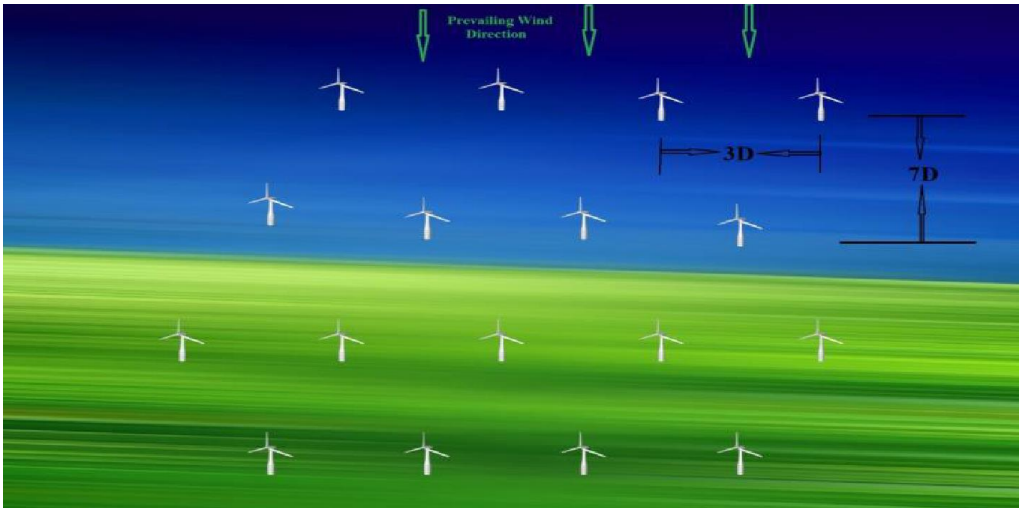


Figure 3.5(c): Placement of WT in the Near Shore Wind Farm considered.

The front area of our total beach is 574 kilometers (574,000 meters). We have taken half of the The beach front zone (26,700 m) is thought to be for wind turbines and a further 30% of the area for activity coordination, business space and reliable workers' homes and offices. [22] It has been observed that the normal wind speed increases as it gets higher. Thus, the extraction energy is expanded. Kikata 25 m Normal wind speed 4.463 m / s. Normal wind speed is increasing to a height of 50 meters at 6.734 m / s. Clearly, the age of air control will be higher in height. This

strengthens the link between title length and wind control. The maximum height of the turbines is 140 m and the width of the rotor is 107 m. Due to normal wind speeds with a minimum distance of 5 ° / sec, including the blade distance, the first estimate is d = 35 m, hour = length, h = 35 m and d = 25 m. H = 60 m, D = 50 m; HC = 80 m, D = 60 m and H = 100 m and D = 75 m Twist speed is taken as 7 m / s in these three stairs.

Chapter-4

Solar Energy

4.1 Solar Energy

Solar energy is, essentially, energy given by the sun. This energy is as solar radiation, which makes the generation of solar power conceivable. Power can be created specifically from photovoltaic, PV, cells. These cells are produced using materials which show the "photovoltaic impact" i.e. at the point when daylight hits the PV cell, the photons of light energize the electrons in the cell and cause them to stream, creating power. Solar energy produces power when it is sought after – amid the day especially hot days when forced air systems drive up power request. Being used, solar energy creates no discharges. One megawatt hour of solar power balances about 0.75 to 1 ton of CO_2.

4.2 Temperature on the Surface of the Sun

Its density closes as one million to ten million to ten million cubic feet of photoshosier heat and lightens the sun's power. Most sunlight we can see from its surface. The photosphere is 340 miles thick and its temperature is 5,500 degrees Celsius at 5,500 degrees Celsius. It has a dark spot called sunspot, which is the only observable solar activity in the naked eye. Temperature above 4000 degrees Celsius above the temperature, and the temperature increases to 27,800 degrees Celsius. There is a hot gas in violent motion in the region and called the chromosphere. It shows gas burning flames. Displacement zone at the next level of the Bello WorldSpace It is 60,000 miles thick and its temperature can reach 2 million degrees Celsius. The zoning zone is directly below the radiation zone. Before surfacing, the power from the core rebounds for centuries and the temperature is around 300 million miles thick in 6.5 million degrees Celsius. The sun's center is 200 billion times less than the surface pressure of the Earth. It is 60,000 miles thick and the temperature is not more than 15 million degrees centigrade. Hydrogen is very hot in helium.

4.2.1 The Extraterrestrial Radiation

External radiation, such as radiation, which is achieved without climate, is equally important to know about external circulation. Sunlight-based range on different points of the Earth's Sun can be isolated between three main fields, usually divided into wave groups (1 micron = 1m = 10-6, mm = 10-6 m).

• Ultraviolet area (L <0.38 mm). Sunlight-based radiation layer 7%

• Visible area (0.38 <L <0.78 mm) percent radiation 47.3%.

• Providing infrared area (l> 0.78 mm), 45.7%

Extractor radiation I_ON = I_SC (1 + 360 n / 0.033 cus) Any time the ICC supplies based on the sunlight and Ion is considered to be the radiation of the outer universe which can be almost a plane.

On the first day of January, the sun's first N = 1 10 solar radiation differs from radiation in the same region of the opposite surface, it is detected from the sun. WRC has adopted the estimation of 1367W / m ^ 2.

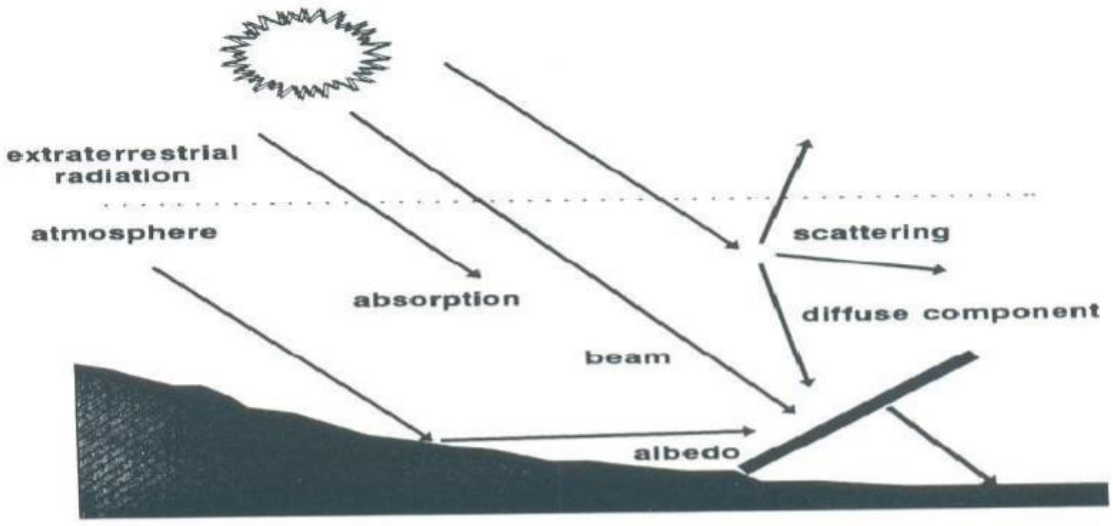


Figure 4.2.1: Extraterrestrial radiation

4.2.2 Equation of time

E = 229.2(0.000075+0.001868 B- 0.032077 sin B - 0.014615 cos 2B 0.04089sin2B)

Where, B = (n-1)360/365 and n is the day of the year.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave
4.02	4.64	5.01	5.37	4.83	4.22	4.00	4.13	4.15	4.23	4.04	3.80	4.37

Table 4.2.2: Monthly averaged daily global radiation (kWh/m2/day)

4.2.3 Conversion of Sunlight into Electricity

A silicon semiconductor power to reduce the injury, makes the flow of the electron flow. Frameworks can create sun-powered power through this property and change the power of direct light.

To overcome the rotary flow (AC), the power inverter experience, which we can use at home or at the same office - sunlight-based boards (additional so-called-dolar modules and coordinate flow (DC)

A utility is available by the power company: There are two types of sunlight-based power generation structures: Network related structure, which is related to business-based organizations; And the single framework, a battery feed for getting quick access or power access. Clothing structures are used for workshops and strip malls, for example the House, Open Office, for example, schools and healing facilities and business offices. The electricity generated by the day can be used immediately, and electricity and power plants can be sold again. Structure does not generate enough energy or in any way (for example, a shadow or dust day or evening), power is derived from Power Utility Company. Electricity levels and surplus can be tested on a regular screen, a compulsory method for measuring daily living. Crisis control framework is used, which is used with crisis control supplies and remote access is not accessible on current grounds.

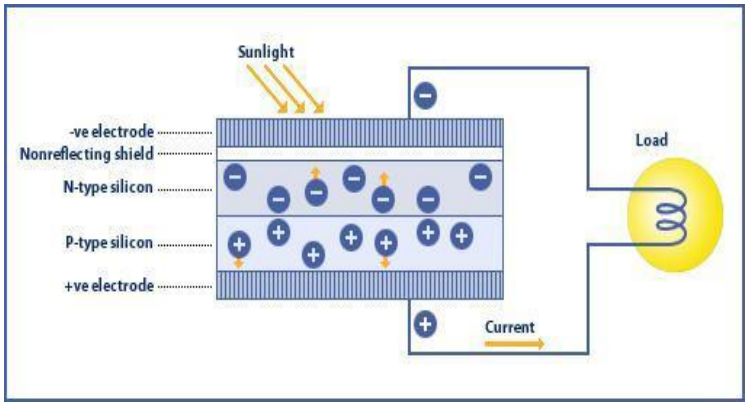


Figure 4.2.3(a): Conversion of sunlight into electricity

When the sunlight decreases in Figure 2-2, an electron becomes slower and the n-type tugs are dragged. It creates more negative electrons between the n-type semiconductor and more positive electrons, which creates the type of flow of type P-type - which is known as photovoltaic effect.

Figure 4.2.3(b): Sun Earth Relation-1

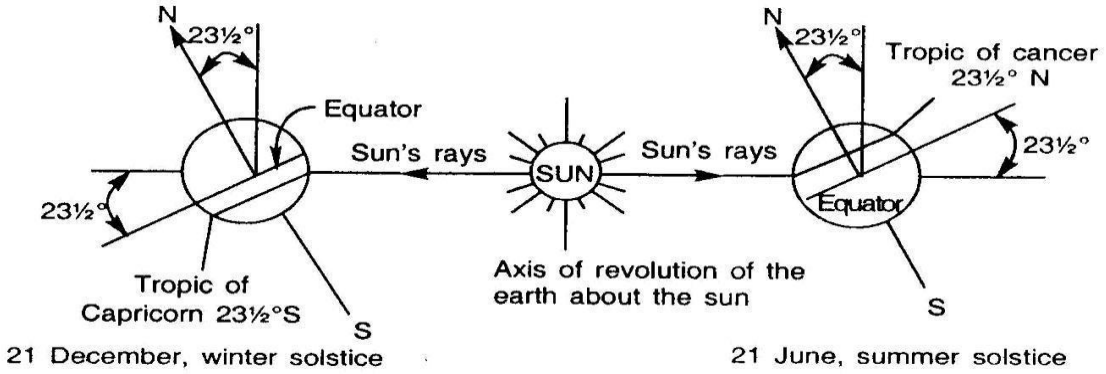


Figure 4.2.3(c): Sun Earth Relation-2

4.2.4 Energy

The world's vibrant 2 basic structures, warmth and light. Consistent, earning enough day-to-day returns to live the whole world. Every year, the life of the sun achieves the life of the sun 4 x 1018. 4 x 1018 joule / year ÷ 365 days / year = 1 x 1016 joule / day. 1 x 1016 joule / day ÷ 24 hours / day = 4 x 1014 jewels / hour. About 3 x 1014 jewelery of the total population will be spent each year.

4.3 Solar Power System

Change the light of the day in the sun-based energy power. It contains eight planets in the sun and its planets, their moons and other outstanding articles. The central structure uses the following structure to center a significant area of focal points or a mirror and a illumination in the lower pole of the sun-powered power structure. Business Solutions Sunlight-based power plants were first built in the 1980s.

4.3.1 Applications of Solar Power System

Sunlight is transformed into electricity. In the light of day, using photovoltaic (PV) may be replaced by electricity, or bubbles can be regular round-out pathways with regular sun germs controlled Sun-based power (CSP). Various progress exists in the same way, for example, the Sterling Motor Dish which uses the Sterling cycle motor under the generator control. Photovoltaics are first used to control a small and medium-sized device application, which is controlled by closed-matrix homes photovoltaic clusters, which are controlled from the single-sun-based crutch control regulator. They are an essential and common economic heir, where group control is poorly altered, neglected or expensive not expensive.

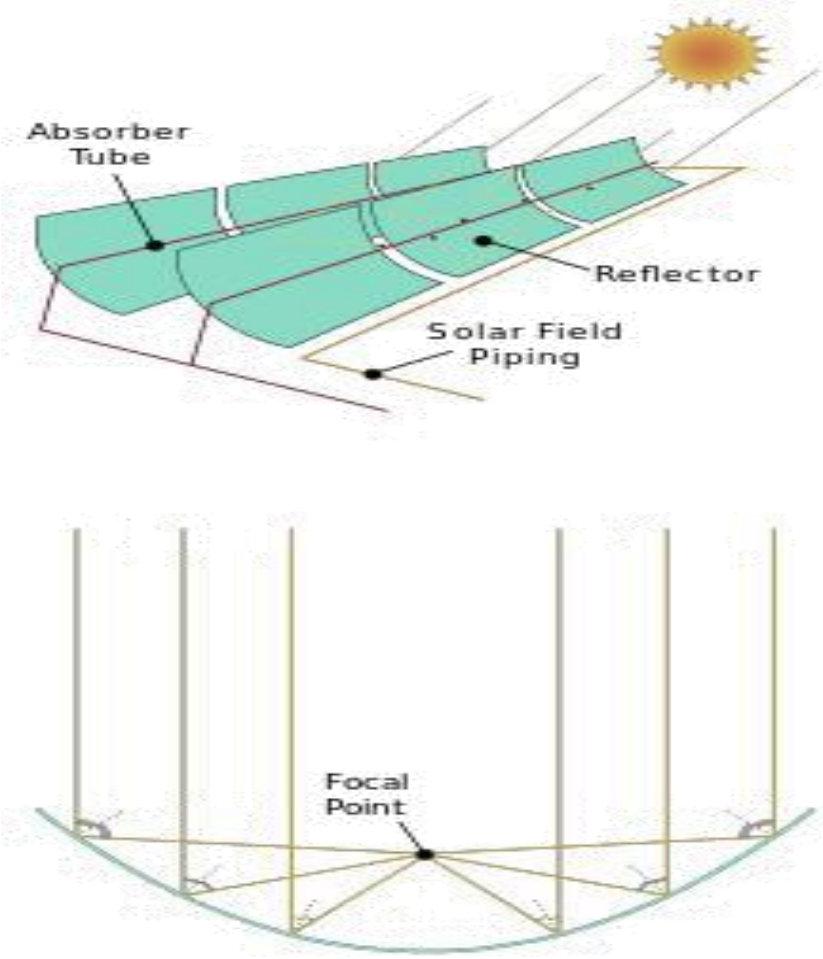


Figure 4.3.1: Application of solar Power system

4.3.2 Photovoltaic system

Sunlight is transformed into electricity. In light of day, photovolite (PV) may be replaced by electricity, or bubbles can be regular sun-based power-based sun-driven (CSP) routine round-out way. Various progress exists in the same way, for example, the Sterling Motor Dish which uses the Sterling cycle motor under the generator control. Photovoltaics are first used to control a small and medium-sized device application, which is controlled by closed-matrix home photovoltaic clusters, which are controlled by single-sun-based crutch control regulators. They are an essential and common economic heir, that is, the photovoltaic framework (PV framework) uses the sun-based board. A structure is composed of at least one photovoltaic (PV) board, a DC / AC control converter, sun-powered board, electrical interconnection and framework that is mounted for different sections. The expression "photovoltaic" is derived from Greek-defined "light" and "volts", which is the unit of electro-thinking drive, volt, which is named after the name of Italian physicist Alessandro Volter. Electrochemical cell manufacturer. Sun-based or photovoltaic (PV) cell semiconductor material is made. The sunlight attacks the cells in the sun, and releases the

electrons into the components, which then turn to electric current (DC). Alternatively, it can include a great Powerpoint Tracker (MPTP), battery framework and charger, sun-based tracker, animated administration programming, sun-based collector or other hardware. A little PV structure can give a secluded buyer, or biology to an isolated device like a separate or weather instrument. PV structures related to expensive jackets can not change the bad, neglected or costly costly controls of the group.

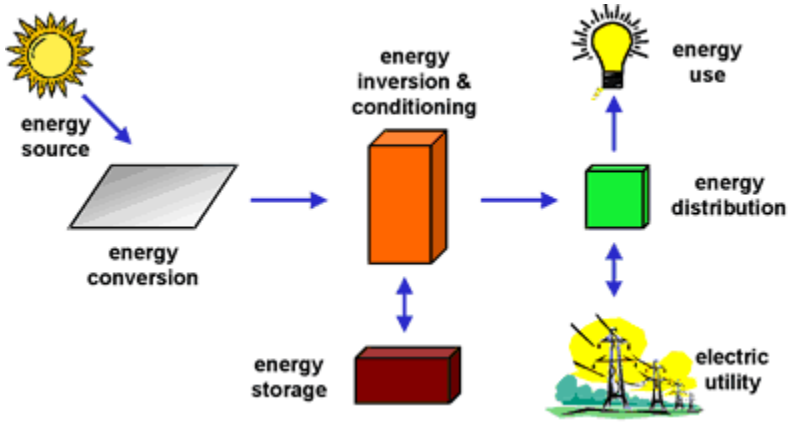


Figure 4.3.2: Solar park or PV farm

4.3.3 Photovoltaic Array

A photovoltaic exhibition (or sunlight-based cluster) is a joint assembly of sun-based boards. The power one module can provide is sometimes enough to fill the home or business preconditions, so the modules meet to create a display frame. The maximum PV display uses an electronic rectifier to switch the DC control delivered by the current exchange module, which can control the light, engine and various compounds. Modules in a PV exhibition are usually added to achieve the first greedy voltage; The individual strings are then added to the current current and more active current parallel. Sun-operated boards are generally estimated in watts according to STC (standard test conditions) or PTC (PVS testing conditions). Mills board assessment can be up to 400 watts more than 400 watts. The performance rating includes a brief summary of Board Assessment Boards, Prices, Kilowatts, or Megawats.

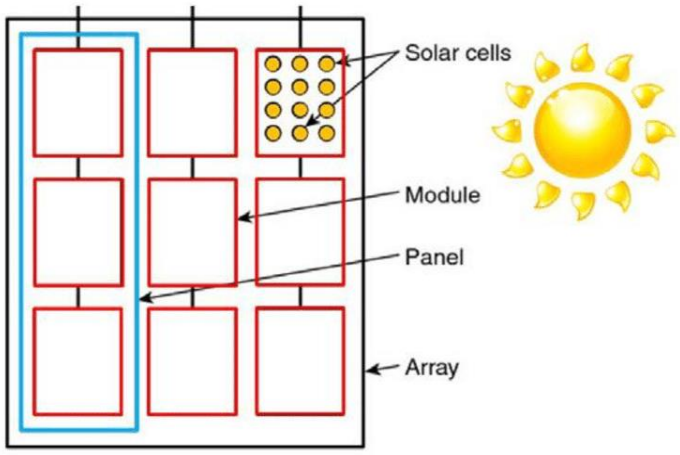


Figure4.3.3: Basic Photovoltaic Components Used to Capture Solar Energy

4.3.5 Module Circuit Design

• A PV module voltage is usually perfect with a 12V battery.

• An intelligent Silicone Sun-powered cell contains only 0.6 degree Celsius 25 degree Celsius and AM 1.5 Lighter Voltage. Due to the normal reduction of PV modules voltage due to temperature and 15V or more voltage for the battery, there may be 36 sun-based cells in most modules.

• It gives an open circuit voltage around 21V quality test conditions and gives maximum operational power and an operational voltage of approximately 17 or 18V.

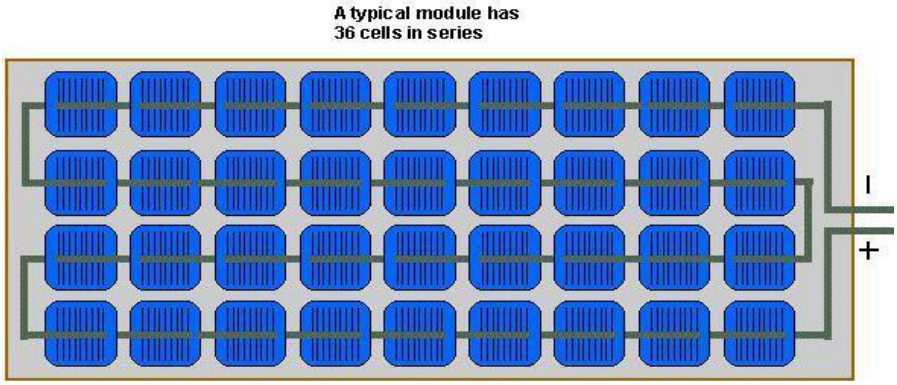


Figure 4.3.5(a): In a typical module, 36 cells are connected in series to produce a voltage sufficient to charge a 12V battery.

• A PV module voltage is usually perfect with a 12V battery.

• An intelligent Silicon Sun-powered cell contains only 0.6 degree Celsius 25 degree Celsius and 1.5 Meter Lighter Voltage. Due to the normal reduction of PV module voltage due to temperature and 15V or more voltage for the battery, most modules may have 36 sun-based cells.

• It gives an open circuit voltage of 21V quality test conditions and gives maximum operational power and an operational voltage of approximately 17 or 18V.

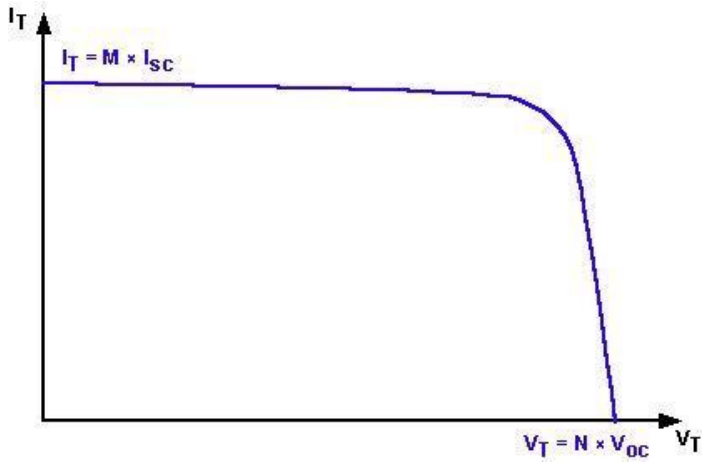


Figure 3-5(b): The overall IV curve of a set of identical connected solar cells.

4.3.6 Mismatch of PV cells

• Mailmatch - PV cells or modules have different features or different conditions.

• When a sun-based cell is covered, the remaining part is not the module, the energy produced by the "large" sun-based cell can be spread against the hip through the rotating cells below.

•Melmach can prompt for very limited power isolation (problem area) and this can lead to unexpected loss of nearby warming modules.

• On the other hand, a significant cause of quarrel with the shadow PV modules of a module area.

• PV modules occur when the electrical parameters of the sun-based cell remain constant from the rest of the gadget. Crisscross relies on impact and power losses:

Purpose of PV Modules

- circuit setup; And
- Parameter (or parameter) that is not left like sun-based cells.

Mismatch for Cells Connected in Series

• In addition to adding maximum PV modules, management confusion is like the most widely accepted experience.

• Crisscross is two simple types

I'm feeling hesitant in the current short

Feeling hesitant in an open circuit voltage

• Short out current is confusing than a confusion, because undoubtedly some parts of the module may be by shadow. This type of confusion is the same extreme.

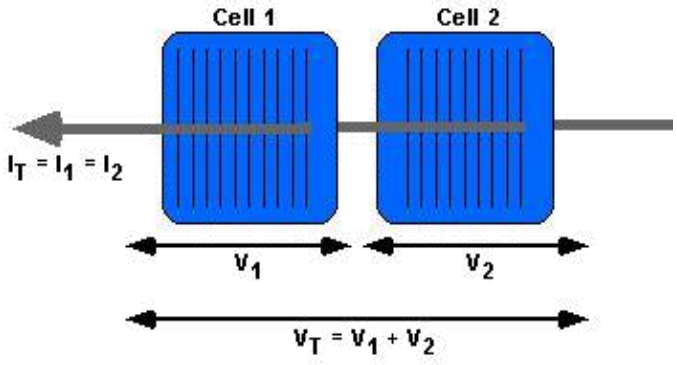


Figure 4.3.6 (a): Feel free to connect with the series

The current should be equivalent, the particle indicates the current that the total current from the design is at least equal to the current.

Open Circuit Voltage Mismatch for Cells Connected in Series

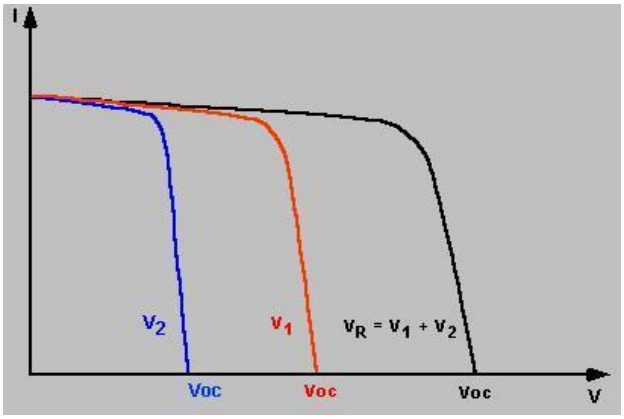


Figure 4.3.6(b): Graph of Open Circuit Voltage

At the most extreme power point, the general power is diminished on the grounds that poor people cell is producing less power. As the two cells are associated in arrangement, the current through the two sunlight-based cells is the equivalent, and the general voltage is found by including the two voltages at a specific current.

Short-Circuit Current Mismatch for Cells Connected in Series

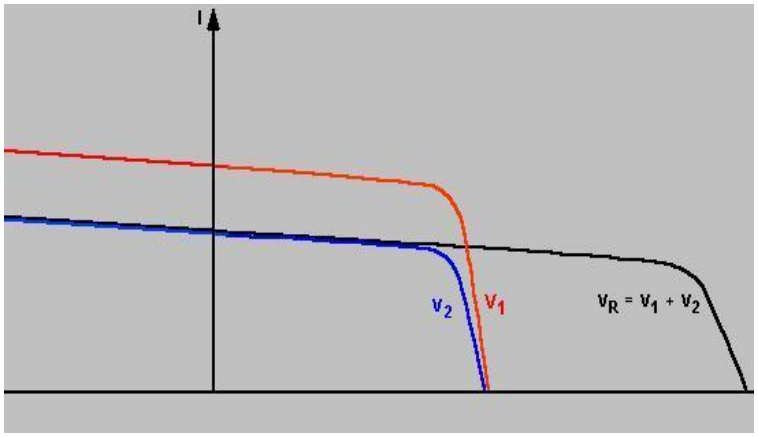


Figure 4.3.6(c): Graph of Short Circuit Current

Current bungle for two cells in arrangement can be very genuine and very normal. The Isc of the mix is restricted to the Isc of the most minimal cell.

- At open-circuit voltage, the effect of a lessened short out current is generally minor.
- The current from the blend can't surpass the short out current of the poor cell.
- At low voltages where this condition is probably going to happen, the additional current-producing capacity of the great cells isn't scattered in every individual cell however rather is disseminated in the poor cell.

4.3.6 Hot-Spot Heating

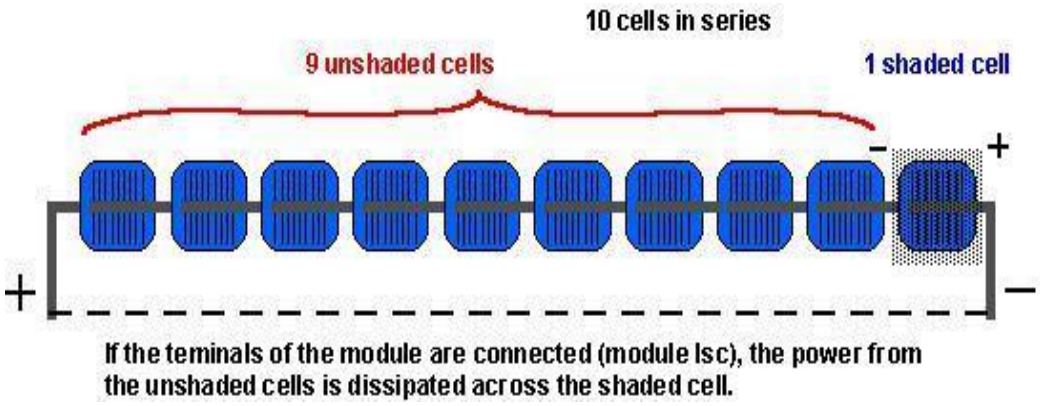
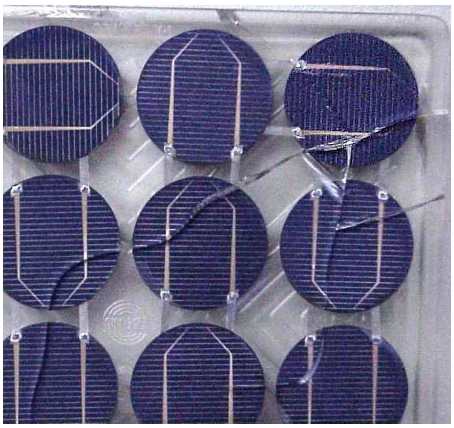


Figure 4.3.6: Module Connected to Series

- Hot-spot warming happens when there is one low current sun-based cell
- in a string of somewhere around a few high short out current sun-oriented cells
- One shaded cell in a string decreases the current through the great cells, making the great cells deliver higher voltages that can frequently turn around inclination the awful cell



Problem area warming happens when a substantial number of arrangement associated cells cause an expansive switch inclination over the shaded cell, prompting vast scattering of intensity in the poor cell.

1. Essentially the whole producing limit of all the great cells is dispersed in the poor cell. The tremendous power scattering happening in a little region results in nearby overheating, or "problem areas", which prompts ruinous impacts, for example, cell or glass splitting, liquefying of bind or debasement of the sun-based cell.

4.3.7 Blocking diode

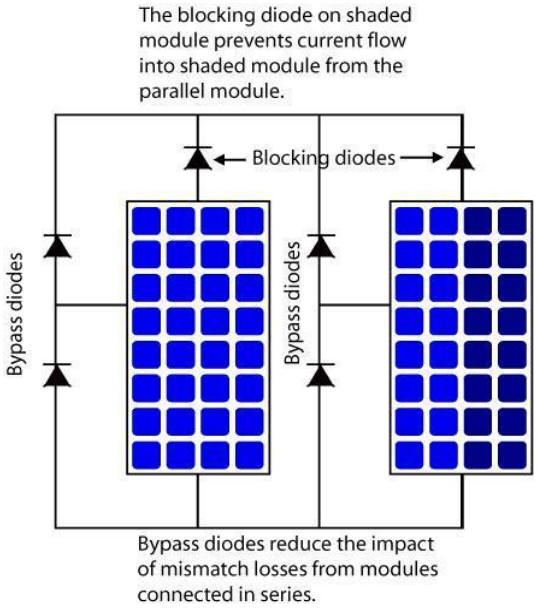


Figure 4.3.7: Circuit Diagram of Blocking Diode

• The blocking diode is used to load the battery between the evening module to keep the current spill from the PV array to the battery.

• With parallel connected module, each strand connected parallel must have its own blocking diode. This does not reduce the current portable power level required by the blocking diode, but it closes the current spelling of the parallel string of the lower strings and thereby limits the divided losses created in parallel connected arrays.

4.3.8 Solar Cell

Sun-based cells (likewise photovoltaic sales) are an electrical gadget that gives direct electricity power through photovoltaic effects. It is a type of electric chamber (its electrical properties, such as flow, voltage or obstruction, when it is illuminated), which is present in the light, can not produce external flow outside, and bowlers can use it as a voltage source. Photovolitics is the field of inventions and research, which is used to detect the use of photovoltaic cells from illumination, but is usually used to understand electricity from electricity. The cow can be portrayed as photovoltaic, although the light source is not really light (Lamightite, net light, etc.). In this case, the phone is used as a frequent photograph identifier (for example infrared finders) to detect light or other electromagnetic radiation near the indefinite range or to detect light energy prediction.

A photovoltaic (PV) cell needs three basic properties:

2. Light Holding, Electron-Opening Set or Excel Production.

3. Reverse type of reverse type.

Those separation of external circuitry carry

4.3.8.1 Solar Cell Theory

Solar cells work in three stages:

1. Eating by daylight photos and ceramicon materials on solar boards, for example, silicon.

2. Electron (reverse charge) is thumped to free from their molecules, causing the difference of an electrical potential. The flow starts through coursing through potential drop material and this capability is caught. Due to unique solar cells, electrons allow only neutral bearing transfer.

3. A direct flow of solar cells (DC) shows the change in electricity efficient solar biology.

4.3.8.2 Solar Energy Uses

Solar energy uses in various respects. Such as:

• Generate electricity using photovoltaic solar cells.

• Use of solar power generation frequently.

• Energize the air activated by ventilation, which enables the solar updraft tower turbine.

• Direct structure, directly through solar building planning.

• Through solar oven, heat foods.

• Hot water or air for hot water and warmth space requires warm water or air.

• Heat and cool air using solar stack.

• Create energy in the Geosynchronous Circle using solar energy satellites.

4.4 Aspects of Solar Energy in Bangladesh

A reliable, reasonable and secure supply of vitality is imperative for financial advancement. As a nation of intense power emergency Bangladesh is currently anticipating build up its sustainable power sources notwithstanding its customary wellsprings of petroleum product. It has exceptionally constrained non-sustainable power wellsprings of its own yet it's supplied with sustainable power sources like biomass, wind, hydro and solar insolation. The accompanying exploration paper depends on the possibilities of solar vitality from point of view of Bangladesh. Conceivable executions of solar innovations like photovoltaic cells (PV) and Solar warm vitality (STE) are talked about with their ideal limit, effectiveness, storeroom and cost per unit control. Some social, financial and natural limitations in regard to the execution of solar innovation are featured and some conceivable arrangements are advertised.

4.4.1 Crisis of Power in Bangladesh

Electricity and improved life are given in the present day. Improve power is difficult to imagine the world. Regular surprise to increase intensity in Bangladesh. At present, multi-data has become a major problem. Low accessibility is explained behind

• Some plants are out of activity for support,

• Rehabilitation and Overhaul

• Due to the capacity of maturing plants due to various plants

• Lack of Gas.

Power Emergency Transmission Unfortunately (special unfortunate and indeterminate weakness), the consequences of hunger, misfortune, loss, and collapse administration. Non-special misfortune is misfortune, misfortune charge and accumulation is unfortunate. As power power is increasing, installing a new power plant to speed up the request is fundamental. It may be that, in our country, new power plants can not be imaginable for development. Again, the existence of the old power plants is in existence. All things are thought to be a part of the unit or the entire station at once. So the national structure is different and the whole country becomes soft [28].

4.1.1.1 Data on power crisis in Bangladesh

Year	Installed capacity (MV)	Generation Capability (MW)	Demand forecast (MV)	Load Shedding (MV)
2003-04	4680	3592	4259	694
2004-05	4685	3782	4375	800
2005-06	4690	3810	4490	1312
2006-07	4693	3849	4550	1212
2007-08	5466	4415	4800	385

Table:4.4.1.1 Data on power crisis in Bangladesh

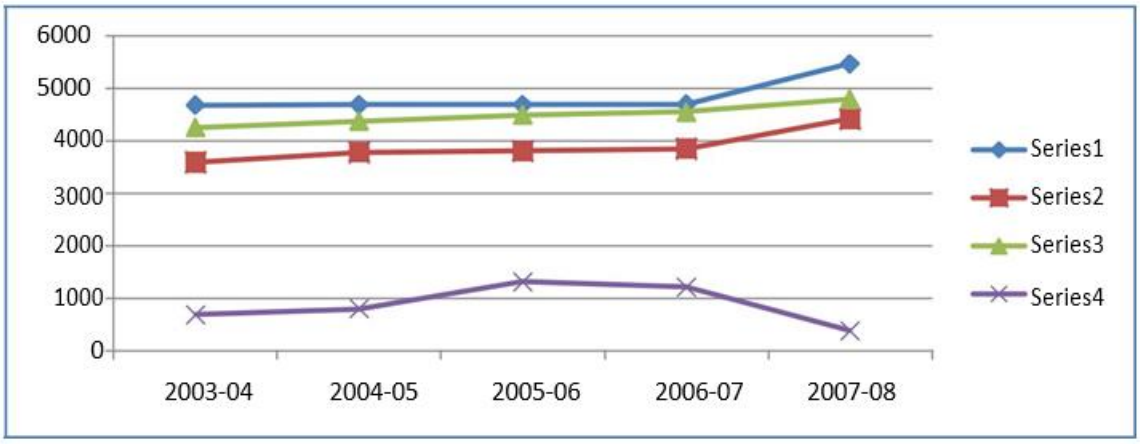


Figure 4.4.1.1: Graph of Power Crisis

4.4.2 Solar Energy Project

Infrastructure Development Company Limited (IDCOL) promotes solar home system (SHS) under rural energy and renewable energy development project (Rearcopy). Geopol has undertaken a solar energy development program under the Chittagong Hill Tracts. Two projects successfully completed in Jurachhari area of Rangamati area. About 600 homes have been provided under this project. The second phase was adopted in Thanchi upazila of Rangamati district. This project will set up 120 SPS 600 SSS, 20 sets of solar photovolicy 75V each street lighting system, 1800 watts per 50,000 liters per pump capacity, 2 set solar PV drum side water pump, 6 PV vaccine for solar PV solar A set of 10 kW central AC market electrifying system for refrigerators power plants. As follows: Rural Electrification Board (RRB) has adopted three solar PV projects in different areas of Bangladesh:

1. The project was started in 1994 and in 1998, it was done in two unions from Meghna to Narsingdi Sadar Police Station (Karimpur and Nazrpur). According to this program, about 1000 numbers of different departments have been benefited.
2. The project was originally targeted at the Austrian Strait Islands (Kishoreganj), Shingra (Natore), Kotalipara (Gopalganj), Moshekhali, Kutubdia and sub-centers of the Bay of Bengal. The main objective of the project is to pay 6000 rupees. PV solar home system in remote and isolated rural areas.
3. Project for three projects in Sirajganj, Natore, Pabna, Barisal, Cox's Bazar and Sunamganj. The main objective of the project is to provide 16000 SHSs in rural areas and about 80,000 people will be benefitted.

4. On the other hand, some non-governmental organizations like IPC and solar power programs, BRAC Bangladesh, Summit Power, Grameen Shakti, Rahim Afroz and ANRGYPA are playing an important role..

4.4.3 Development in Solar Energy Program

The durable power source is the focus couple and these are not contrary and different nations are entrenched. So experts are not turning that point. Due to the huge reserve and experienced labor due to emergency, Bangladesh can import solar cells from abroad and make the board here. As a result, it is expensive and difficult to use, so clients are not excited to use solar boards. In any case, open the solar life program in Bangladesh. Geow has undertaken a solar bi-purpose program in the Tract region of Chittagong Shield. This program should be extended to the provincial region of the entire region. To improve the solar biography program, it will establish more than 10 permanent durable power sources, where skilled experts will come and prepare others. Open Private Association programs can be created for valuable reserve. IPP applications extend their program. Candidates should be aware of the general public for importing GOV solar cells using solar panels and sponsors.

4.4.4 Solar Home Systems in Rural Bangladesh

It is set in the east, west and north sides and south of the Bay of Bengal. Similarly, there are various parts of the desert on the southeast along with Myanmar. A region of Bangladesh is 147,570 sq km. An expected population of 158,570,535 (July 2011) (World Factbook, 2011). 75% of the population lives in the population (Bangladesh Bureau of Statistics, 2009). Human Development Index (2009) 146 Human Development Index (HDI) among 146 people in 177 countries across the country have occupied. National Matrix Bangladesh

The extension is indeed and is not actually achievable, it is used to create various types of solar home framework (SHS) of PV cells. The SHS uses PV innovation to get the family's family exposed and other basic home appliances, for example, lights, radios and little reverse TVs. The main component is solar boards, batteries and charge controllers that can work at least in preparation (Amazon Infield 2001, page 50). Solar photovoltaic framework can change daylight (a kind of resonance), without changing any moving part (other kinds of biographies). Figure 2.1 Solar inventions Necessary renewable energy sources are not required in order to talk with the generation of electricity because the light of the day is the main raw material. The dead light is generally accessible, intelligent and reliable sources of energy. In addition, with the slightest support of gear, the solar home structure can run smoothly and produce power for a long time [26].

4.4.5 Overview on Villages and Household Characteristics

Prior to focusing on issues related to living and financial impact, the basic point of this examination is to make a general picture of the situation and condition of city and family unit in the unit.

Assistant Bangladeshi family units will show some useful information about financial settings, problems and wishes [25].

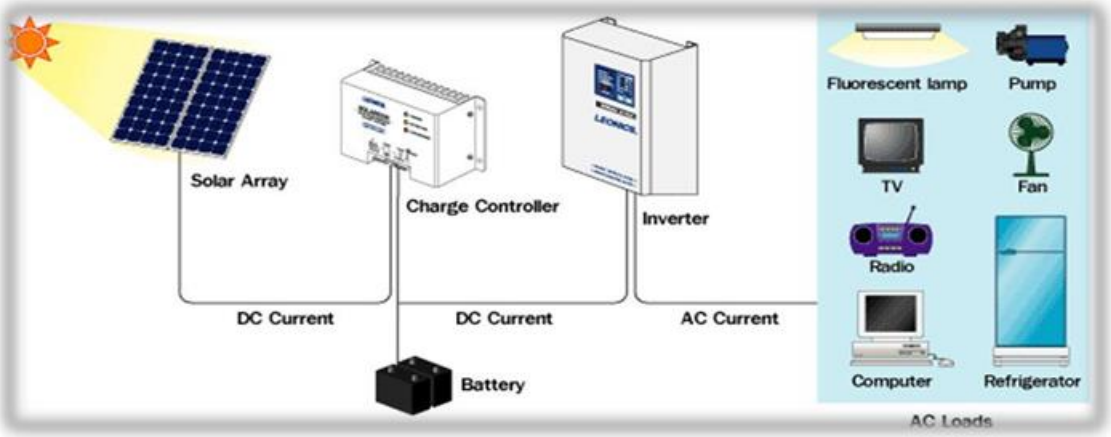


Figure 4.4.5: Solar Home Systems to Produce Light

4.5 Solar Home System Design

Basic Components:

- Module
- Battery
- Charge Controller
- Load

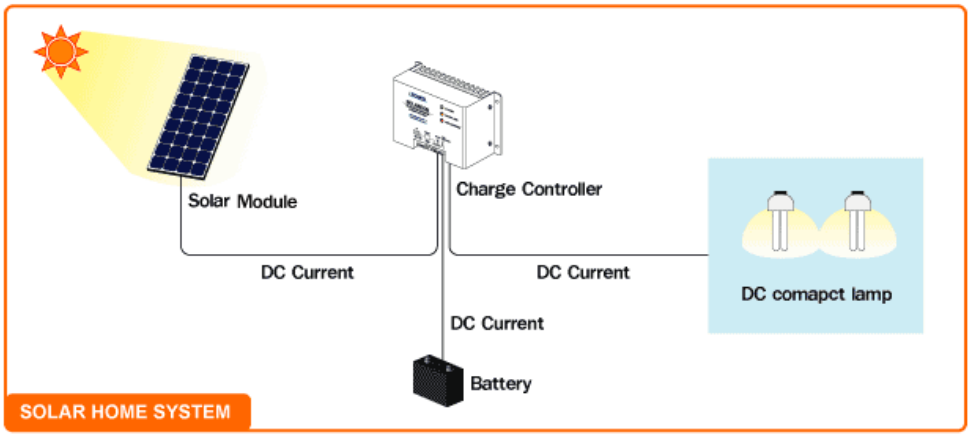


Figure 4.5: Design of Solar Home systems

4.5.1 Block Diagram of solar home system design process

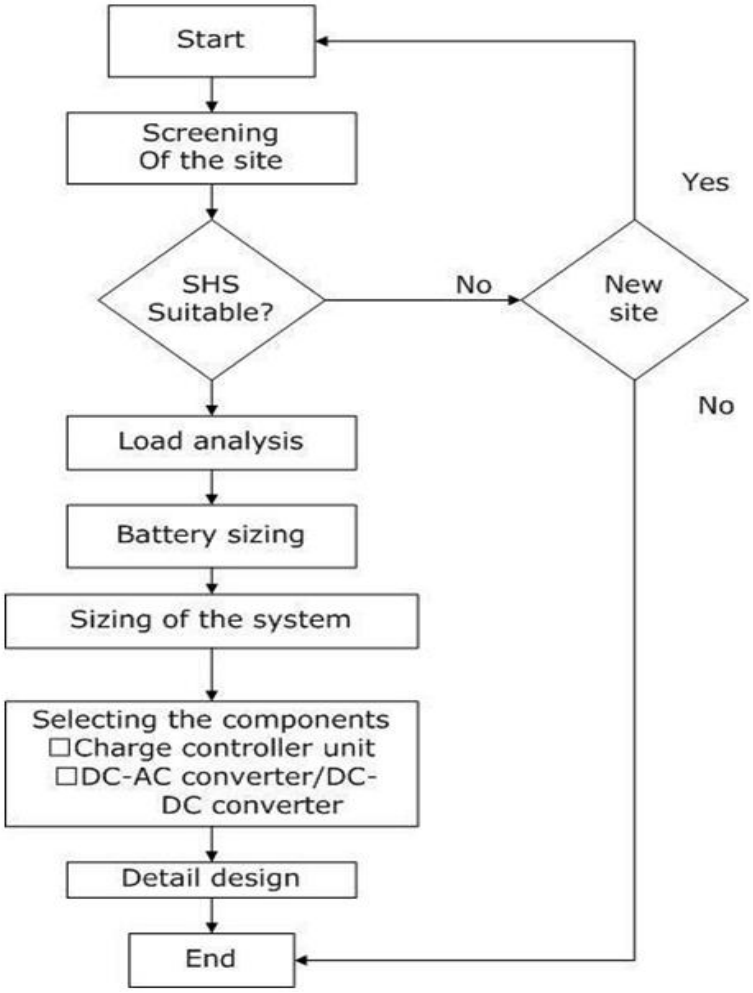


Fig 4.5.1(a):Block Diagram of solar home system design

The solar home framework configuration method is displayed in the upper-left diagram. The procedure starts with site screening. It implies that it is located in a place where there is sufficient sunlight. After evaluating the stack in the first stage of that stage and after that battery measurement. At that time, different parts of the structure, for example, the Charge Controller Unit and Voltage Converter (if required) are selected. Along this line, the entire structure is prepared in the configuration.

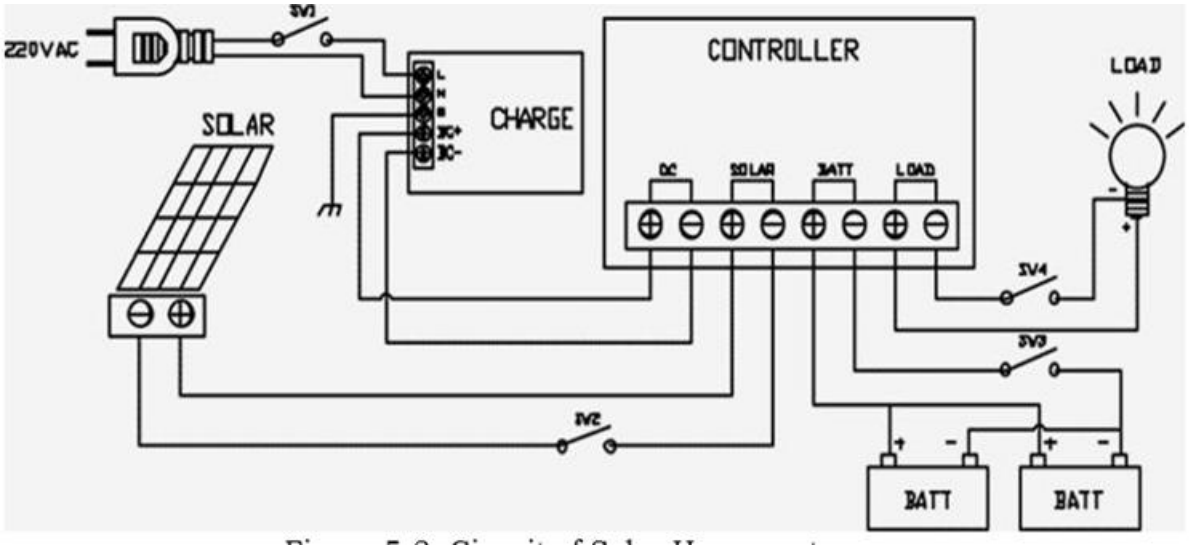


Fig 4.5.1(b):Circuit of Solar Home System

4.6 Site Screening

The solar home framework configuration method is displayed in the upper left diagram. The procedure starts with site screening. It implies that it is located in a place where there is sufficient sunlight. After evaluating the stack in the first stage of that stage and after that battery measurement. At that time, different parts of the structure, for example, the Charge Controller Unit and Voltage Converter (if required) are selected. Along this line, the entire structure is prepared in the configuration.

4.7 Load Determination

To find out the daily average load, A family consists of 4 persons using TV for 5 hours, 6

Led Bulbs for 6 hours, 3 fan for 15 hours daily, Laptop for 1.5 hours.

So power requirement of various types of loads are given bellow:

Item/loads	Rated Power
Television	60W
Led Bulbs	6W
Electric Fan	65 W
Laptop	70W

Table 4.7: various types of loads

Solution:

The daily energy needed for the given family =5*60+1.5*70+3*15*65+6*6*6

= 3,546 Wh

=3.546 KWh

4.8 Battery Sizing

The following characteristics are needed for a solar home system battery:

- For deep cycle, long lifetime
- Low maintenance
- High charging capacity
- The ability of completely discharge
- Low internal discharging rate
- Reliability
- Minimum change under excessive temperature

4.9 Array Sizing

Array sizing of a PV system means the calculation of the number of PV modules.

4.10 Selection of Charge Controller

Functional parameter of solar home system charge controller

- Maximum current receive from PV panel
- Ability of maximum power supply on the load
- Mark it low voltage level
- Mark it high voltage level
- Electric protection from thunder
- Good regulation
- Protection from reverse polarity
- Adjust with system voltage

4.11 Selection of Converter

TA Solar Home Framework for equipment requires air conditioner and DC voltage. Solar Module As a yield voltage DC, this structure requires DC-DC converter or DC-air conditioner converter. A part of the hip is added to the essential converter.

4.12 System Wiring

PV modules frame needs electrical cables. The voltage drop wire will occur in the internal anti-wire. Solar Home Framework This voltage drop should be kept under a break point. The cost of the cable is essential and the cable length will be a little shorter. Under the turning the solar segment association will be satisfied.

- The system must be safe
- This system is not created in error for system performance
- Each material works according to their maximum performance
- Use centralized 12volt DC system if possible
- If possible, use the central 24volt DC system

4.13 Wire Standard Size

Cross Section area (mm^2)	Wire Gauge (AWG or SWG)	Current Rating (A)
1.0	18	10
1.5	16	15
2.5	14	20
4.0	12	30
6.0	10	35
10.0	8	50
16.0	6	70
25.0	4	90

Table 4.13(a): Standard Size of wire

Cable Size (mm^2)	Maximum Cable Length (m) for Various Load Requirement							
	Load Power (W)	24	36	48	60	72	96	120
	Current at 12 v (A)	2	3	4	5	6	8	10
1.5		12	8	7	5	5	4	3

2.5		20	13	10	8	7	6	5
4.0		31	21	16	13	11	8	7
6.0		46	31	23	19	16	12	10
10		76	51	38	31	26	20	16

Table 4.13(b): Maximum length of wire for 0.6 volt drop in 12 volt system

Cable Size (mm^2)	Maximum Cable Length (m) for Various Load Requirement						
	Load Power (W)	48	72	96	120	144	192	240
	Current at 12 v (A)	2	3	4	5	6	8	10
1.5		23	16	12	10	8	7	5
2.5		38	26	20	16	13	10	8
4.0		61	41	31	25	21	16	13
6.0		91	61	46	37	31	23	19
10		151	101	76	61	51	38	31

Table 4.13(c): Maximum length of wire for 1.2 volt drop in 12 volt system

4.14 A small size 12 volt Home System Design

Let, Load determination for 3546Wh/Day design a 12 volt solar home system. Here 85Wp module (Isc = 7.9A, Imp = 7.00A & nominal voltage=12), 660 Ah battery (DOD = 60%, Efficiency=80%) will use.

- Cabal voltage drop maximum 5%
- Maximum power loss 5%

Inverter efficiency 90%

Battery size

DC Wh/day = 3546 ÷ (0.9*0.95)

=4147.36Wh Daily load

= 4147.36 Wh ÷ 12V

=345.61Ah Battery efficiency = 80%

DOD (Depth of Discharge)= 60%

If autonomy of battery 3 day

So Amp-hour for battery = (345.61*3)÷(0.6*0.8)

= 2160.06Ah Number of battery required

= 2160.06 ÷ 660 = 3.27 ≈ 4

So 4 batteries are needed.

Each one is 660Ah.

Array sizing

Daily PV module output = 12*7.00*6

= 506 Wh/day Module nominal voltage

= 12V Daily avg. pick insulation = 6 hours

Summarizing 15% loss PV Array Sizing= 506*0.15 =75.6Wh

DC watt-hours Available = 506-75.60Wh = 430.4Wh

So no. of module = 3546/430.4 = 8.24 ≈ 9

Inverter size

Size of the inverter = 355/ (.9) *1.25 = 493.06W ≈

500W So 500W inverter is needed

Si No	Description of items	BDT
1	Solar Panel (9)	79500
2	Battery (4)	24000
3	Charge Controller	2500
4	wire	3500
5	Panel Mounting	5500
6	Miscellaneous	2000
7	Maintenance Cost (Labor & Other)	25000

	Total	142000

Table 4.14: Cost of Solar Power System (3.546 kw-h)

4.15 Cost of Power from DESCO (3.546 kw-h)

Per Unit Cost of power from DESCO ≈ BDT 7 Per year cost

of power from DESCO= BDT 9060

Total cost for 20 Years (without considering any maintenance cost)

=BDT 9060×20
= BDT 181200

Comparison	Solar Home System	Power From DESCO
Cost	Total Cost for 20 Years = BDT 142000	Total Cost for 20 years (without considering any maintenance cost) = BDT 9060*20 = BDT 181200
Load Shedding	No	Yes
Cost Variation Due Time	No	Yes
Utility Bills	Low	High
Buck up Capability	Around 4 Day	No
Source Of production	Sunlight (No green House Gasses)	Coil, Burning, Gas, Water, Garbage etc.

Table 4.15: Comparison Between Solar Home System and Power from DESCO

4.16 Identifying Direct Costs

Direct costs items are usually classified into two types:

- Capital costs
- Operating and maintenance Costs

Capital costs

- Land and other natural resources that have current alternative uses
- Detailed engineering and design
- Preparatory installation work
- Cost of equipment, raw materials and supplies for construction

- Cost of building and auxiliary installations
- Engineering and administrative cost during construction
- Organization costs
- Expenses of running in periods
- Contingencies

Operating and maintenance Cost

- Raw materials and other supplies
- And energy and fuel
- labor
- And rent and insurance
- Reduces natural resources
- potential
- The technical research of the items mentioned above should have been identified and reflected in financial analysis
- Sunk Cost
- Project evaluation has been spent before.
- Worth of ideas
- These prices reflect the price and outages of the project inputs, their relative deficiencies or availability.

4.17 Advantage of Solar Home System

1. Save Money on Electric Bills Immediately

- Dynamically installing a home solar system will significantly reduce your electric bills. Many zamindars save 30% of their electricity bills
- O- even their electric bill extraction
  - A common Bangladeshi family uses 3.546 daily electricity. A residential solar installation of 840 kilowatts per month from the renewable energy corporation will offset your electricity consumption.
  - Your actual savings will depend on the energy requirements of your home, space available for photovoltaic system and your PV system adaptation. Please contact the Renewable Energy Corporation for an analysis and estimation.

3. Reduce Your Carbon Footprint

- The average American household generates 7.4 tons of carbon dioxide (CO2) per year through electrical use.
- This equates to 185 tons of CO2 over 25 years, which is how long Solar World solar panels is guaranteed to perform.
- Carbon Dioxide creates global warming which is dramatically affecting
- our climate causing glacier loss, shoreline erosion, and endangering many animals around the world.

4. Conserve Our Natural Resources

Each hour enough sunlight hits the earth to power the world for year.

- That‘s 400 trillion gigawatts per second and enough to power 400 quintillion homes.
- Putting the sun to work reduces the amount of coal and nuclear energy needed to power your home which helps preserve the earth‘s supply of non-renewable resources.
- Coal and nuclear energy production consume vast amounts of water. Consequently, solar on your home can conserve over 16,000 gallons of water per year.

4.18 Limitation of Solar Home System

- Limited number of supplier & lack of experience in the solar technology market, resulting the high price of SHS. So it is necessary to increase technology market
- During Rainy season sometimes sunlight aren‘t available.
- Initial costing is high that‘s why some middle class family can‘t afford it.
- If Solar panel is damage then have to change the panel.

Chapter -5

CONCLUSION

This paper is all about how renewable energy like solar energy and wind energy work and utilize in order to Bangladesh. Here we discuss all scenario of our energy and try to solve the problem by renewable energy. The energy situation of Bangladesh is high costly with thermo electrical, coal plant, gas plant. This kind of plants is so much environment effective which damage our ecosystem of green nature. Unfortunately, These three power sources have three errors. Coal and petroleum fossil fuels and therefore restrict the amount of internal amounts. This fuel is highly contaminated, and can not create a foundation for a completely durable society. Other large sources, the power of hydroelectric power, comes from adverse adverse effects on local aquatic animals from different waters. There is still the need to reduce the power of hydroelectric power due to reducing greenhouse gas emissions, which could be one of the deficiencies caused by the extinction of climate species in the future, which we would like to explore in the future. In the meeting, there is a need to meet the demand for conventional energy in the GOB initiatives and planning

discussions. It is clear from the above study we have enough opportunity to solve the problem by set up renewable resources like solar system in every regional area, wind plant, biogas plant and hydroelectric plant which needs the capital to installation cost.it have not need to carrying cost. Renewable energy will be a definite solution for meeting the future energy demand of Bangladesh.

Also using the most advanced solar, wind, biomass based projects and solar-powered equipment,wind power will be a definite way to meet the future energy needs of Bangladesh.

Renewable energy is becoming more and more popular in Bangladesh, especially in rural areas. The installation of renewable energy (solar energy, bio-energy, mini-wind energy, etc.) provides a cheap and sustainable way to deliver high quality, reliable, clean and clean, and environmentally friendly services. It has a huge impact on the lives of our rural people in Bangladesh by giving them numerous direct and indirect socio-economic benefits. But some limitation like high generation cost, lack of sufficient backup support by battery insufficient service due to dust accumulation and rainy season. Renewable energy can provide better aid facilities in education, recreation and communication in rural area and it can improve some commercial activities as well as living standard of rural community.

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