International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8 Issue-2, July 2019

Planing, Structure and Preparation of Cost Effective Sun Oriented Vitality Based Electrical Power Framework System at Alakh Prakash Goyal Shimla University, Himachal Pradesh

Vikas Sharma, Anand Mohan

Abstract: ***The vital reason behind this paper is to plan, structure and set up a perfect electric power age using feasible power source at Alakh Prakash Goyal Shimla University, Shimla. A daylight based crucial rate has been suggested that will cover the sun based power age cost, then again called the cost recovery program. Likewise one of the significant parts of this investigation is to diminish vitality utilization in Alakh Prakash Goyal Shimla University, Shimla; this paper endeavors to propose electrical power age with the utilization of sun powered vitality. The point was to show that sustainable power source can be a suitable elective hotspot for providing the required electrical power vitality. The photovoltaic power plant has a normal sun based radiation of 6.54 KWh/m^2 for most recent multi year. All out burden on college is around 200 KW and the college expends units between 40000 - 75000 units, bringing about a normal charging of INR.₹ 2.0 – 3.5 Lakhs bill. After establishment of Solar PV modules power bill has been lessen by INR.₹ 0.5-1.20 Lakhs.***

Keywords: Solar energy, Photovoltaic cells, Tilt angle, Electrical power generation, Module efficiency.

I. INTRODUCTION: ABOUT SOLAR PANEL:

A sun based board is really a gathering of photovoltaic cells, which are used to make control through photovoltaic effect.. This power is as radiation, the photon of light energize the electron

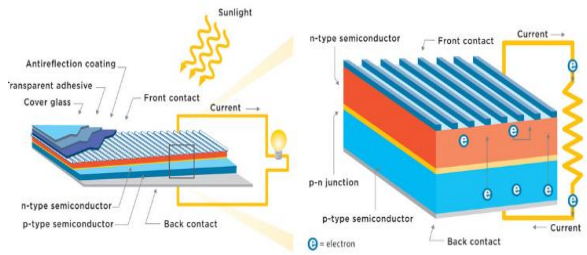

Fig.1. Different Layers in Photovoltaic cells

Cell of a sun oriented board cause to create power. Sun oriented boards are comprised of crystalline Silicon cells.

Revised Manuscript Received on 30 July 2019.
***** Correspondence Author

Er. Vikas Sharma*, Department of Electrical Engineering, under the School of Technology and Sciences at Alakh Prakash Goyal Shimla University, Shimla (INDIA).

Dr. Anand Mohan, Professor in the department of Electrical Engineering under the School of Technology and Sciences at Alakh Prakash Goyal Shimla University, Shimla (India).

Nowadays' sun powered boards are utilized in wide-going electronic gear resembles divider light, Lantern adding machines and Mobiles which function as long as daylight is accessible. As the enthusiasm for daylight based electric systems creates, dynamic producers are including sun fueled photovoltaic's (PV) as credibility for their customers.

This survey of sun based photovoltaic structures will give the maker a fundamental appreciation of [1].

a) Assessing a structure site for its sun situated potential.
b) Common system related photovoltaic structure courses of action and sections.
c) Considerations in picking parts.
d) Considerations in plan and foundation of a photovoltaic system.
e) Typical costs and the work required to present a photovoltaic structure.
f) Building and electric code essentials.
g) Where to find more information.

1.1. STEPS IN SOLAR CELL PRODUCTION:

a) Construction of Photovoltaic: The field of Photovoltaic producing power with sand and salt. Sun powered vitality is final product of complex substance and physical procedures. In first step crude Silicon is separated from quartz sand, to use in PV industry, it is 99.99% unadulterated. To produce control photovoltaic, enterprises uses the semi-conducting properties of Silicon, in ovens crude Silicon is liquefied at a temperature of above 1400°C, a seed crystal is then submerged into the fluid Silicon crude material and pulled reinforcement in all respects gradually. In this procedure fluid Silicon lay up on the seed crystal and hardened and is currently cut into a rectangular shape of millimeter thin slices. The individual cuts are called as wafers and structure the base of sun powered cell.

When they have been cut, and afterward put into wash tunnels, as littlest bit of biting dust can bargain sun oriented cell creation. Presently the wafer surface is level simply like a mirror, many beams of light is reflected back, so never again be utilized to produce power, to avert this reflection the surface is edged and roughened in chemical shower, bringing about pyramid structure with these pyramid structure light is mirrored on numerous occasions enabling approaching light to be utilized for all the more viably

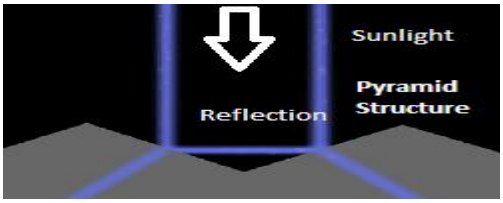

Fig.2. Pyramid Structure with Light Reflection

second step is diffusion; here a negative charged phosphorous layer is added to every wafer positively charged layer, in ovens warmed to fairly 900°C phosphorous atoms are infused with the assistance of nitrogen, a vaporous phosphorous-nitrogen blend is stored on the wafer. The interface among positive and negative charge layer the free charge bearers made by the light are discharged. This creates an electric flow.

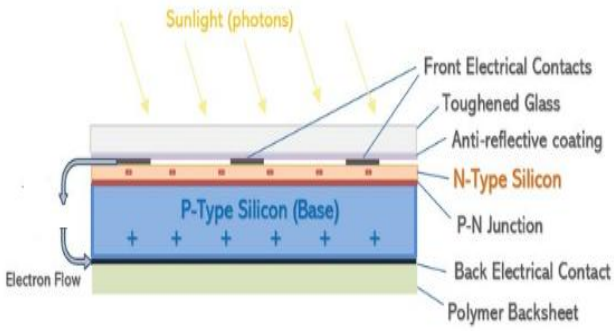

Figure.3. Diffusion Process in Silicon

Presently a stamp presses a Silver alloy onto the front of the cell this makes an average lattice design. This silver covering guarantees the power can be transported last on. The sun oriented cells are presently finished; they can create and transport control. In a procedure laminations cells are gathered behind a glass, subsequently they are shielded from the components for over 25 years. One module may contain 60 cells. At the point when various modules are associated with each other sun based power plant is made and control is created from the sun and the sand.

1.2. Working of Solar Cell:

One Hi-tech technique utilizes Solar cells to create power, when daylight strikes certain material to produces a little measure of electric flow through photovoltaic impact. The capacity of a sunlight based cell depends on the material called Silicon (Si). Silicon is the second most regular component in earths outside. In the periodic table of the elements, Silicon just underneath the carbon and guarantees numerous carbon highlights. The dot diagram as shown in fig.4 shows key highlights of Silicon.

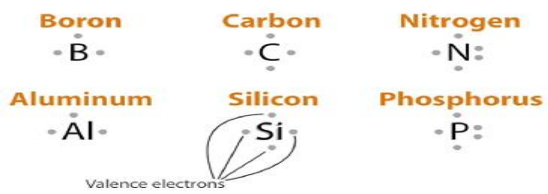

Fig.4. Dot Diagram of Silicon

Carbon and Silicon each have 4 valance electrons. By sharing valance electrons a Silicon particle can bond with four other Silicon molecules. Along these lines main atom basically gets four external shells of 8 electrons. As a result of a four external shell is an increasingly steady design, accordingly Silicon atoms joined to frame large Silicon precious crystals. Silicon crystals structure the bases of sun oriented cells.

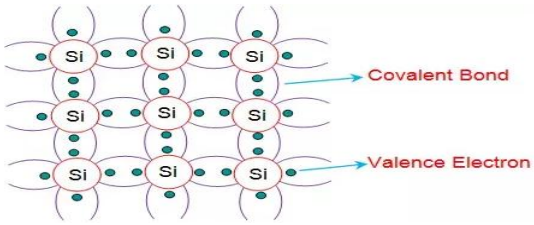

Fig.5. Silicon Crystal Structure

In the event that the voltage is connected to the precious crystal the free electrons and holes relocates inverse way in electric field to appositively charged poles. This may speak to a little current stream. Rather than Silicon, a genuine channel, for example, copper (Cu) has considerably more failure hold on its electrons and with the voltage connected an expansive current will course through the copper wire as appeared in figure underneath. As sun oriented cell has explicit contaminations resulting N-type and P-type side.

In P-type side: some Silicon particles are swap with Boron (B) atoms. Therefore seven as opposed to 8 electrons are shared among Boron around the Silicon molecules in courses of action that is unstable.

In N-type side: it contains Phosphorous instead of some Silicon molecules. In P-N intersection the additional electron from Phosphorous endeavor to fill openings in nearby Boron atoms, along these lines electrons stream from N side to P-side. As electron leaves the Phosphorus atoms it abandons an unbalance charged on the Phosphorous particle. As positive and negative charges are isolated from one another, the voltage or electric field creates at the intersection known as depletion zone.

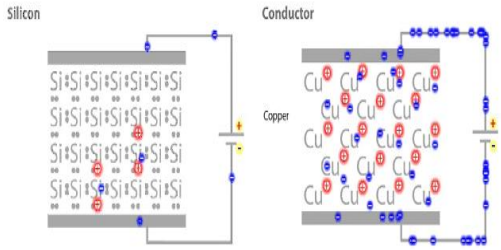

Fig.6. Flow of Current in Silicon Wafer and Copper Conductor

Presently think about a sun oriented cell is in a circuit with a load. At the point when photons of light strikes the crystals the vitality might be sufficient to thump the free electrons of the atoms, accordingly negative charged free electrons leaves positive charged openings in the gem. The free electrons endeavors to fill accessible gaps this may happen in couple of various ways.

- Electrons may essentially recombine with adjoining openings in the N-layer.
- Alternatively electron may endeavor to fill the numerous openings in the P-layer; anyway the bank of negative charges on the P side of exhaustion zone forestalls the contrarily charged electrons to going legitimately through it.

This is the focal element of a sunlight based cell.

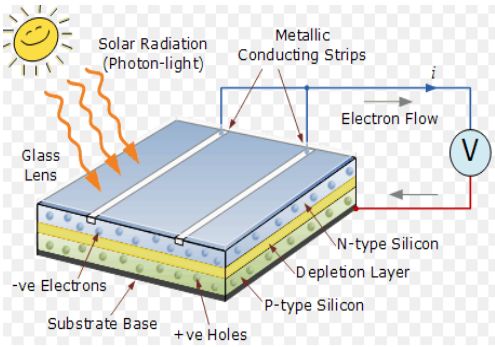

Fig.7. Flow of Electron through Connected Load

1.3. Daylight Based Photovoltaic Systems: Outline of cardinal Unit-

The difference in sun orchestrated scattering to useful electric power is a procedure of high concentrated all-round design. Photovoltaic modules are the focal point of the structure. This article will delineate the essential parts of a daylight based photovoltaic structure [2].

1.3.1. Photovoltaic Array: This is the focal point of the structure [3], made out of a couple of sun arranged modules which are accordingly made out of daylight based cells. Each sun controlled cell is an individual commission unit, which makes charge energy at whatever point it gets light. It is vital an observation that sunlight based photovoltaic modules produce charge energy in any light source. Crystal clear silicon Photovoltaic section makes larger part out of the photovoltaic wholesale. Utilizing substantial that is fit for giving a voltage yield in light of occasion light.

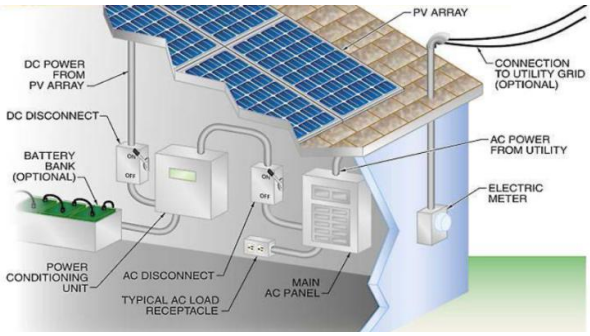

Fig.8. Different Components used in Photovoltaic System

1.3.2. Batter Bank:

Sun based PV structures hardly produce crucial energy now and again when it isn't needful. Like a bare house is right off production. In the event this occurs, the superfluous energy can be sold-out or set away in batteries. There are two essential clarifications behind using battery accumulating is expanding funds and battery reinforcement.

1.3.3. Potentiality work Out Unit: This bit of the system has three basic limits [4]:

a) Giving assurance against electric issues, for example, S.C. (short-circuits) or L-G (line-to-ground) imperfections. It is normally bored with warm appealing circuit breakers, which are open for D.C. (Direct Current), rotating current.
b) Joining energy supply generated by Photovoltaic unit and changing over an electrifying power supply that can integrate with the electric benefit or to control home appliances?
c) Controlling centrality information and yield of battery stock, by systems for a charge controller. On the off chance that the structure doesn't utilize batteries, this fragment is neglected.

1.3.4. D.C. and A.C. Disconnects:

Programmed and manual wellbeing separates shield the wiring and segments from power floods and other gear glitches [5]. They likewise guarantee the framework can be securely closed down and framework parts can be expelled for support and fix.

1.3.5. Main A.C. panel: This is the zone of each electric load in the structure are related, and guaranteed with circuit breakers. At the point when the yield from the Photovoltaic system has been changed over to A.C. force of the acceptable frequency.

1.3.6. Energy Meter: At the point when Photovoltaic frameworks are executed, the metering device must be modeled with final metering limits. That is, the meter ought to without a doubt check the vitality stream and its bearing. This permits the passed on energy to be subtracted from the ate-up energy when the home credit holder is charged by the electric organization affiliation

II. FACTORS BEHIND ASSESSING SOLAR PHOTOVOLTAIC POTENTIAL:

1.4. Assessing Structure Site: The proposed site found is at A P Goyal Shimla University, Mehli-Shoghi Bypass Road, District Shimla, Himachal Pradesh 171009, Latitude 31.0628° N and Longitude 77.1648° E, Shimla is a standout among the peerless global University in Shimla, Himachal Pradesh that endeavor distinctive Learner and Alum courses, like Bachelors and Masters courses and also in the field if Legal studies and Journalism.

The site is all around connected with road and airplane terminal. There is no wild life announced around there and this territory has no wellbeing dangers made due to sun based solar plant as it is eco inviting and very much associated with adjacent emergency clinics. There is no archeological and history of this spot.

Fig.9. Site of Alakh Prakash Goyal Shimla University

1.5. Mounting Location: Sun put together units are commonly mounted with respect to housetops.

If housetop zone isn't open, photovoltaic units can be shaft, ground and divider mounted or presented as a part of a dusk skeleton.

1.6. Overshadowing: photo floods exhibits an inimically impacted by shading. A well-organized Photovoltaic structure needs clear and unhindered access to the sun's shafts from around 09:00 to 15:00 hours reliably. Without a doubt, even little shadow would altogether be able to reduce the power yield of a sun based module even shading from the structure itself

1.7. Dome Types: For housetop mounted systems, ordinarily course of action shingles are least difficult to work with and slate and tile housetops are the trickiest. To present Photovoltaic modules on all housetop types, will require supplanting inside 8 -12 years, it should be displaced at the time the PV system is acquainted with evade the cost of removing and reinstalling the PV structure.

III. SOLAR POWER CALCULATIONS FOR ALAKH PRAKASH GOYAL UNIVERSITY:

A 4 Blocks, each 5 stories building has been selected in University. As University campus is spread in approx. 36 Bighas, out of which only the unused rooftops of building has been considered for installation of Solar system.

Table1. Solar panel Specifications

Module Type	ASP-7-320
Maximum Power (P_{max})	320 Watt
Open Circuit Volt. (V_{oc})	44.97 Volts
Short Circuit Curr. (I_{sc})	9.18 Amperes
Power voltage(Maximum) (V_{mp})	36.85 Volts
Power Current(Maximum) (I_{mp})	8.65 Amperes
System Voltage(Maximum)	1000 Volts
Maximum Resistance Fuse Rating	15 Amperes
Power Tolerance	0-4.99 Watt
Dimensions	1960×992×35
Weight	21.7 Kg
Class	Class A

1.8. Tilt Angle Calculation: Tilt: The Tilt edge of the photovoltaic (PV) exhibit is the way to an ideal vitality yield. Sun oriented boards or PV exhibits are most proficient, when they are opposite to the sun's beams.

So as to augment the board effectiveness, we need to change the tilt angle β, to get extreme radiation by altering the tilt angle in each autumn. In any case, because of the expanding cost and multifaceted nature have utilized a still tilt point to generate most vitality over the entire season utilized for ascertaining the tilt point is given by equations [6].

$\beta = 0.76 \times \phi + 3.1°$ …….Eqn.1

Where ϕ = Topographical latitude.

Shimla Topographical latitude, ϕ=31.10°.

So the ideal tilt edge of this area is $\beta = 0.76 \times 31.10 + 3.1° = 26.73° \approx 27°$

1.9. Distance between Row's Calculations:

Limit conditions for the establishment and execution of Photovoltaic modules is to decide right separation between consecutive arrays.

To evade exorbitant shadowing, the clusters must be dispersed separated by a separation 'D', in connection to the module width 'A' [7]:

$D/A = \cos\beta + \sin\beta/\tan\varepsilon$ …….Eqn.2

and, $\varepsilon = 90° - \delta - \phi$ …….Eqn.3

Where, ε = Dim angle, and δ = ecliptic angle [8].

As, δ = ecliptic angle = 23.5°

From eqn. (1), (2) and (3), ε = 35.4° and d/a = 1.52 m ≈ 5 feet.

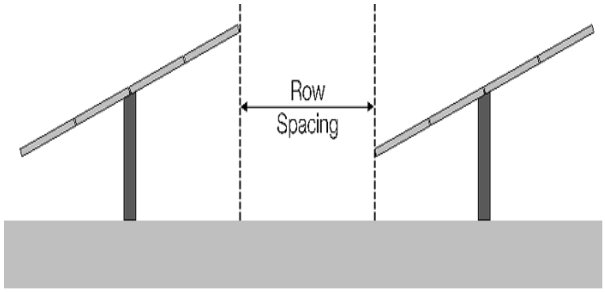

Fig.10. Row Spacing between Two Photovoltaic Modules

1.10. Determination of Module Efficiency:

So as to compute the array effectiveness, the accompanying recipe given beneath is utilized [7]:

$$\eta = \frac{Isc \times Voc}{Pin} \times FF \quad \text{…….Eqn.4}$$

$$FF = \frac{Imp \times Vmp}{Isc \times Voc} \quad \text{…….Eqn.5}$$

Where, η = Efficiency of Module,

I_{SC} = Current (Short Circuit)

V_{OC} = Voltage (Open Circuit)

FF = Fill factor,

V_{mp} = Operating voltage (Optimum),

I_{mp} = Operating current (Optimum),

P_{IN} = solar power (Input) [9].

For the above work, 320W monocrystalline module fabricated by Adani (Dimensions of the module: 1.960m × 0.992m ×0.035m) has been used. From specifications printed by manufacturer, we concluded that:

$P_{IN} = 1000\ W/m^2 \times$ Module area (m) …….Eqn.6

$= 1000 \times 1.960 \times .992 = 1944.32$ Watt.

FF = Fill factor = 0.7721 ≈ 0.77

η = .1634 ≈ 16.34 %

1.11. Output Power Calculations of Module:

The month to month normal yield control from a sunlight based module and the all out framework yield can be determined from the accompanying equations [6].

$P_{pv} = Y_{pv} \times f_{pv} \times (G_T / G_{T,STC})$ …….Eqn.7

Where, Y_{PV} = Evaluated limit of Photovoltaic cluster (which means its capacity yield under standard test conditions in kW)
f_{PV} = Framework (derating factor) = 0.8
G_T = radiation intent on array in the mean time (kW/m^2),
$G_{T,STC}$ = Intent radiation (S.T.P.= 1 kW/m^2).

Table 2. Monthly average Cosmic Energy Incident from Solar Array

Month	Average cosmic energy incident / (KW-Hr/m^2/day)	Average cosmic energy incident/KW/m^2	Blue print of O/P power from system (KW)
Jan-18	3.75	0.156	95.74
Feb-18	4.06	0.169	103.66
Mar-18	5.39	0.225	137.62
Apr-18	5.38	0.224	137.36
May-18	6.01	0.250	153.45
Jun-18	5.43	0.226	138.64
Jul-18	4.34	0.181	110.81
Aug-18	4.23	0.176	108.00
Sep-18	4.33	0.180	110.55
Oct-18	4.91	0.205	125.36
Nov-18	3.32	0.138	84.77
Dec-18	3.21	0.134	81.96
Jan-19	2.39	0.100	61.02
Feb-19	2.71	0.113	69.19
	Average	**0.177**	**108.44**

As the temperature coefficient of intensity is little, we determined the framework yield dismissing the impact of temperature.

Rated capacity of PV module = 320 W
Numbers of modules mounted = 352 panels

While considering an operating factor for system as 0.85, then [2]

Genuine power yield of a PV board = Peak control rating × operating factor ……. Eqn.8
= 320 × .85
= 272 W

Vitality created by one board in multi day = Genuine power yield of a PV board × 8 hours/day ……. Eqn.9
= 272 × 8
= 2176W ≈ 2.176 KW
Total solar energy produced by system = Vitality created by one board in multi day × no. of panels installed. ……. Eqn.10
= 2176 × 352
= 765952 W ≈ 765.95KW

Total watt-hours rating of the system = Total connected load (watts) × Operating hours ……. Eqn.11
= 200000 × 8
= 1600000 Wh

Number of sunlight based boards required to fulfill given evaluated every day load: = (Total watt-hour rating (daily load)/ (Vitality created by one board in multi day) ……. Eqn.12
= 1600000/2176
= 735 panels

Therefore, Y_{pv} = Rated capacity of PV arrays = 765.95KW
As, for the month of January, G_T = 0.156 KW/m^2 (From Table 2.)
Along these lines, to figure the normal yearly sunlight based generation, thinking about 8 hours of activity in multi day, however consequently aggregate of 2920 hours of activity in a year.
The average cosmic energy yielding/year = 108.44 × 2920 = 316644.8 KWh.

2. Load Analysis:

Total connected load in university is 200 KW; from the survey number of electrical equipments with their consumptions and month to month power bills for peculiar year is considered.

From the gathered information normal utilization in university is determined as:

Table3. Normal Energy Avail every Spell in University

Energy Consumed Month wise in the University						
Year	Month	Total energy consumed for whole university (KWh)	Tariff Rs/ KWh	Amount in Rs	Meter rent/ month (RS.)	Total Cost (RS.)
2018	Jan	74927	4.7	352156.9	150	352307
2018	Feb	69814	4.7	328125.8	150	328276
2018	Mar	55483	4.7	260770.1	150	260920
2018	Apr	53485	4.7	251379.5	150	251530
2018	May	40524	4.7	190462.8	150	190613
2018	Jun	42654	4.7	200473.8	150	200624
2018	Jul	41258	4.7	193912.6	150	194063
2018	Aug	40754	4.7	191543.8	150	191694
2018	Sep	44516	4.7	209225.2	150	209375
2018	Oct	47178	4.7	221736.6	150	221887
2018	Nov	51210	4.7	240687	150	240837
2018	Dec	54181	4.7	254650.7	150	254801

Number of units consumed (Average, 1 year) = 51332 units
Average expenditure = 51332 × 4.7 = Rs. 241260.
Total Average expenditure = 241260 + 150 = Rs. 241410.
After commencement of solar system reduced energy consumption has been observed in the month of January and February 2019.

Table4. Average Energy Consumed per Month after Installation of Solar system in University

Year	Month	Total energy consumed for whole university (KWh)	Tariff Rs./ KWh	Amount in Rs.	Meter rent/ month (Rs.)	Total Cost (Rs.)
2019	Jan	57208	4.7	268877.6	150	269028
2019	Feb	59210	4.7	278287	150	278437

3. 4. Cost Recovery Scheme:

4.1. Calculation of Cost- Capital Cost for installed Solar power system in University is calculated as:

4.2.

Table5. Capitalized Calculation of the Schemed Cosmic Energy

Sr. No.	Name of Item	Units	Unit Cost (Rs.)	Total Cost (Rs.)	Operation & Maintenance (%)	Operation & Maintenance Cost	Net total expenditure
1	Adani Solar PV Array	352	8543	3007136	2%	60143	3067279
2	Delta 30 KW Solar Inverter	4	140000	560000	2%	11200	571200
3	PV combiner Box	4	4900	19600	2%	392	19992
4	Fuse Box	4	1200	4800	2%	96	4896
				Average		**71831**	**3663367**

In the above table system running and operating cost has also been considered, the Operation & Maintenance cost of solar system varies between 1-3% [10-11] of Capitalized price/year over 20-25 years.

4.3. Cost Balancing:

Photovoltaic panels have an average life span of 20-25 years. Their esteem and wattage yield decline relentlessly after some time. So on average a solar system life span is considered here as 20 years.

Table6. Calculation of Per Unit Cost of Solar Electricity

Sr. no.	Findings	20 years of life span for solar system
1	Average annual depreciation value	Rs. 183168.35
2	Operation & Maintenance cost	Rs. 71831
3	O & M + Depreciation costs	Rs. 254999.35
4	Average Solar energy production/year	316644.8 KWh
5	Average Solar energy production/month	26387 units
6	Entity amount of Solar electricity = (O & M + Depreciation costs)/(Average Solar energy production/year)	Rs.0.80

4.4. Cost Benefits: The University consumes average of 51332 units per year from the utility. The latest tariff plan imposed on university by Electricity board is Rs 4.70/unit

Table7. Cost benefit analysis due to installed solar PV modules

Solar generation units (Average)	Solar generation @ Rs. 0.80	If purchased from Govt. @ Rs. 4.70	Net savings (Rs.)
26387	21109.65	124018.9	102909.25

If we compare it with previous electricity bills, then the finds are as follows:

Table8. Cost Benefit after Installation of Solar System

year	month	Total energy consum-ed by university (KWh)	Saved units	Tariff if not solar in Rs/KWh	Amount in Rs	Total Savings (Rs)
2018	Jan-Feb	144741	28323	4.70	680282	133118
2019	Jan-Feb	116418		4.70	547164	

IV. CONCLUSION

In this study Alakh Prakash Goyal Shimla University, Shimla is overviewed and normal power utilization for a year has been determined. Study has been done to evaluate the specialized and financial arability in university by methods for Photovoltaic control plant for gathering vitality request. For this a fresh project has been installed on the vacant rooftop to get new power connection for different utilities. Following conclusion can be made from study:

- It has been observed that this particular area gets an average of 6.54 KWh/m^2 of solar radiation and 8-9 hours of sunshine hours.
- Average solar energy production per year is 316644.8 KWh, and it resulted in avoiding tones of Co_2 emissions.
- It is observed from the tables, that net saving of Rs. 0.5 - 1.20 lack has been achieved every month.

REFERENCES

1. R. P. D. Carolyn. Ph.D., "Solar Electric System Design , Operation and Installation," no. October, p. 35, 2009.
2. S. P. V Systems, M. Components, and E. Efficiency, "Solar PV Systems: Overview of the Main Components - Wiki - Energy Efficiency," pp. 2–5, 2019
3. M. Aghaei, Y. H. Md Thayoob, M. Imamzai, P. Piyous, and N. Amin, "Design of a cost-efficient solar energy based electrical power generation system for a remote Island - Pulau Perhentian Besar in Malaysia," Proc. 2013 IEEE 7th Int. Power Eng. Optim. Conf. PEOCO 2013, no. June, pp. 203–208, 2013.
4. S. Kumarappa and H. Naganagouda, "Design and Development of 5MW Solar PV Grid Connected Power Plant Using PVsyst," Int. Res. J. Eng. Technol., pp. 778–785, 2017.
5. M. Chakravarthy, K. V. R. Murthy, and B. N. Devi, "Design, erection, testing and commissioning of 200Kwp rooftop grid tied solar photovoltaic system at Vasavi College of engineering," Proc. - 2015 IEEE IAS Jt. Ind. Commer. Power Syst. / Pet. Chem. Ind. Conf. ICPSPCIC 2015, pp. 146–152, 2017.
6. P. Roy, Y. Arafat, M. B. Upama, and A. Hoque, "Technical and financial aspects of solar PV system for city dwellers of Bangladesh where green energy installation is mandatory to get utility power supply," 2012 7th Int. Conf. Electr. Comput. Eng. ICECE 2012, pp. 916–919, 2012.

7. Adolf Goetzberger and Volker Hoffmann, Photovoltaic Solar Energy Generation, Springer-Verlag Berlin Germany, 2005
8. N. C. Bhowmik, Bangladesh Renewable Energy Report, APCTTUNESCAP,2011
9. (2011) Electro Solar Power Ltd. website on PV Module. [Online].http://www.emsbd.com/
10. Apr.20,2019)The Guardian website.
11. [Online].http://www.guardian.co.uk/environment/2011/jun/20/solar-panel-pricedrop/
12. (Apr. 22, 2019) The Investor's Words website.
13. [Online].http://www.investorwords.com/4181/replacement_cost.html/

AUTHORS PROFILE

Er. Vikas Sharma is perusing Post-Graduate (M.Tech, Power System, EE) course from the Department of Electrical Engineering, under the School of Technology and Sciences at Alakh Prakash Goyal Shimla University, Shimla (INDIA). He has got his B.Tech in the field of Electrical Engineering from Himachal Pradesh Technical University (HPTU), Hamirpur, India. Also got his Diploma in Electrical Engineering from Himachal Pradesh Takniki Shiksha Board (HPTSB) Dharamshala, Himachal Pradesh, India. He has one year experience in the field of maintenance in pharmacy sector.

Dr. Anand Mohan is currently working as Professor in the department of Electrical Engineering under the School of Technology and Sciences at Alakh Prakash Goyal Shimla University, Shimla (INDIA). He is also taking care of School of Technology and Sciences as Dean. He has more than 15 Years for academic, administrative and industrial experience in various renowned organizations of India. He has written more than 15 research manuscripts in International and National Journals and He has been the reviewer of many journals of repute in India as well as abroad. He has got his Ph. D in the field of Power System Engineering from University of Petroleum and Energy Studies, Dehradun, India.. Recently has been invited as Speaker in the International Conference on Machine Learning and Intelligent Systems (MLIS 2019) at National Dong Hwa University, Taiwan. He also speaking in the 6th Annual World Congress of InfoTech-2019, with the theme of "Launch a New Era of 5G and Global Future Network", that will be hold during May 10-12, 2019 at Nanjing, China. He was the Special invited member of Board of Studies of Electrical Engineering for HPTU, Hamirpur.