

# **Proposal for 1KWp Roof-Top Solar PV Plant**

# Jayanna Kanchikere<sup>1</sup>, K. Kalyankumar<sup>2</sup>

<sup>1</sup>Research Scholar, Vinayaka Mission Sikkim University, East Sikkim, INDIA <sup>2</sup>Former Vice-Chancellor, Vinayaka Mission Sikkim University, East Sikkim, INDIA

**Abstract** - Energy demand in Karnataka state is increasing, however the electric utilities failed to meet this load demand. Photovoltaic (PV) solar power plant is used for larger development of solar power generation. In a solar roof top system, the solar panels are installed on the roof of any residential, commercial, institution and industrial building. The solar roof top system may come up with storage facility using battery or grid connected. The roof top system with storage facility has a battery to store solar electricity and can be utilized during night when sunlight is not available. In this research paper, it is aimed at providing technical details of 1KWp with 1.5KVA off grid solar roof top power plant on turnkey solutions and Simulation analysis is carried out using PV Syst for Davangere city location and simulation results of energy output of PV module, energy supplied to the load and unused energy are presented

#### Key Words: Grid, Roof top system, solar photovoltaic panel, solar radiation, Energy.

# **1. INTRODUCTION**

Solar energy is a clean, pollution free renewable source of energy. Karnataka state being located between 11° 40' and 18° 27' North latitude and the geographical location favors the harvesting and development of solar energy. Karnataka state is having 300 sunny days with good solar radiation of 5.4 to 6.2 KWh / square-meter /day. Davangere city comes under Karnataka state in India which is 250KM from the Bangalore, the capital city of Karnataka state. The yearly average solar radiation on horizontal surface of Davangere city is 5.24 KWh/m<sup>2</sup>/day at latitude of 14.4384 °N and longitude of 75.956082 °E [6].

Electric utilities are finding it difficult to meet rise in peak demand and as a result, most of cities and towns are facing severe electricity shortages. Most of commercial establishments use one or more diesel generator for backup power. In order to utilize the existing roof space of buildings, the scheme proposes to promote rooftop solar PV systems on buildings to replace diesel generator sets.

# 2. OFF-GRID ROOF TOP SOLAR POWER PLANTS

Solar PV cells converts sunlight to generate electricity through a photovoltaic process. There are two types of solar PV systems: standalone and grid connected. Standalone solar PV systems work with batteries [5].

In off Grid rooftop solar power plant, the DC power generated from solar photovoltaic (SPV) panel is converted to AC power using inverter and is fed to the load through single phase lines and at the same DC power is stored in Battery during day time and loads are served by Battery back in night hours. A schematic sketch of a typical off grid solar rooftop photovoltaic power plant is shown in Fig1 [7].

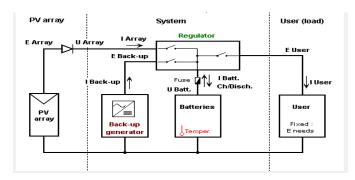


Fig1. A Schematic sketch of a typical 1KWP off Grid Solar **Roof Top Photo Voltaic Power Plant** 

#### **3. COMPONENTS OF SOLAR PV SYSTEM**

A Grid-connected solar PV system consists of following main components [1]:

#### A. Solar photovoltaic (PV) modules

Solar PV modules are mounted on the roof of buildings and convert sunlight into direct current. To achieve a required voltage and current, a group of PV modules are wired into large array called PV array.

#### B. Solar PV array support structure

These are galvanized steel structures secure the solar PV modules on the roof of building. The mounting structures require roof to be penetrated and mounting solar panels correctly is part of maximizing power generation

# C. Solar Off-grid inverter

Solar Off-grid inverter converts generated direct current into alternating current which is required for all electrical appliances through a charge controller. It also regulates battery charging if required

#### D. Balance of system

All other components considered for solar rooftop power plant are cables, junction boxes, fuses etc. The size of solar plant require depends on requirement of electrical load, number of KWh consumption

#### 4. REAL TIME SYSTEM DESIGN

The main target is to design and install 1KWP solar rooftop solar power plant [4].

#### A. Key facts of solar rooftop power plant

Plant capacity in Wp : 1KWp Rooftop Solar power plant PV Technology/Module: Poly crystalline modules Power conditioning unit: 1.5KVA Power evacuation : 230V AC, Single phase, 50HZ

#### B. Number of PV panels for the system

Capacity of each module: 250WP Number of PV panels or modules required = 04

Module area =  $7.5m^2$ 

Nominal PV Power = 1KWP Maximum PV Power = 1KWdc

Fixed Tilted plane = Tilt  $:30^{\circ}$ ; Azimuth  $:0^{\circ}$ 

The maximum power of this module is 1KWP; hence it requires 04 modules to design 1KWP PV system. The selected PV is manufactured by Alfa Solar Ltd.

The PV module parameters and ratings are given in Table 1[2].

Electrical Characteris	stics
Rated Maximum power (Pmax)	250Wp
Maximum power voltage (Vmp)	30.84 V
Maximum power current (Imp)	8.15A
Open circuit voltage (Voc)	37.26V
Short circuit current (Isc)	8.907A
Module efficiency	15.37%
Operating temperature	- 40°C to
	+85°C

The PV module specifications and dimensions are given in Table 2[2].

Table 2. PV module specifications and dimension

Specifications and Dimens	sions of PV module
Solar cells	Multi crystalline solar cells
Solar cell size	156 mmx156 mm(6 inx6 in)
Number of cells(pieces)	60 (6x10)
Module dimensions	1644 mm x994 mm x50 mm
Weight	18.8 kg
Front glass	3.2 mm tempered glass
Frame	Anodized aluminum alloy
Protection degree	IP 65
High efficiency	17.4%
Grid connection	OFF grid
No. of PV	04
modules/panels	

#### C. Solar off- Grid Inverter rating

For this system, solar off grid inverter designed is 1.5KVA. The inverter parameters are given in Table 3

Table 3	. Inverter	parameters	[3]	
---------	------------	------------	-----	--

Inverter specifications				
1-phase inverter chosen	1.5KVA off grid			
	inverter			
Maximum efficiency	90%			
Maximum ac output power	1000W			
Rated ac power	900W			
Rated ac off grid voltage	12V			

# D. Battery Back up

The battery maker is Electrona has following ratings.Each Battery rating: 150 AhTotal Number of batteries: 04Total Capacity: 600AhBattery Voltage: 15V

#### **E. Daily House Hold Consumptions**

#### The daily house consumptions are given in Fig.2

lumber	Power	Mean Daily use	Daily energy
6 Fluorescent lamps	14 W/lamp	5.0 h/day	420 Wh
1 TV / Magnetoscope / Pi	C 75 W/app.	3.0 h/day	225 Wh
3 Domestic appliances	60 W/app.	9.0 h/day	1620 Wh
1 Fridge / Deep-freeze		0.60 kWh/day	600 Wh
1 📑 Dish-washer, Cloth-washer		1.20 kWh/day	1200 Wh
Other uses	0 W tot	1.0 h/day	0 Wh
Stand-by consumers	0 W tot	24h/day	0 Wh
? Appliances info	urly distribution	Total daily energy Total monthly energy	4065 Wh/day 122.0 kWh/monti

Fig.2 The daily house consumptions



e-ISSN: 2395-0056 p-ISSN: 2395-0072

Total daily house hold energy needed = 4065Wh/day Total monthly house hold energy needed =122 KWh/month

#### 5. SIMULATION ANALYSIS RESULTS

For simulation purpose, the considered PV module capacity is 1KWP, 15V Si-Poly with array current of 56.1A from Alfa Solar. The Considered battery capacity is 600Ah, 12V with stored energy of 7.2KWh from Electrona. Due to non- availability of correct make, it is considered from other manufacturers with appropriate ratings. The global system configuration of the PV array is shown in Fig.3 [7]

Presizing help					
Av. daily needs : Ent	er accepted LOL 5.	<u>0</u> <u>+</u> %	?	Battery (user) voltage	12 ÷ V 🧃
4.1 kWh/day Ent	er requested autonomy 4.	- davísi	2	Suggested capacity	1500 Ah
	,			Suggested PV power	1.1 kWp (nom.)
Select battery set					
Sort Batteries by 🕟 vol	tage —— C capacity	,	- C manufacture	r	
12 V 150 Ah	Dural SC		Electrona		💿 🛛 👌 🖸
1 🕂 🔽 Batteries in	serie 🖵	Number of b	atteries <b>4</b>	Battery pack voltage	12 V
				Global capacity	600 Ah
H Batteries in	parallel ii			Stored energy	<b>7.2</b> kWh
Select module(s)					
Sort modules by: ( por	wer ——— 🔿 technolo	ogy ———	- C manufacture	er All modules	•
250 Wp 15V Si-poly	alfasolar 250 P		AlfaSolar	Photon Mag. 200	💽 🛛 <u>ष</u> 🖸 Den
1 ÷ ▼ Modules in :	serie			Array voltage at 50°C	16.0 V
4 🕂 🔽 Modules in p	parallel			Array current	56.1 A
4 Modules				Array nom. power (STC)	) <b>1.0</b> kWp

Fig.3 The global system configuration of the PV array

The mateo for Davangere, synthetic data is shown in Fig. 4[7]

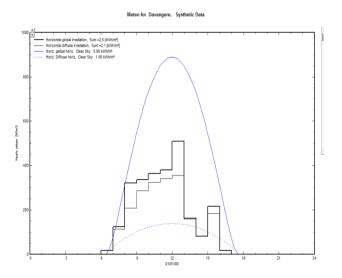


Fig.4 Mateo for Davangere city.

The simulation input and the main results of standalone 1KWP project are shown in Fig.5 [7]

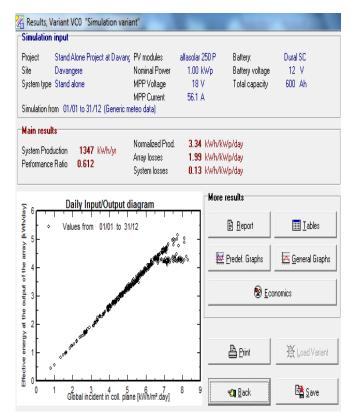


Fig.5 The simulation input and the main results of standalone 1KWP project

The standalone simulation parameters of 1KWP project are shown in Fig.6 [7]

PVSYST V4.37				15/05/17 Page
s	tand Alone System:	Simulation pa	arameters	
Project :	Stand Alone Project at Da	avangere		
Geographical Site	Davangen	•	Country	India
Situation Time defined as	Latitude Legal Time Albedo	14.5"N Time zone UT+5	Longitude Altitude	75.9*E 603 m
Meteo data : I	Davangere , synthetic hou	rly data		
Simulation variant :	Simulation variant			
	Simulation date	15/05/17 11h37		
Simulation parameters				
Collector Plane Orientation	Tit	30*	Azimuth	0-
PV Array Characteristics				
PV module SI-poly	Model Manufacturer	alfasolar 250 P		
Number of PV modules		1 modules	In parallel	4 strings
Total number of PV modules	Nb. modules		Unit Nom. Power	250 Wp
Array global power	Nominal (STC)		At operating cond.	
Array operating characteristics (50	PC) Umpp		1 mpp	56 A
Total area	Module area	7.5 m*		
PV Array loss factors				
	(800 W/m*, Tamb=20*C, wind 1 n		NOCT	
Wiring Ohmic Loss	Global array res.		Loss Fraction	
Serie Diode Loss	Voltage Drop	0.7 V	Loss Fraction	
Module Quality Loss Module Mismatch Losses			Loss Fraction	3.0 % 4.0 % (fixed voltage)
Incidence effect, ASHRAE paramet	trization IAM -	1-bo (1/cos I - 1)		
System Parameter	Purtow have	Stand Alone Syste		
Battery		Dural SC		
,	Manufacturer	Electrona		
Battery Pack Characteristics	Voltage		Nominal Capacity	600 Ah
	Nb. of units			
		Fixed (20°C)		
Regulator		General Purpose D		
Battery Management Thresholds		Undefined 13.7/13.1 V	Temp coeff. Discharging	-5.0 mV/*C/elem.
eavery management i nresholds	Back-Up Genset Command		Crecharging	11.0/12.0 V
User's needs :	Daily household consumers		ear	
	average	4.1 kWh/Day		
	_			

Fig.6 The standalone simulation parameters of 1KWP project

L

The standalone system details of user's needs of 1KWP project are shown in Fig.7 [7]

sameters System type Stand alone 20 Mon Sation S 20 P Prom 250 Wp No. of modules 20 P Prom total 1.06 KVp Model Dural SC Technology winted, labular No. of unit 2 VV05g/e / Capacity 11 V/ 466 An Dally household consumers Constant over the year global 1.65 KVm/year Annual values Namber Power Use Energy Annual values 1 angos 6 1 1 75 Wapp 3 hoasy 1220 Winday documers 1 60 Wapp 9 hoasy 1220 Winday e-prises 1 60 Wapp 9 hoasy 1220 Winday + / Cloth-waher 1 100 Winday 1200 Winday 1200 Winday	Project :         Stand Alone Project at Davangere imutation variant :           Simulation variant :         Simulation variant :           Sain system prevails :         Six 30° actinuin 0°           V Field Orsentation :         No           V Array :         No.01           Satery Pack :         No.01           Satery Pack :         No.01           Satery Pack :         No.01           Jeer's needs :         Daily nousehold consumers :           Daily nousehold consumers :         Contact over the year :           Jeer's needs :         Daily nousehold consumers :           Daily nousehold consumers :         Contact over the year :           Array :         Nummer :           Nummer :         Prover the year :           Satery :         Prover :           Nummer :         Prover the year :           Array :         Satery :           Nummer :         Prover the year :           No         <	VSYST V4.37					15/05/17 Page 3	
variant : Simulation variant arameters System by a standalone standalone both of model affective standalone No. of model affective standalone No. of model affective standalone Daily household consumers Constant over the year global 1.00 kVp Daily household consumers Constant over the year global 1.40 kVh/year bid consumers, Constant over the year global 1.40 kVh/year bid constant over the year global 1.40 kVh/ye	imulation variant : Simulation variant  Tain system parameters  Tain system parameters  Tain system parameters  To modules  System type  System type System type System type System type System type Sys		Stand Alone Sys	stem: I	Detailed User	s needs		
variant : Simulation variant arameters System by a standalone standalone both of model affective standalone No. of model affective standalone No. of model affective standalone Daily household consumers Constant over the year global 1.00 kVp Daily household consumers Constant over the year global 1.40 kVh/year bid consumers, Constant over the year global 1.40 kVh/year bid constant over the year global 1.40 kVh/ye	Number of the second		Otran di Aliana a Dana la					
sameters System type Stand alone 20 Mon Sation S 20 P Prom 250 Wp No. of modules 20 P Prom total 1.06 KVp Model Dural SC Technology winted, labular No. of unit 2 VV05g/e / Capacity 11 V/ 466 An Dally household consumers Constant over the year global 1.65 KVm/year Annual values Namber Power Use Energy Annual values 1 angos 6 1 1 75 Wapp 3 hoasy 1220 Winday documers 1 60 Wapp 9 hoasy 1220 Winday e-prises 1 60 Wapp 9 hoasy 1220 Winday + / Cloth-waher 1 100 Winday 1200 Winday 1200 Winday	Name         System type         Stand alone         Solution			vangere				
Satisfield         Soft associat 250 P         But much         Of associat 250 P         Percent 250 V(P)           No         All associat 250 P         Percent 250 V(P)         Percent 250 V(P)         Percent 250 V(P)           No         Model         Dural 50 V(P)         Percent 250 V(P)         Percent 250 V(P)           No         of associat 250 V(P)         Percent 250 V(P)         Verdet Abultar         Verdet Abultar           Daily household consumers         Constant over the year         global         142 / 600 An           Annual values         Annual values         Energy         430 V(N)           Isampsi /         61 V(N)         3 holay         225 V(N)           opsnances         3         60 W(app         9 holay         420 V(N)           ep-mese         1         00 V(N)         225 V(N)         40 V(N)	V Field Constration         118         30"         azinutin         0"           V Field Constration         118         30"         azinutin         0"           V modelies         Noodel affastalar 250 P         Pumonic         2010         Pumonic           Model         Unata Sci         Technology         Vental SC         Technology         Vental SC           attery Pack         Daily household consumers         Constant over the year         global         1.454 KWhyear           attery needs         Daily household consumers         Constant over the year         global         1.454 KWhyear           attery needs         Daily household consumers         Constant over the year         global         1.454 KWhyear           attery needs         Daily household consumers         Constant over the year         global         1.454 KWhyear           attery household consumers         Constant over the year         1.454 KWhyear         1.454 KWhyear           Tv: / Angerebooger / PC         1         1.454 KWhyear         1.252 Wholey           Domestic applicationes         3         60 Wapp         3.150 Wholey           Dish-waster / tobe-presee         1         1.20 Wholey         1.20 Wholey	Simulation variant :	Simulation varian	t				
Model         attasciar.250 P         Phom 125 Vipp           Nic. of modules         A         Phom 1081         1.08 KVp           Model         Dural SC         Target Phomology         vended Lobuster           Model         Dural SC         Target Phomology         vended Lobuster           Daily notewhold consumers         Constant over the year         global         1.464 KVh/vaar           XM consumers, Constant over the year         Power         Use         Energy           Lismps         6         1.4 VWanpo         5.hotay         2.420 Vincay           toscope /PC         1         7.8 Wapp         3.hotay         2.22 Vincay           opplaneces         3         60 Wapp         9.hotay         120 Vincay         500 Vincay           r / Coder-waher         1         120 Wincay         120 Wincay         120 Wincay         120 Wincay         120 Wincay         120 Wincay	V modules         Model         attaciolar 230 P         Phom         250 Wp           V modules         No. of modules         4         Phom total 100 KV/p         Model         Data SC         Technology         vender, booch           verser         Model         Data SC         Votage / Circlology         vender, booch         Votage / Circlology         vender, booch         Votage / Circlology         vender, booch         technology         vender, booch         technology         vender, booch         technology         technol	Main system parameters	Syn			animuth (		
No. of moules         Pennitolal         1.00 kV/pp           More         Dural SC         Technology         Technology           Daily household consumers         Constant over the year         global         4.84 kV/h/year           bid consumers, Constant over the year         global         1.64 kV/h/year         1.64 kV/h/year           bid consumers, Constant over the year         global         1.64 kV/h/year         1.64 kV/h/year           tid consumers, Constant over the year         A Invuole         Values         Energy           tiamps         Number         Power         Use         Energy           tiamps         1         16 Vintopp         5 hday         120 Vintopy           opinaces         1         60 Vintopy         500 Vintopy         500 Vintopy           reportaces         1         60 Vintopy         120 Vintopy         120 Vintopy         120 Vintopy	N Array No. of modiles 4 Phone total 100 kt/ps Barry Poc No. Mode Dural 8C Technology werket, boolas Barry Poc No. Part No. 100 kt/ps // Carly 8C Technology werket, boolas beer in each Daily household consumers constant over the year plant household consumers, Constant over the year Barry Pourse Constant over the year global 1484 kt/htyear Prover Use Energy Prover Use Energy Prover Use Energy Prover Consult and the second	PV modules						
Nb. of runts         4         Voltage / Capacity         12 V / 600 An           Daily notewhold consumers         Constant over the year         global         1484 k/Wyear           bid consumers, Constant over the year         at kW/M/day         Annual values           Mumber           Number         Power         Use         Energy           tamps         6         14 Witamp         5 h/day         420 Winday           tamps         6         14 Witamp         3 h/day         225 Winday           tamps         6         17 5 Witapp         3 h/day         225 Winday           obscope: /PC         1         75 Witapp         9 h/day         120 Winday         500 Winday           sp-frace         1         60 Witapp         9 h/day         120 Winday         140 Winday         120 Wi	Voitage / capacity         12 V / 600 An           Jaily household consumers         Constant over the year         global           Jaily household consumers         Constant over the year         global           Jaily household consumers         Constant over the year         global           Ally household consumers         Constant over the year         global           Ally household consumers         Constant over the year         global           Fluorescent lamps         Number         Power         Use           Privorescent lamps         6         14 Witamp         5 hotay           TV / Magnetoscope / PC         1         75 Wapp         3 hotay         120 Winday           Privage / Deep-freeze         3         60 Wapp         9 motay         120 Winday           Dish-washer / Lobe-washer         1         120 Winday         120 Winday         120 Winday	PV Array	Nb. of					
Daty household consumers         Constant over the year         global         1.484 KV/h/year           bid consumers, Constant over the year, average = 4.1 KV/h/day         KV/h/day         KV/h/day           bid consumers, Constant over the year, average = 4.1 KV/h/day         KV/h/day         KV/h/day           Konsult         Values         KV/h/day         KV/h/day           Konspe (PC)         6         14 Wintop         5 hday         20 Whiday           Songer (PC)         1         5 Wintop         5 hday         120 Whiday           ep/fraces         1         60 Wintop         9 hday         160 Whiday           ep/fraces         1         50 Wintop         100 Whiday         120 Whiday         120 Whiday	Iser's needs         Daily household consumers         Constant over the year         global         1484 kWhyear           ability household consumers, Constant over the year, werage = 4.1 kWhylas         Status         Status         Status           Annual Values           Number         Power         Use         Energy           YV, Magnebicoppi / PC         6         14 Wilamp         5 Notary         4 20 Whitary           Tomesita appliances         3         60 Wilapp         9 Notary         1 200 Whitary           Demesita appliances         3         60 Wilapp         9 Notary         1 200 Whitary           Disenvasent / tobe-veseer         1         60 Wilapp         1 200 Whitary         1 200 Whitary	Battery						
Not consumers, Constant over the year, average = 4.1 kWh/day           Annual values           Number         Power         Use         Energy           1 amps         6         1.4 Witamp         5 holay         420 Wholay           toscope /PC         1         75 Witapp         3 holay         222 Wholay           op/nexce         3         60 Witapp         9 holay         120 Wholay         600 Wholay           ep-freaze         1         500 Wholay         1200 Wholay         1200 Wholay         120 Wholay         120 Wholay         120 Wholay	Number Notice         Number         Power         Use         Energy           Fluorescent tamps         6         14 Witamp         5 hotay         420 Winday           TV / Magnetoscope / PC         1         75 Wagp         3 hotay         225 Winday           Priorescent tamps         6         6         00 Winday         100 Winday           Dimetito applicationes         3         60 Wagp         9 hotay         120 Winday           Priores / Deep-resee         1         60 Winday         120 Winday         120 Winday         120 Winday         120 Winday         120 Winday					Voltage / Capacity 1		
Annual values         Use         Energy           Istrope / Co         6         14 Million         3 Million         253 Million           particle / Co         6         14 Million         3 Million         253 Million           particle / Co         3         75 Million         3 Million         253 Million           particle / Co         3         60 Willion         9 Million         250 Willion           p-Messe         3         60 Willion         9 Million         200 Willion         200 Willion           r / Coldrwaher         1         120 Willion         120 Willion         120 Willion         20 Willion         20 Willion	Annual values           Number         Power         Use         Energy           TV / Magnebscope / PC         6         1 Wimmp         5 Notary         23 Winday           TV / Magnebscope / PC         6         1 Wimmp         5 Notary         23 Winday           Drinesits applicationes         3         60 Winap         60 Winap         160 Winay           Disn-asser / Lober-sece         1         600 Winay         120 Winay <td< td=""><td></td><td></td><td></td><td></td><td>r giocal 1</td><td>464 kwnyear</td></td<>					r giocal 1	464 kwnyear	
tamps 6 14 Witamp 5 hitay 420 Whitay descope /PC 1 75 Wapp 3 hitay 225 Whitay pplmaces 3 60 Wapp 9 hitay 1225 Whitay pplmace 1 600 Whitay 600 Whitay 1200 Whitay (r / cloth-washer 1 1200 Whitay 1200 Whitay	Plucrescent tamps         6         14 Witamp         5 Inday         420 Winkday           TV: / Magnetoscope / PC         1         75 Witapp         3 Inday         225 Winkday           Domestic applicationes         3         60 Witapp         9 Inday         1220 Winkday           Fridge / Deep-freeze         1         600 Winday         1000 Winday         1000 Winday           Dish-washer / 1         1         1200 Winday         1	Jaily nousenoid consumers, o	constant over the year,	-				
doscope /PC         1         75 Wilapp         3 http://dx         225 Wiltiagr           pplinaces         3         60 Wilapp         9 http://dx         600 Wilapp         600 Wilapp           ep-freeze         1         600 Wilapp         600 Wilapp         600 Wilapp         600 Wilapp	TV / Magnetoscope / PC         1         75 Wagp         3 Nday         225 Whitay           Domestic applinances         3         60 Wapp         9 Nday         1620 Whitay           Pridge / Deep-freeze         1         600 Whitay         1600 Whitay         1200 Whitay           Dish-washer / LiobH-washer         1         1200 Whitay         1200 Whitay         1200 Whitay			Number	Power	Use	Energy	
doscope /PC         1         75 Wapp         3 http://dx         22 Windby           pplances         3         60 Wapp         9 http://dx         600 Windby         600 Windby           ep-freeze         1         600 Windby         600 Windby         600 Windby         600 Windby	TV / Magnetoscope / PC         1         75 Wapp         3 noary         225 Windary           Domestic applinances         3         60 Wapp         9 noary         1250 Windary           Pridge / Deep-freeze         1         600 Windary         600 Windary         1200 Windary           Dish-washer / Citobr-washer         1         1200 Windary         1200 Windary         1200 Windary	Fluorescent lamps		6	14 W/lamp	5 h/day	420 Wh/day	
ppllances         3         60 Wrapp         9 hday         1620 Whday         1620 Whday         600 Whiday         600 Whiday         600 Whiday         600 Whiday         600 Whiday         1200 Whiday         120 Whiday <td>Domestio appliances         3         60 W/app         9 Inday         1620 Winday           Pridge / Deep-freeze         1         500 Winday         600 Winday         1620 Winday           Dish-washer         1         1200 Winday         1200 Winday         1200 Winday         1200 Winday</td> <td></td> <td></td> <td>1</td> <td></td> <td></td> <td></td>	Domestio appliances         3         60 W/app         9 Inday         1620 Winday           Pridge / Deep-freeze         1         500 Winday         600 Winday         1620 Winday           Dish-washer         1         1200 Winday         1200 Winday         1200 Winday         1200 Winday			1				
r / Cloth-washer 1 1200 Wh/day 1200 Wh/day	Dish-washer / Cloth-washer 1 1200 Wh/day 1200 Wh/day			3		9 h/day	1620 Wh/day	
		Fridge / Deep-freeze		1		600 Wh/day	600 Wh/day	
adds vilveay	Total cally energy 4005 VM caly	Dish-washer / Cloth-washer		1		1200 Wh/day	1200 Wh/day	
		Total daily energy					4065 Whiday	
						1200 Villoay		

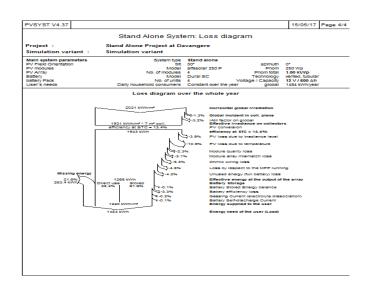


Fig.9 The standalone system loss diagram over the whole year of 1KWP project

The standalone system energy output of array of 1KWP project are shown in Table 4[7]

Simulation variant Energy Use								
	EArray	E Load	E User	SolFrac	T LOL	Pr LOL		
	k₩h	k₩h	kWh		Hour	%		
January	125.0	126.0	120.0	0.952	34	4.6		
February	118.4	113.8	113.7	0.999	0	0.0		
March	126.0	126.0	120.7	0.958	30	4.0		
April	117.4	122.0	115.4	0.946	38	5.3		
May	105.6	126.0	106.0	0.841	116	15.6		
June	88.3	122.0	85.7	0.703	213	29.5		
July	87.8	126.0	78.2	0.620	280	37.7		
August	96.5	126.0	95.3	0.756	179	24.1		
September	102.3	122.0	98.3	0.806	138	19.2		
October	103.7	126.0	102.3	0.812	139	18.7		
November	92.9	122.0	89.0	0.730	193	26.9		
December	102.5	126.0	95.8	0.761	176	23.6		
Year	1266.4	1483.7	1220.4	0.822	1538	17.6		

Table 4. The standalone system energy output of array of 1KWP project

The Global irradiation and array energy output and unused energy/day are shown in Fig.10 [7]

# Fig.7 The standalone system details of user's needs of 1KWP project

The standalone system main results of 1KWP project are shown in Fig.8 [7]

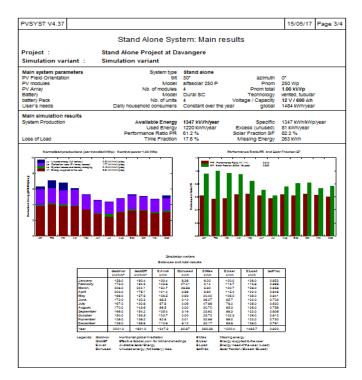


Fig.8 The standalone system main results of 1KWP project

The standalone system loss diagram over the whole year of 1KWP project are shown in Fig.9 [7]



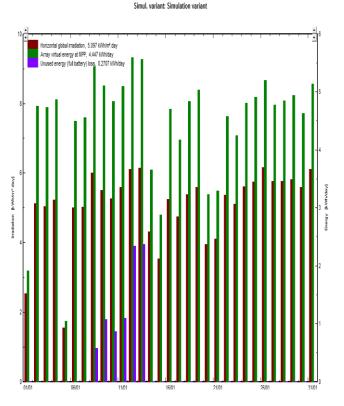


Fig.10 The Global irradiation and array energy output and unused energy/day

The balances and main Simulation results of 1KWP Project are given in Table 5[7]. Simulation variant

	GlobHor	GlobEff	E Avail	EUnused	E Miss	E User	E Load	SolFrac
	k₩h/m²	k₩h/m²	kWh	kWh	k₩h	k₩h	k₩h	
January	158.0	190.4	133.4	8.39	6.00	120.0	126.0	0.952
February	173.0	194.3	145.8	27.41	0.14	113.7	113.8	0.999
March	208.0	204.1	154.7	28.66	5.30	120.7	126.0	0.958
April	203.0	176.1	121.4	3.99	6.60	115.4	122.0	0.946
May	199.0	157.6	106.5	0.93	20.02	106.0	126.0	0.841
June	172.0	132.3	88.5	0.12	36.27	85.7	122.0	0.703
July	167.0	130.8	87.8	0.06	47.86	78.2	126.0	0.620
August	170.0	143.6	96.5	0.00	30.70	95.3	126.0	0.756
September	166.0	154.2	105.4	3.16	23.62	98.3	122.0	0.806
October	150.0	153.5	103.7	0.00	23.72	102.3	126.0	0.812
November	126.0	138.2	92.9	0.01	32.96	89.0	122.0	0.730
December	129.0	155.9	110.6	8.12	30.17	95.8	126.0	0.761
Year	2021.0	1931.0	1347.3	80.87	263.36	1220.4	1483.7	0.822

Balances and main results

Table 5 The balances and main Simulation results of 1KWP Project

# **6. CONCLUSIONS**

The research paper aimed providing technical details of 1KWp with 1.5KVA off grid solar roof top power plant on turnkey solutions and Simulation analysis is carried out using PV Syst at Davangere city location. From the simulation results, the horizontal global irradiation is

5.097 Kwh/m<sup>2</sup>.day in different months in a year and the available energy at inverter output is 4.447 Kwh /day and energy demand is 4.065 KWh/month. In Jan-March, the PV module output is more than the load demand so we get excess energy in these months and in remaining months PV module output is equal to or slightly more than the demand. The energy demand is 120.7KWh/month in March month while energy output of PV module is 154.7 KWh/month and excess energy is 28.6 KWh / month and energy loss is 5.30KWh/month. The simulation results of energy output of PV module are presented. These outputs of PV module vary with respect to irradiation. The future growth can be enhanced to larger scale PV modules

#### REFERENCES

- [1] Jayanna Kanchikere and K KalyanKumar, "Estimation of cost analysis for 5KW grid connected solar roof top power plant: A case study", International Journal of engineering science and computing, vol 6, Issue 4, PP. 4505-4507, Apr 2016.
- [2] Jayanna Kanchikere, kotresh K and K KalyanKumar, "A 5KW photovoltaic solar roof top power plant design : An analysis", International Journal of engineering science and computing, vol 6, Issue 4, PP. 4501-4504, Apr 2016
- [3] Vinay Janardhan shetty and Keerti Kulkarni, "Estimation of cost analysis for 500KW grid connected solar photovoltaic plan: A case study", International Journal of current engineering and technology, vol 4, PP. 1859-1861, No.3, June 2014.
- [4] Hemakshi Bhoye, Gaurang and Sharma, " An analysis of one MW photovoltaic solar power plantdesign", International Journal of Advanced research in Electronics and Electrical, Instrumentation Engineering, vol 3, Issue 1, PP 6969-6973, Jan 2014.
- [5] Radhey S M, Jeetendra Singh Rathore and Shivani J, "Grid connected roof top solar power generation: A review", International Journal of Engineering development and research, vol 3, Issue 1, PP.325-330,2014.
- [6] https://eosweb.larc.nasa.gov/sse.
- [7] www.pvsyst.com