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RESEARCH ARTICLE

"STUDY TO ELECTRICITY GENERATION FOR A BUILDING FROM UNCONVENTIONAL ENERGY SOURCE".

Dr. P.S Kaushik, Govind shay Sharma, Radha Krishna, Rajesh kumar Bairwa, Nemi chand and Mahendra saini
Department of Applied & Electrical Eng Shree Digamber Institute of Technology, Dausa Rajasthan.

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Abstract

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Photovoltaic power systems convert sunlight directly into electricity. A residential PV power system enables a homeowner to generate some or all of their daily electrical energy demand on their own roof. The house remains connected to the electric utility at all times, so any power needed above what the solar system can produce is simply drawn from the utility. PV systems can also include battery backup or uninterruptible power supply (UPS) capability to operate selected circuits in the residence for hours or days during a utility outage. Sun is the largest source of power if we utilize it. From plants to animals, from human beings to domestic insects, from technology to science, nothing seems to maximize its existence without the availability of light.

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Introduction:-

The non- conventional which are easily available in nature and human using it without any cost. These are the long time power source in the nature. This is in the form of wave, sunlight, & wind etc. This is great for us to convert it in another form of energy. According (Swami r. , July 2012) [1] the world's fossil fuel resources are unable to sustain our current energy requirements beyond the next few decades and so the need for inexpensive alternatives is now urgent. Organic devices are well placed to meet the needs of both the electronics and energy industries because their manufacture does not require expensive processing steps and they can be adapted to a range of applications. [1] Described about the types of energy and focus on the solar energy.

(Sharma, jain, & Sharma, Solar cell: In research and application - A Review, 2015) [2] Have reviewed a progressive development in the solar cell research from one generation to other, and discussed about their future trends and aspects. The article also tries to emphasize the various practices and methods to promote the benefits of solar energy. According to them fabrication of solar cells has passed through a large number of improvement steps from one generation to another. Silicon based solar cells were the first generation solar cells grown on Si wafers, mainly single crystals. Further development to thin films, dye sensitized solar cells and organic solar cells enhanced the cell efficiency.

(A.O, A.A, & O.D, Design and construction of solar power based lighting system, Sep.2013) [3] Presented how solar energy is being harnessed to Power Street light and virtually removes manual works to 100%. The system automatically switches ON lights when the sunlight goes below the visible region of the eyes. This is done by a

Corresponding Author:- P.S Kaushik.
Address:- Department of Applied & Electrical Eng Shree Digamber Institute of Technology, Dausa Rajasthan.

sensor called Light Dependant Resistor (LDR) which senses the light actually like the human eyes. It automatically switches OFF lights whenever the sunlight comes, visible to the eyes.

A Model Predictive Current Control (MPCC) of single phase Photo Voltaic (PV) integrated Shunt Active Power Filter (SAPF) is proposed by (kumar, V.Indragandhi, K., & Kunnam, 2017) [4]. A PV integrated single phase Voltage Source Inverter (VSI) is used to generate a part of the real power and compensate harmonics, reactive power of a Non-Linear Load (NLL). In this paper, a DC link voltage regulation based PI control algorithm is adopted for determining the reference current at the filter side. The performance of SAPF with PV and associated control methods like switch on response and change of nonlinear load were carried out.

The solar interior consists mostly of elements that comprise 99% of ordinary meteorites – Fe, O, Ni, Si, S, Mg and Ca – elements made in the deep interior of a supernova. Solar energy arises from a series of nuclear reactions triggered by neutron-emission from the collapsed supernova core on which the Sun formed studied by (O.Manuel, Kamal, & M.Mozina, 2006) [5].

(R.Timilsina, kurdgelashvli, & A.narbel) [6] analyzed the technical, economic and policy aspects of solar energy development and deployment. While the cost of solar energy has declined rapidly in the recent past, it still remains much higher than the cost of conventional energy technologies. Like other renewable energy technologies, solar energy benefits from fiscal and regulatory incentives and mandates, including tax credits and exemptions, feed-in-tariff, preferential interest rates, renewable portfolio standards and voluntary green power programs in many count. (Iberraken, Medjoudj, & Aissani, Dec.2014) [7

Deals with the failure mechanisms of photovoltaic system and highlights the effect of competing risk of breakdowns initiated by severe weather in the south. A special interest has been given to this phenomenon in this paper. Electrochemical corrosion can appear with the junction of two metals in the presence of dust. The speed of the corrosion depends on the nature of the electrolyte. In this paper a number of failure modes of photovoltaic system were identified and observed in the field. In addition to the influence of temperature and of the irradiance, dust accumulation, which is significant over a relatively short period of time, has a significant impact on the performances of the system by reducing the amount of sunlight that the PV panels are exposed, polluting the components connections and degrading the system energy storage. (Hu, Wang, Li, & Hong Du, Dec 2017) [8] the total amount of cold storage increasing year by year, the disorderly access of heavy power load will make the power grid peak and valley difference increase. At the same time, the high operating cost will also increase the burden of users, so the optimal operation of the cold storage is crucial. Based on the TOU price policy, the optimal operation model of cold storage is established with the objective function of minimizing the operating cost and the load power variance. The optimal operation strategy of cold storage is solved by membership function and particle swarm algorithm, and the load and start of cold storage are calculated according to the 0-1 knapsack algorithm. The influence of different price on the operation strategy is analyzed. Making a garlic market in Henan as example analysis, shows the results that considering the PV and TOU case, optimal control strategy to reduce operating costs and power grid peak valley difference has obvious advantages, in which the cost saving rate in cold season and boom season are 199.4% and 92.6% respectively.

Photovoltaic power systems convert sunlight directly into electricity. A residential PV power system enables a homeowner to generate some or all of their daily electrical energy demand on their own roof, exchanging daytime excess power for future energy needs (i.e. nighttime usage). The house remains connected to the electric utility at all times, so any power needed above what the solar system can produce is simply drawn from the utility. PV systems can also include battery backup or uninterruptible power supply (UPS) capability to operate selected circuits in the residence for hours or days during a utility outage.

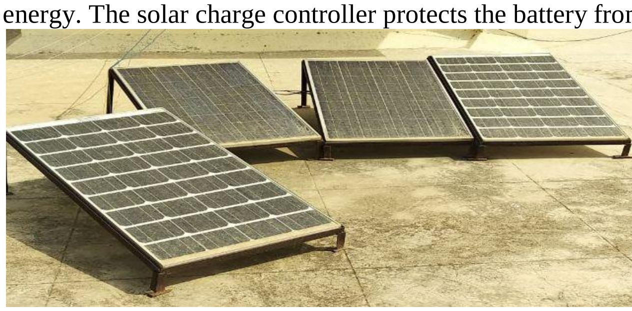
As this project on solar energy, it is good starts the discussion with general thought on energy. Energy has the large number of different forms. A single PV cell is a thin semiconductor wafer made of two layers generally made of highly purified silicon (PC cells can be made of many different semiconductors but crystalline silicon is the most widely used). The layers have been doped with boron on one side and phosphorous on the other side, producing surplus of electrons on one side and a deficit of electron on the other side. When the wafer is bombarded by sunlight, photons in the sunlight knock off some of excess electrons; this makes a voltage difference between the two sides as the excess electrons try to move to the deficit side. In silicon this voltage is 0.5 volt.
The main parts of a PV system are:

1. ➔The PV panel
2. ➔A storage battery
3. ➔wires to carry the electricity to and from the battery
4. ➔A controller to control the flow of electricity
5. ➔Appliances (such as lights) use electricity. Each part of the rainwater system does a similar job to a part in the PV system.

Photons in sunlight hit the solar panel and are absorbed by semiconducting materials, such as silicon. Electrons are excited from their current molecular/atomic orbital. Once excited an electron can either dissipate the energy as heat and return to its orbital or travel through the cell until it reaches an electrode. Current flows through the material to cancel the potential and this electricity is captured. The chemical bonds of the material are vital for this process to work, and usually silicon is used in two layers, one layer being doped with boron, the other phosphorus. These layers have different chemical electric charges and subsequently both drive and direct the current of electrons.

An array of solar cells converts solar energy into a usable amount of direct current (DC) electricity. An inverter can convert the DC power to alternating current (AC). The most commonly known solar cell is configured as a large-area p–n junction made from silicon. Other possible solar cell types are organic solar cells, dye sensitized solar cells, proves kite solar cells, quantum dot solar cells etc. The illuminate side of a solar cell has transparent conducting film for allowing light to enter into active material and to collect the generated charge carriers. Typically, films with high transmittance and high electrical conductance such as indium tin oxide, conducting polymers or conducting nano wire networks are used for the purpose.
The energy from the solar panels reaches to the load and then to the batteries through the charge controller and then to the inverter. It suffers attenuation in each process, whenever it passes through each component. We are going to discuss the effect on the energy, when it passes21through the above components. Let’s take the case of each component one by one:

Solar Panels (Conversion loss):-
The basic function of the solar panel is to convert the solar energy into the DC electrical energy. The certain fraction of the solar energy that is falling on the surface of the panel gets converted into the DC electrical energy and the remaining energy is either reflected back or gets dissipated as heat into the surroundings. In noontime and the clear sky, a solar panel of area 1m2, lying flat on the earth’s surface receives around 1,000 watts of solar power. It is able to convert a small percentage, say 15%, efficiency of solar panel of the solar power into electrical power. The remaining 85% of the energy is either reflected back or dissipated as heat into the surroundings. This, I call as the conversion loss of the energy. You can see that out of 1000 Watts of solar energy only 15% that is 150 watts gets converted into DC electrical energy. The solar charge controller protects the battery from getting overcharged.



Battery (Conversion loss):-
When you are not using energy from the solar panels to run your electrical appliances, the energy gets stored in the solar batteries in the form of chemical energy which later on can be utilized to run the appliances, when there is no sunlight or during night. The battery provides energy by converting the stored chemical energy into DC electrical energy and there occurs a loss in this conversion. If your battery is 85% efficient then it will convert 85% of its stored chemical energy into DC electrical energy.

Inverter (Conversion loss):-
The energy after getting converted into DC electrical energy by the solar panels is passed through the inverter. The basic function of the inverter is to converts a DC electrical energy into22 AC electrical energy. This is a conversion of energy from one form into the other. Suppose your inverter is 95% efficient, means that it is able to convert 95% of the input DC electrical energy into AC electrical energy. It will convert those 150 watts of DC electrical energy into 95% of 150 or 142.5 watts of AC electrical energy. Those 7.5 watts are lost as conversion loss into the system.

Wires (Transfer loss):-
The energy that we receive as the output and which runs our electrical appliances, needs a medium to travel from one point to the other point and this medium is provided through wires. The different components of the solar power system are connected through copper wires. When the energy travels through a wire, some of it gets lost as a heat into the surroundings. The longer is the distance between the solar panel and your electrical appliance, the more is the wastage of energy as heat. Therefore, one should try to keep minimum or optimum distance and the right sizing of the wires between the various components and the electrical load. If I say that the wire losses are 1% of the DC electrical energy, that is 1% of 150 watts or 1.5 watts are lost as heat. You can summarize the above explanation in two lines; there is conversion loss within the components and the transfer loss, through the wire running between the components.

Solar energy = AC electrical energy (usable energy) + conversion loss + Heat loss + energy So,

If I quantify it in number 1000 watts of solar energy = 141 watts of AC electrical energy (usable energy) + 859 watts are lost
Overall efficiency of the system is 141/1000 = 14.1 %

It means that you are only able to use around 14% of the solar electricity to run your electrical appliances. If you closely notice, then you can find that the major conversion loss occurs at the first stage when solar panel converts solar energy into DC electrical energy.

An increase in the efficiency of the solar panel can definitely boost the efficiency of your solar power system that will further enhance the feasibility of your solar system. In modern society, humans do not only require energy to keep their body running, but in fact we consume energy for many different purposes. We use energy for heating the water in our houses and for heating our houses. If water is heated, its thermal energy increases, and this energy must be supplied.

A room basic requirement is full fill with the following energy equipments. In study of a unconventional room with the solar power, there is some basic requirements:-

S.No	Name of Equipments	Rating
1	Solar Panel	20V,168.11 W
2	Battery	150 Ah, 12V
3	LED light	3 W,220AC
4	LED T.V	90 W, 220 V AC
5	Inverter	1100/12 V
6	Connection wire	6.1 mm2

7	Exhaust fan	50 W, 220 V AC
8	Wall fan	75 W, 220V AC
9	Switches	6 points

Led Light:-
No. of unit × rating of equipment
= 4×3 watts =12 watts-hours
28
Watts-hours rating
Connecting load × operating hours/ day
=12×6
= 72 watts-hours/ day

Exist Fan:-
No. of unit × rating of equipment
=1×50 watts =50 watts
Watts-hours rating
Connecting load × operating hours/ day
=50×8
=400 watts-hours/ day

Wall Fan:-
No. of unit × rating of equipment
=1×70 watts =70 watts
Watts-hours rating
Connecting load × operating hours/ day
=70×8
=560 watts-hours/ day

Computer:-
No. of unit × rating of equipment
=1×75 watts =75 watts
Watts-hours rating
Connecting load × operating hours/ day
=75×2
=150 watts-hours/ day

Led Tv:-
No. of unit × rating of equipment
=1×90 watts =90 watts
Watts-hours rating
Connecting load × operating hours/ day
=90×3
=270 watts-hours/ day

Other Ac Appliances:-
No. of unit × rating of equipment
=1×50 watts =50watts
Watts-hours rating
Connecting load × operating hours/ day
=50×2
=100 watts-hours/ day

Total watts-hours rating of the system
= Sum of the all connected watts-hours rating load
= 72+400+560+150+270+100 watts

= 1552 watts-hours /day

AC Appliances	AC Watts	Hours used / day	Watt Hrs/ day
LED	3 x 4	6	72
Exhaust fan	50	8	400
Wall fan	70	8	560
Computer	75		150
LED T.V	90	3	270
Other	50	2	100
			152 Wh/day

Total power (p) =V×I
Total panel =3 (1 panel=168.11)
Total power =3×168.11
=504.33 watt

Panel voltage =19.97 Volt
Panel current =8.14 Amp.
Max. Output power of panel =504.33×80% W/h (20% losses considerations)
=403.464 W/h

Battery estimation:-
Battery rating 150 Ah
Battery voltage = 12 Volt
Total power of battery = 12×150 W/h
=1800 W/h
Battery full charge time =1800/403.464
= 4.461 Hours
Charging current of battery
= charging current should be 1/10 of battery Ah
= 150/10
= 15Amp.

Consideration of losses wire connected between panel and inverter = 6mm2

Cost estimation of the system:-
Cost of solar panel
= Number of PV modules × Cost /module
= 3× 5499
31
= 16490 Rs
Cost of battery
= Number battery modules × Cost /module
= 1× 20500
= 20500 Rs
Cost of inverter
= Number inverter modules × Cost /module
= 1× 9995
= 9995 Rs
Cost of LED lights
= Number LED lights modules × Cost /module
= 4× 250
= 1000 Rs
Cost of LED TV (32 inch.)
= Number LED TV modules × Cost /module

= 1× 20000
= 20000 Rs
Cost of exist fan
= Number e-fan modules × Cost /module
= 1× 1200
= 1200 Rs

Cost of wall fan
= Number e-fan modules × Cost /module
= 1× 2300
= 2300 Rs
32

Total cost of system
= 16497+20500+9995+1000+20000+1200+2300
= 71492 Rs

Additional cost of wiring may be taken as 6% of total system
= 71492+4289052
= 75781.52
=76000 Rs

Result:-

This paper analysis the cost of solar panel and conversion cost of power for a home. There are the basic appliances which need in each home. There are several benefits of the solar energy which are using for the electricity.

1. This is an inexhaustible source of energy and the best.
2. Solar energy is environmental friendly.
3. Solar cells are use for variety of purpose to production solar energy.
4. In an energy deficient country like India, where power generation is costly, solar energy is best for power generation.

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