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Research article

Analysis of Solar Energy & the Solar Power Plants to Neutralize the Load-shedding Problem in Bangladesh

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Abstract

This paper presents the analysis of solar energy & electricity generation system from solar energy in Bangladesh. The solar energy can optimize the present electricity shortage in the country. Solar power is the conversion of sunlight into electricity. The sunlight is incident on the solar panels and then the electric current continues to flow. This energy is stored into charging battery with the help of charge controller. The DC power comes from the battery is converted into AC power with the help of Inverter circuit. Finally, the AC output power is delivered to the Load. The system described by this paper is essential to neutralize the current Load-shedding problem in Bangladesh & ensure the continuity of supply among peoples.

Index Terms: Bangladesh, Electricity generation, Load Shedding, Solar energy, Renewable energy

I. INTRODUCTION

Energy is the part and parcel of our life. Life is unimaginable without energy [1]. There will be no life after the extinction of energy. We make good use of energy. It is everywhere around us and in us. There is not only one type of energy. There is heat, electricity, light. Energy is stored in our bodies. The energy present in the molecules of carbohydrates, proteins and other substances enable us to breathe, move, grow, think, speak and live. In working, playing and doing anything even sleeping need energy.

Human beings are living on this planet from billions of years. They have suffered to make their lives easier. The humankind has invented millions of appliances and machines to make the lifetime easier and comforting. Some of these machines make use of electricity to fulfill our needs where others use fuel to fulfill the task. Heat and electricity are the most common forms of energy. The moving particles in any substance generate heat. The warmth depends on the movement of the particles. The movement of electrons in a conductor like copper electric wire creates electricity. Besides heat and electricity there are also a number of other energies that we are making use of. Energy can be divided in two basic types:

- **RENEWABLE ENERGIES**
- **NON-RENEWABLE ENERGIES**

The non-renewable forms of energy are the one who exhaust on exploitation, for example natural gas, oil, radioactive elements, coal, etc. the renewable energy is replaceable. The supply is never ending. The energy is extracted from the natural sources in natural manner without spoiling the natural flow. The renewable energy comes from the sun rays, water, wind and many other natural resources. By the virtue of collectors, designed for the purpose, we can store energy from these resources and utilize them for our specific purpose. Such supply of energy will continue to serve us unless or until water (oceans) is flowing, sun is blazing, wind is blowing and trees are growing.

Sun is providing us with extensive amount of energy from the very first day of its dawn. Sun provides us with heat, light, X-ray and radio waves. There are collectors and modules to collect the sun energy and to convert it into different usable forms of energies. Solar energy is a brilliant source of most popular forms of energies that is heat and electricity. For

remote use of energy, solar power is getting popularity like agriculture applications such as pasture management and irrigation, tropical states that are detached from electricity grid, for heating swimming pools, telecommunication towers and much more.

The sun light casting upon water and earth cause the air to move above at getting warm, that gives wind which has been one of the best sources of energy from ages. Initially wind was used for carrying ships, grinding grains, pumping water and much more. Today wind is one of the cleanest and renewable sources of energy. Biomass is composed of different forms of energy. Biomass refers to straw, wood, biological waste products, etc. in energy industry as they contain abundant energy. The reserved energy can be released by burning the biomass or by presenting it to micro organisms that can be utilized it to make bio-gas.

Water is used by the mankind for more than 3000 years ago. Hydroelectric dams are created to collect the potential of water. The snow falling and rain provides water to the reserves. Moving water is a renewable and everlasting source of energy.

The renewable sources are useful as they are cost effective. The non-renewable sources of energy or fossil fuels are getting expensive as the reserves are getting exhausted with increasing usage. Besides, fossil fuels are spoiling the atmosphere as well as the aqua life. On the other hand, the renewable sources of energy are environment friendly and do not affect the natural order of the planet. The sources will never exhaust and will cause no trouble in case the demand will be increased by the passage of time.
The latitude & longitude of Dhaka is *23*°43'N and 90°26'E respectively, which is very ideal for electricity generation from solar energy. The latitude & longitude of Bangladesh is shown in figure-1. The long-term average Sunshine data indicates that the period of bright Sunshine hours in the coastal region of Bangladesh varies from 3 to 11 hours daily. The global radiation varies from 3.80. These date indicate that there are good prospect for solar thermal and photovoltaic application in Bangladesh

Figure-1: The latitude & Longitude of Bangladesh

Solar power is the conversion of sunlight into electricity. Sunlight can be converted directly into electricity using photovoltaic (PV), or indirectly with concentrated solar power (CSP), which normally focuses the sun's energy to boil water which is then used to provide power. Other technologies also exist, such as Stirling engine dishes which use a Stirling cycle engine to power a generator. Photovoltaic were initially used to power small and medium-sized applications, from the calculator powered by a single solar cell to off-grid homes powered by a photovoltaic array.

Solar energy means using the energy of sunlight to provide electricity, to heat water, and to heat or cool homes, businesses or industry.

Sunlight is a clean, renewable source of energy [3]. It is a sustainable resource, meaning it doesn't run out, but can be maintained. Coal or gases are not sustainable or renewable: once they are gone, there is none left. More and more people want to use clean, renewable energy such as solar, wind, geothermal steam and others. It is called 'Green Power'.

Photovoltaic (PV) solar cells directly convert sunlight into electricity. The simplest cells are used to operate wristwatches and calculators, and more complicated systems are used to light houses. PV cells are combined into modules called arrays, and the number of arrays used determines the amount of electricity produced. For example, a large number of arrays would be needed to generate electricity for a power plant. A power plant can also use a concentrating solar power system where sunlight is focused with mirrors to create a high-intensity heat source to produce steam or mechanical power to run a generator that creates electricity.

Solar water heating systems have two main parts: a solar collector and a storage tank. Generally, the collector is a thin, flat, rectangular box with a transparent cover mounted on the roof, facing the sun. The sun heats an absorber plate in the collector, and this heats the water running through tubes inside the collector. The heated water is pumped or moved by gravity into the storage tank. Solar water heaters can use about two thirds less energy than those of other methods.

II. SOLAR ENERGY

Solar electricity is the energy which is extracted by Sun using solar power plants. Sun is the richest source of energies like light and heat. Huge amount of energies are available for us to take and make big impact on our electricity requirements. Our sun throws as much amount of energy on earth in one day which is equivalent to the energy requirement for the entire year.

For better understating about what solar energy is and how it generated we need to know bit more about Sun which provide us with this amazing source of energy. Solar energy is radiant energy which is emitted by Sun [4]. One interesting question which one may ask is how sun manages to provide such amount of radiant energy constantly, what does sun possess which in result produces such massive amount of energy ? It is obvious that all this energy comes from within the core of sun. This huge ball is full of gases like hydrogen and helium, hydrogen atoms however is present on larger scale. Energy is formed because of nuclear fusion reaction when hydrogen atoms combine to form helium; this entire process takes place in the core of the sun which is the hottest part.

Extreme high pressures and temperatures are formed due to nuclear fusions reaction which in result hydrogen atoms to break apart and their nuclei to combine or fuse. One helium atom is formed when four nuclei of hydrogen are fused together; however helium atoms posses lesser mass then four hydrogen atoms. During the nuclear fusion reaction some of the matter is lost which is release into the space, this matter comes out into space as radiant energy.

Sun surface is about 109 times bigger than surface of the earth. It takes millions of years for energy generated from the center of the sun to reach to the surface of the sun. Our mother earth is about 149.63 * 106 kilometers away from the sun, and light takes about 8 minutes and 31 seconds to reach to the surface of the earth. Light from the sun travels 186,262 miles per second to reach to earth. Energy emitted from the sun which reaches earth is in massive amount and can be extremely dangerous for mankind on earth if direct exposure is made.

Earth posses layer of ozone which filters all harmful radiant energy and allows only that light and heat energy to the surface of earth which benefits living organisms. The energy which finally reaches earth is very low to the amount of energy filtered, yet this amount of energy is sufficient to provide enough electricity to the earth for entire year. Some portion of energy is reflected back into space, little portion is used to evaporation process, some amount of energy is utilized by land, oceans and plants, still rest of the energy is up for us to take and produce solar electricity out of it.

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III. CLASSIFICATION OF SOLAR POWER PLANTS

In the future, fossil fuel power plants - namely coal plants in the world - will be replaced with clean, renewable sources of energy. Solar energy will play a major role in that future. Presently, solar power plants are gaining a foothold in utility-scale power generation.

Solar power plants can produce energy in two ways:

1. Solar thermal power plants - In this set-up, solar energy heats a transfer fluid, which is used to heat water. That water creates steam to spin a turbine that can then produce electricity.

2. Solar photovoltaic (PV) plants - PV plants utilize solar power panels to convert solar radiation directly into electricity.

A. Solar Thermal Power Plants

Solar thermal power plants also work in a few different ways. The most common type uses a parabolic trough design. In these plants, commonly known as concentrated solar power (CSP) plants, several rows of trough-shaped, parabolic mirrors are strategically designed to capture and concentrate the sun's rays onto a focal point; much like a child might use a magnifying glass to burn ants. That point is a black pipe running the length of the row of mirrors. Inside this pipe is a transfer fluid, which heats up to very hot temperatures, often upwards of 300 degrees Fahrenheit. The heated fluid is piped to a power generator, where its heat is used to boil water, creating steam and electricity.

Another version of a solar thermal power plant is a "power tower". Power towers take CSP technology in a new direction. Mirrors are situated to focus solar radiation onto a single focal point: a tall tower which houses a receiver that boils water to create steam. Mirrors are usually connected to a tracking system that allows them to follow the sun across the sky. Power towers have some key advantages, such as smaller footprints and relatively fast construction time.

Solar Photovoltaic Plants

Photovoltaic plants are very straightforward. Several solar power panels are installed to form an array. Typically, a handful of panels will be "strung" together in series on a single mounting system. Each set of panels collects solar energy, converts it directly into electricity, and sends that electricity through wiring to the electric grid. PV power plants are relatively rare because solar thermal power is currently much more efficient at producing electricity on a large scale.

IV. SOLAR PANEL & IT'S WORKING

There is one most common example for solar product is calculator which we use in our homes and office. These calculators do not have batteries but operates on solar cells and usually it remains on and do not have off buttons, for them to keep on working only light is required. There are little advance examples for solar power applications available in fewer parts of the world [5], solar application like solar signals on highways, emergency road signs, emergency call boxes, parking lights and garden lights.

Proper solar panels are getting common these days, these solar panels can take up the entire electricity load of home, although this is not yet that common but definitely on the way to be very useful and adoptable in coming future. That time is not that far when most of our homes will be using solar power home.

WORKING OF SOLAR POWER PANEL:

To understand how solar power panels work and provide electricity I have broken down its working and processes in to steps for better understanding. These steps are mentioned with the in the order as it happens in given solar plant. Steps like Sun light, Earth surface, Photovoltaic Cells, Weather Station, DC switch, Inverter, Transformer, AC switch, Electric meter.

The diagram shown in figure-2 is known as a photovoltaic process [6]. Radiation energy is absorbed by semi conductor cells normally silicon and transformed from photo energy (light) into voltaic (electrical current). When the sun's radiation hits a silicon atom, a photon of light energy is absorbed, 'knocking off' an electron. These released electrons create an electric current. The electric current then goes to an inverter, which converts the current from DC (direct current) to AC (alternating current). The system is then connected to the mains power or electricity grid.

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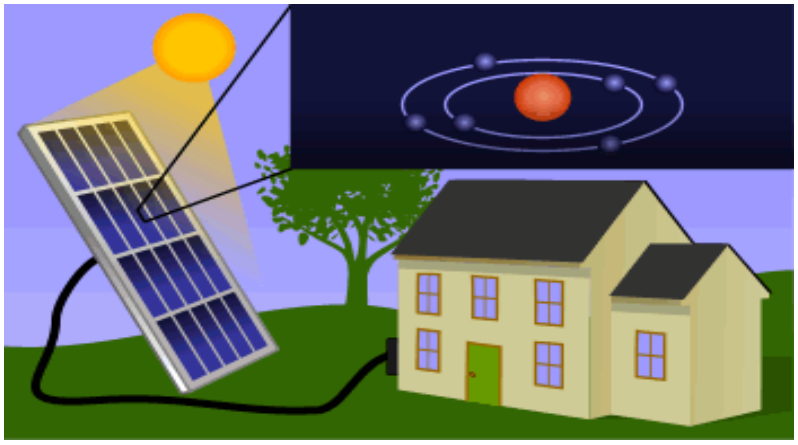

Figure-2: Incident of sunlight into the solar panel

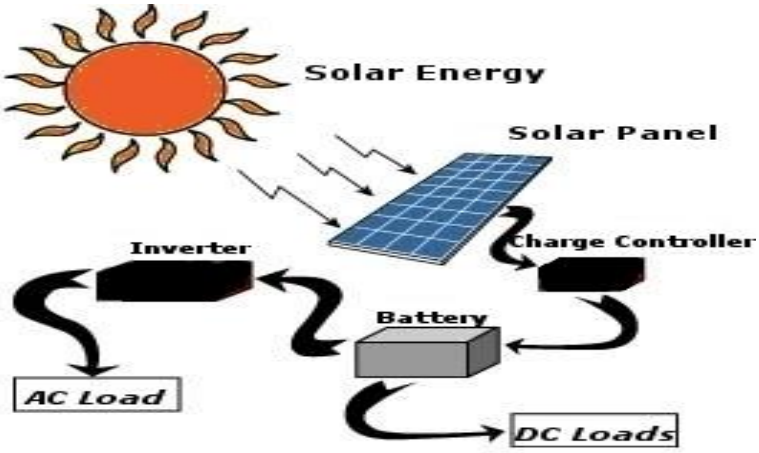

Figure-3: Power generation processes from solar energy

1. **SUN LIGHT:** Sun is the only source for light for earth, sun produces enormous amount of energy due to fusion reactions with in its core. Portions of energy are travelled to the surface of the earth; these portions of energy are called photons. Sun light passes through different layers before entering into atmosphere of earth, these layers have specific filtration process which filter harmful energy and light and prevent it to reach on earth. The energy which gets in the atmosphere is reflected and absorbed by earth, crops water, oceans etc and some of the energy is reflected back into space. Rest of the energy is available to take to produce energy from.

2. **Earth Surface:** Earth receives enormous amount of radiant energy from the sun, even after reflection of most of the energy during traveling from sun to earth. This energy available is still on huge scale to be converted into electricity using solar panels. Sun light is the most important part to complete life cycle of human beings and other living organisms including animals and plants. Combination of sun light, sea and atmosphere creates wind pressure which keeps weather systems of earth intact, these winds can also be utilized for producing electricity with help of wind machines.

3. **Photovoltaic Cells:** The most important component of solar panel which produces electricity is photovoltaic cells. The basic function of photovoltaic cells is to convert sun radiant energy into electricity. The word photovoltaic itself means light energy, photo means light and voltaic means energy. Each photovoltaic cell is packed into modules which are called arrays. These cells produce DC direct current when sun is shining directly over them, produced electricity is then send to building electric system or grid station for next step.

4. **Inverter:** Inverter is device which converts direct current (DC) into usable Alternative current (AC). Photovoltaic cells produce direct current which inverter converts into alternative current so that it can be consumed by building. Most of electric devices like computers, house lights, air conditioners etc require alternative current (AC) to operate.

These are four steps which are must to be taken place for any solar panel to work. However there may be some additional steps which can be installed by different companies to enhance and improve the maintenance and overall performance or entire solar panels. These steps may include, electric meter, weather station device, DC switch disconnection module, Transformer, AC switch disconnection module, data acquisition module, electricity distribution panel module.

Electric meter: These electric meters are used for the same purpose as our normal electric meters are used for. They keep the record of energy being consumed which is produced by solar panels. Normally electric energy is measured in watts or kilowatts. Most of solar panels come with electric meters especially when panels are designed to produce energy on large scale.

Data acquisition module: Data acquisition module is important module which receives inputs from weather station module and electric meter. It is normally designed in such a way that it gathers important information to calculate weather conditions and output of solar panels.

Weather Station module: Weather station is another useful add-on for solar panels. As name suggests it keeps the record of weather conditions. Weathers conditions are very crucial as far as the performance or solar panels are concern, therefore keeping weather conditions as record is important. These modules are normally located near photovoltaic cells or arrays. Weather station normally have anemometer to keep the record for wind speed, pyranometer keeps record for solar energy falling on solar panel arrays and of course thermometer to measure temperature. All these inputs are then send to data acquisition module for further processing.

Transformer: Transformer is an important component for any electric system; it makes sure that electricity coming from inverter is compatible with electric voltage of house, building office etc.

DC switch disconnection module: This module helps professional solar panel electricians to disconnection solar panel from the rest of its system. When DC switch is off, electricians can do maintenance task on the rest of solar panel components.

AC switch disconnect module: This module allows electricians to disconnect electric supply of house or building from photovoltaic system. With AC switch turned off maintenance of solar photovoltaic system can be performed.

Electricity distribution panel module: This module is designed to receive energy from solar panels which is then combined with other electricity supply company. From here this energy is passed on electric wiring all over the building, house office etc to run electric appliances.

LATEST DEVELOPMENTS IN SOLAR PLANTS:

Using latest technologies like nontechnology and bio developed solar panels are already on scene, these panels are not yet commercially lunched, however they are on scene and will be available for public and commercial use within couple years.. Portable, flexible and folding PV (photovoltaic) array modules are present today providing ease of use.

V.HOW TO PRODUCE ELECTRICITY FROM SOLAR ENERGY

Solar panels are constructed from a semi-conductive material with the most common material of choice being silicon. The semi-conductive material contains electrons which will naturally just stay there not doing anything.

When photons (contained within the sun's rays) hit a solar cell, the electrons contained in the solar cell material absorb this solar energy, which transforms the electrons into conduction electrons. If the energy of these photons is great enough then the electrons are able to become free and carry an electric charge through a circuit to the destination.

Photovoltaic modules, commonly called solar modules, are the key components used to convert sunlight into electricity. Solar modules are made of semiconductors that are very similar to those used to create integrated circuits for electronic equipment. The most common type of semiconductor currently in use is made of silicon crystal. Silicon crystals are laminated into n-type and p-type layers, stacked on top of each other. Light striking the crystals induces the "photovoltaic

effect," which generates electricity. The electricity produced is called direct current (DC) and can be used immediately or stored in a battery. For systems installed on homes served by a utility grid, a device called an inverter changes the electricity into alternating current (AC), the standard power used in residential homes.

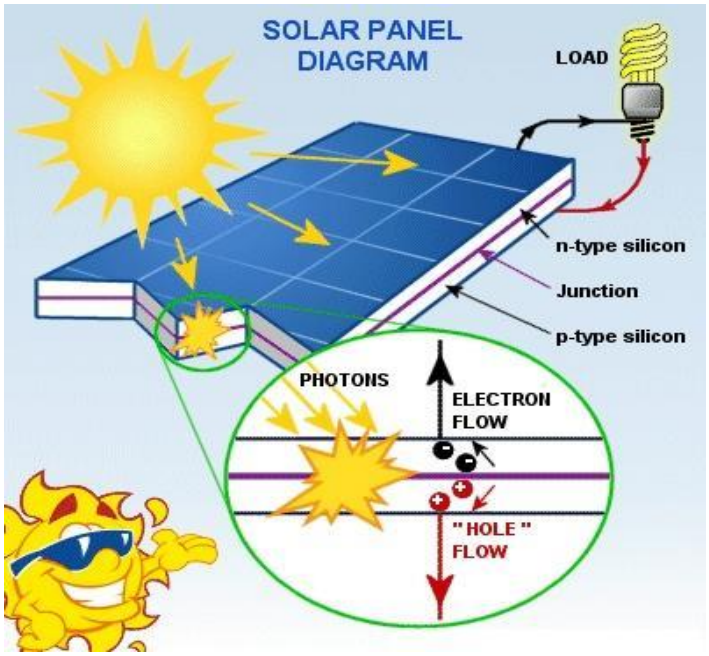

Figure-4: Electricity production from solar panel

VI. APPLICATION OF SOLAR ENERGY

Solar power plants are relatively common than what we have witness in past decay. It is important to adopt some kind of alternative source of power generation before we run out of current sources which produce electricity for us at present. The most obvious and realistic choice is solar energy. Solar energy is available in abundant amount on earth and shifting our electricity requirements on solar energy is most likely to be the option in coming future.

Solar plants have already start providing electricity to us on different levels and scales. What we have all witness since our childhood is solar power calculator or wrist watch but now thankfully things have moved way on. Solar power gadgets or huge solar power arrays are seen producing massive amount of electricity for domestic and commercial areas. Solar power usage is not constant throughout the world. Developed countries more obviously have larger solar power consumption than developing countries. For instance Abengoa Solar launched commercial solar plant in Seville Spain; it produces 20 Megawatts of electricity. Solar Applications can be divided into three categories for understanding them better. Solar applications are available in sectors like Residential, Commercial, Industrial and Agriculture [8].

RESIDENTIAL SOLAR POWER

There are numerous solar powered based devices available in markets which are used in residential sector, products like solar power heater, geezer, outdoor garden lights, battery chargers etc. These days' entire homes can be powered by solar energy. Appropriate solar cells type is used and joined together in modules. These modules of cells are mounted on the roof of the home for direct exposure to the sun light. This sun light is then converted into electricity using solar cells and then transfer into electric system of the house. If power requirement of house is higher then what solar power plant is producing then it can be used supplementary to reduce utility bills and incase if more power is produced than it is required, your electric plant grid station may use net metering and purchase the amount of electricity sent to grid station by your solar power plant. There are systems available which hold battery backups and store the access amount of energy. This energy can be used when conventional electricity is out.

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INDUSTRIAL SOLAR POWER

Solar energy applications : solar energy is been in use in industry and provides multiple industrial applications, especially when power is required in remote locations. Solar power can be useful in such industrial applications where small kilowatt energy is required. Some examples of remote location solar powered applications are TV Station, Radio broadcasting towers, repeater stations, radio telephones etc. Solar power also facilitated electricity in transportation signaling system. In Japan, there are cities which are totally equipped with solar power traffic signal systems and does not require conventional electricity to operate. Other transportation system includes navigation systems, light houses in oceans, runway lights on airports, security camera in dark etc. Other industrial applications where solar power is used are environmental, situation equipment and protection systems for well heads, bridges pipelines etc. Such applications where electricity load is high, solar power can prove cost effective by configure hybrid electric power systems, that joints photovoltaic solar power system with small generators that operates on fuel or natural gas. Solar power is highly reliable and can work on locations where conventional electricity is not reachable. Space is one of the examples for it. Satellites are powered by solar power from the day first when first satellite was launched in space Solar car is another most sophisticated application of solar energy. PV is installed on the surface of the car which converts sun light into electricity to power up a car. Such cars are not yet available for use in market, but they are bound to come for launch commercially very soon in future.

COMMERCIAL SOLAR POWER

Commercial building like offices, school, clinics, community halls, hospitals etc can also take advantage from solar energy electrification. In office buildings, glass/glass PV modules can provide cover over atria, which provide shaded light inside the building. PV systems can also be installed on vertical wall office building in several ways, Curtain wall system, and rain screen over cladding etc.

VII. EFFICIENCY OF SOLAR POWER

The efficiency of solar power, or more specifically a solar panel, depends on the materials used to make each solar cell. A solar cell is that portion of a solar panel in which sunlight is collected and converted to solar electricity. The materials within each cell that perform this valuable duty are called semiconductors. The efficiency of a solar cell - and of solar power - is measured as the percentage of the total sunlight striking the cell that is converted into electricity by the cell.

In conventional solar panels, which you'll see on 90 percent of rooftops today, crystalline silicon is the semiconductor of choice [9]. Silicon solar panels hold the highest consistent conversion efficiencies of solar panels in use today. They convert on average between 15 and 20 percent of the light that hits them.

Thin-film solar panels are considered the wave of the future. They cost much less to manufacture than crystalline silicon panels, but as of yet cannot equal silicon in conversion efficiency. Cadmium telluride (CdTe) and cadmium-indium-gallium-selenide (CIGS) solar panels are the current champions of thin-film solar technologies, averaging around 11 percent efficiency. Most thin-film solar cells reside in the 4-10 percent range.

Solar power is still a relatively young technology. Scientists and researchers believe they can create solar cells that will reach 30-40 percent efficiency and beyond in the not too distant future.

VIII. ADVANTAGES & DISADVANTAGES OF SOLAR ENERGY

A. ADVANTAGES OF SOLAR ENERGY

Solar electricity is definitely the choice of future by energy analysts throughout the world, especially if we keep any eye over other power generation sources fuels, gas etc and their rising prices all the time. Countries have struggled in recent past due to fuel resource for managing their country needs. That is going go on and increase in future if alternative energy/ renewable energy sources are not exploited to their maximum available potentials. Read below the most obvious advantages of solar energy

There are countless advantages associated with Solar Energy [10]. Uses for solar energy are not just for humans to take advantages from but it is amazingly useful for environment as well. Let’s go through several advantages of solar energy.

- The most unique and best feature of solar energy is its abundance in quantity available to our mother earth, if we use it to maximum levels it is not going to go anywhere until next five billion years.

- Solar energy plants are available for both small scale energy requirements and for larger scale energy requirements; it cops the market for both residential and industrial requirements.

- Solar energy can is easily be provided in rural areas where conventional electricity is not present already or it may cost more to setup electric grid station. It is cost effective to use solar energy generation methodologies in such rural areas.

- Solar power plants can also be connected to existing source of power generation to form hybrid system to boost energy requirements during sunny, hot and dry day.

- Solar power plants are normally very flexible. Solar cell modules or arrays comes in different shapes and sizes, it can be fixed on land or can be mounted on roof tops for maximum sun light exposure. Solar cell modules can also be fixed on glass skylights or vertical walls.

- Solar panels now come equipped with such devices which converts DC output from solar panels into AC for consumption. This way residential and commercial business owner can reduce their conventional electricity bills which are increasing day by day.

- Net metering is another impressive advantage of using solar energy. Net metering is term which refers to selling energy to conventional grid station in cases of excess production using solar panels. This way electricity bills are reduced by sending electricity back to grid station.

- Solar power panels are durable and do not require much maintenance, once in while cleaning of solar cell modules will be it. Average life time of solar power panels are up to 20 to 25 years, which justify the initial cost of solar panel.

- Solar power systems are soundless, efficient and without any pollution. Solar panels are capable of connecting with other type electric generators for instance gas turbines, wind, hydro etc. Batteries can also be charges for constant electricity supply.

- Larger solar power panels can help in meeting the demands of new power generation sources. These panels are easy to develop then other power generation plants. Solar power panels are very easy to expand, all is require adding up solar cell modules into it and it will start producing more electricity.

- Solar power systems are very friendly to environment and do not pollute it in anyway, they do not have any by product only electricity is produced. When solar electricity is used in place of energy generated by fossil fuels for meeting needs like lightening homes, office buildings, pumping of water etc, it will reduce amount of carbon-monoxide, greenhouse gasses and other pollution emitted into air. The more electricity from solar panels is used the more it is benefited for environment to reduce impurities from our atmosphere.

- Solar electric system can be useful in employment throughout the world. It has already benefited US economy by producing jobs in US solar electricity companies.

We all should step ahead for solar electricity, create opportunities by exporting solar electric systems to developing countries, reduce the usage of conventional electricity and protect global environment and reduce global warming phenomenon

B. DISADVATAGES OF SOLAR ENERGY

The some disadvantages of solar energy are as under [11]:

- Solar power panels initial cost is very high, this factor discourage solar electric system to spread widely and rapidly throughout the world.

- Cost for solar panels may vary from location to location.

- Rural and remote areas which lack in conventional electricity are best suited for solar energy consumption but it solar electric system initial cost higher than using fossil fuels generated electricity.

- One other disadvantage of solar electric system is that they need whole lot of space of implant panels, sometimes on land and more often of roof top.

- Solar panels are always require to directly face the sun to produce electricity constantly, if panels are not facing sun it will vary in producing watts.

- Since solar cells arrays and modules are exposed directly to the sun, different rays like Ultraviolet rays can slowly deteriorate the surface of the panels, dust, wind, and rain can also effect the overall performance of solar power panels

Solar technology has changed very rapidly in last decay, number of disadvantages of solar electric systems almost faded away. Especially cost factor has dropped a lot in recent times, thanks to government bodies and Green Technology movement.

IX. PRESENT SOLAR ENERGY SECTORS IN BANGLADESH

Bangladesh government takes some essential steps to mitigate the existing load shedding problem. The government has announced that, "Bangladesh is looking for producing 500 MW power from solar system".

Bangladesh has set a target to produce 500 MW of electricity installing solar home systems to reduce greenhouse emissions and ensure sustainable development in energy sector [12].

It also plans to install solar irrigation system to cut diesel cost.

To use Asian Development Bank (ADB)'s fund in solar power project, Bangladesh set the target of electricity generation from solar energy.

"To ensure energy security and to reduce carbon emission we have taken up a massive program to implement renewable energy, energy conservation plan," Adviser to the Prime Minister Dr.Tawfiq-E-Elahi Chowdhury said.

ADB is set to support 3000 MW capacity power project in Asia-Pacific region. To get benefit from it, Bangladesh has prepared its program in collaboration with NGOs.

Bangladesh has achieved a landmark achievement in implementing renewable energy expansion program through installing solar home systems across the country.

Every month, more than 36,000 solar home systems are being installed adding one and half MW of electricity. Just one and half years back about 12,000 systems were installed every month.

According to the power division, Bangladesh made a pledge at Washington International Renewable Energy Conference, 2008 that about five per cent of its total electricity generation will come from renewable sources by 2015.

X.OUTCOMES FROM THIS ANALYSIS

This paper covers all the section of solar energy & their analysis. From this analysis, the main target of the authors is to minimize the present load-shedding problem in Bangladesh.

XI. CONCLUSION

Solar energy can be the best solution for the present load shedding problem in Bangladesh. The solar power may serve as the back-up solution for electricity shortage in all over the country. Due to the geographic advantages, Bangladesh has a great opportunity to use this renewable energy. The several private NGO's are working with solar energies, but without the

help of government financed, it is quite impossible for the private sectors to do well. It is a great pleasure for us, that the government has already taken some steps to develop solar power plants.

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