

# Study of different parameters affecting the utilization efficiency and light conversion of 20kW P-V solar system

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**Abstract:** Present research paper reports the different factor affecting the utilization efficiency and light conversion efficiency of 20 kW P-V on grid roof top solar system. There are few factors which affect the efficiency of solar cell these are climate change dust particles temperature and solar flux out of these dust particles affects more. Two months data has been summarized and analyzed by comparing different parameters. The maximum value of solar flux in December 2018 is 470w/m<sup>2</sup> which has been increased to 606w/m<sup>2</sup> in January 2019. Increase in the solar flux increases the utilization efficiency from 27.15% to 28.24%. This change is very small because of the weather and dust particles that reduce electricity power generation of the solar system. It has been observed that light conversion efficiency in December 2018 is about 10.5% which has decreased to 8.0% in January due to dust particles. Average 40 units (kWh) electricity is generated per day in December 2018, which has decreased to 32 units in January 2019.

## Introduction

Energy demand of India is increasing at very high rate at present due to the high population growth, industrial growth, domestic need, agriculture need. Non renewable sources like coal, oil natural gas will extinct in few years. Solar P-V systems are very good alternative to these sources. Now a day's demand of solar system is increasing every day. But there few factors that affect the working of solar system like climate change, dust partials, temperature and solar flux Haribhai V. Desai College, Pune has installed 20kW roof top Photo voltaic solar system. This P-V solar system is fulfilling the need of electricity of institute. In the present work, the factors affecting the output response and that of the light conversion efficiency and utilization efficiency of 20 kW solar system has been studied. Some parameters such as temperature, solar flux, and generation has been measured for two months and analyzed.

## Experimental Details

20kW roof top on grid photo-voltaic solar system project was installed on the terrace of main building of Haribhai V. Desai College, Pune. The project was installed by Datum Energy Systems Privet Limited, Pune. The project is partially funded by the Savitribai Phule Pune University. This solar project was designed and installed to provide the electricity power needed for the different laboratories of the institute. The project consists of 63 solar cell modules together. Each module has area 119.77m<sup>2</sup> with generation capacity of 320 W. Solar cell modules are made from silicon materials. Light conversion efficiency and utilization efficiency are calculated from the output of the system. The input solar flux is measured using the sun meter.

Table 1 and 2 shows the measured solar flux, generation of electricity power, utilization efficiency and light conversion efficiency of 20kW solar project for typical day in December 2018 and January 2019

Figure 1 shows the 20kW rooftop on grid photovoltaic solar project of Haribhai V. Desai College, Pune.

Figure 2 shows the variation of solar flux in watt per square meter for the typical day during December 2018 and January 2019 with local time.

Figure 3 shows the utilization efficiency of solar project with local time for typical day in December 2018 and January 2019

Figure 4 shows light conversion efficiency of the solar project for typical day in December 2018 and January 2019

Figure 5 and 6 shows output response of light conversion by solar system in December 2018.and January 2019

Table 1: Different measured parameters and efficiency of 20kW P-V solar system December 2018

Local Time	Temperature (°C)	Solar intensity (W/m <sup>2</sup> )	Electricity Generation ( Watt )	System efficiency (%)	utilization efficiency (%)
9:30	28	180	2689	12.47298062	13.445
9:45	32	213	3064	12.01050056	15.32
10:00	32	248	3313	11.15377053	16.565
10:15	28	269	3560	11.04967917	17.8
10:30	34	307	3562	9.687405747	17.81
10:45	34	333	4266	10.69617668	21.33
11:00	32	362	4532	10.45281541	22.66
11:15	34	386	4756	10.28742049	23.78
11:30	34	403	4671	9.677357201	23.355
11:45	32	413	4955	10.01718184	24.775
12:00	32	413	4844	9.792780796	24.22
12:15	36	459	5425	9.868224191	27.125
12:30	36	458	5409	9.860602545	27.045
12:45	36	470	5409	9.60884248	27.045
13:00	34	453	5399	9.951008012	26.995
13:15	34	453	5306	9.779597798	26.53
13:30	36	407	5053	10.36589581	25.265
13:45	36	362	4728	10.90487892	23.64
14:00	34	376	4610	10.23681915	23.05
14:15	37	343	4778	11.63064971	23.89
14:30	30	311	4138	11.10918113	20.69
14:45	32	342	3808	9.296570864	19.04
15:00	32	244	3500	11.97650688	17.5

**Table 2: Different measured parameters and efficiency of 20kW P-V solar system in January 2019**

Local time	Temperature (°C)	Solar intensity (W/m <sup>2</sup> )	Electricity Generation ( Watt )	System efficiency (%)	utilization efficiency (%)
9:30	25	275	3359	10.19833469	16.795
9:45	26	296	3435	9.689179035	17.175
10:00	28	321	3495	9.090632435	17.475
10:15	28	390	3974	8.507759531	19.87
10:30	28	421	4122	8.174813285	20.61
10:45	28	411	4047	8.221353702	20.235
11:00	30	480	4684	8.147560602	23.42
11:15	31	493	4884	8.271431671	24.42
11:30	33	539	5069	7.852093755	25.345
11:45	32	563	5233	7.760581968	26.165
12:00	32	577	5348	7.738691533	26.74
12:15	32	606	5648	7.781691587	28.24
12:30	33	572	5508	8.039885305	27.54
12:45	32	606	5626	7.751380465	28.13
13:00	34	601	5576	7.746405791	27.88
13:15	34	590	5581	7.897906015	27.905
13:30	33	558	5258	7.867528653	26.29
13:45	32	530	5237	8.250089401	26.185
14:00	32	512	4997	8.148756471	24.985
14:15	32	472	4653	8.230818108	23.265
14:30	30	574	4884	7.104208735	24.42
14:45	30	492	4278	7.259849671	21.39
15:00	31	490	3923	6.684580821	19.615

**Figure 1: 20kW rooftop on grid photovoltaic solar system installed at Haribhai V. Desai College, Pune.**

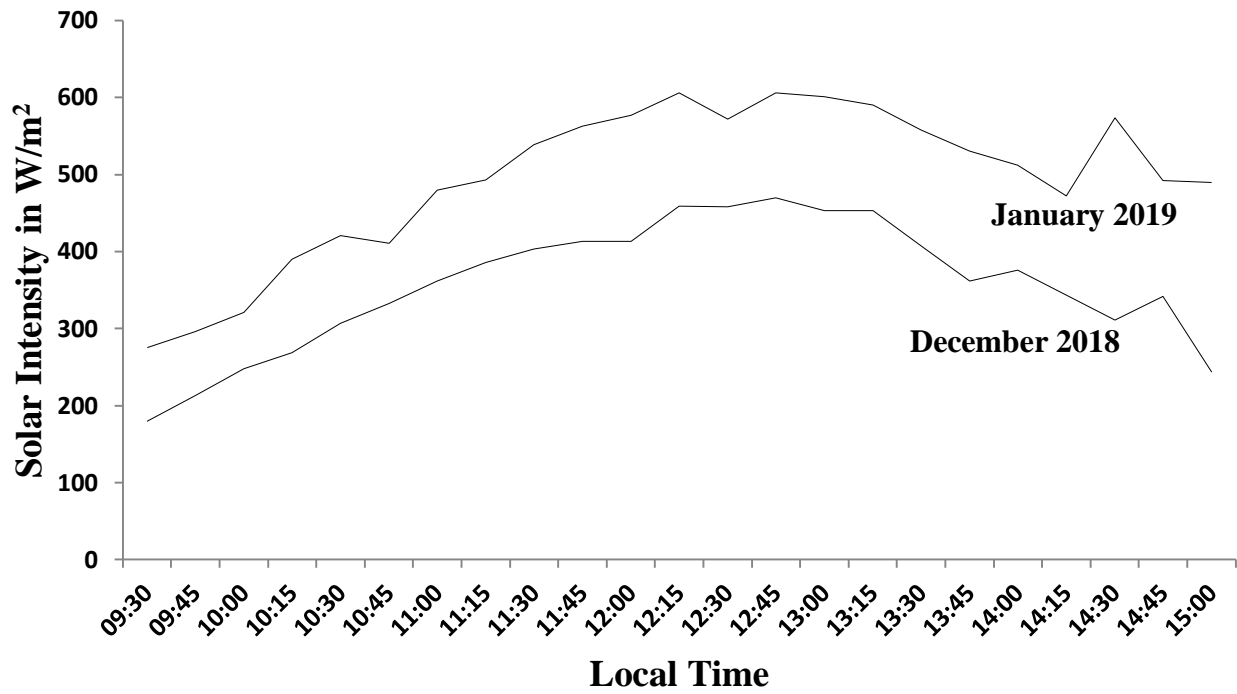


Figure 2: Variation of solar intensity with local time during December 2018 and January 2019.

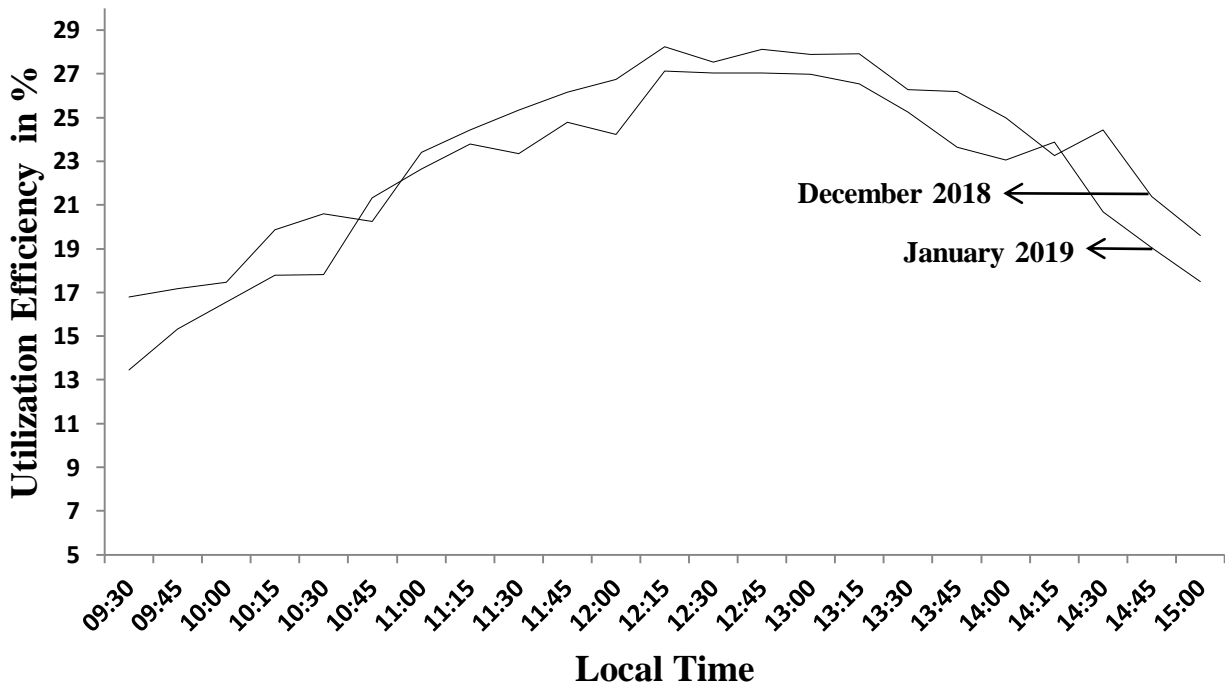


Figure 3: Variation of Utilization efficiency of 20kW P-V solar system with local time during December 2018 and January 2019

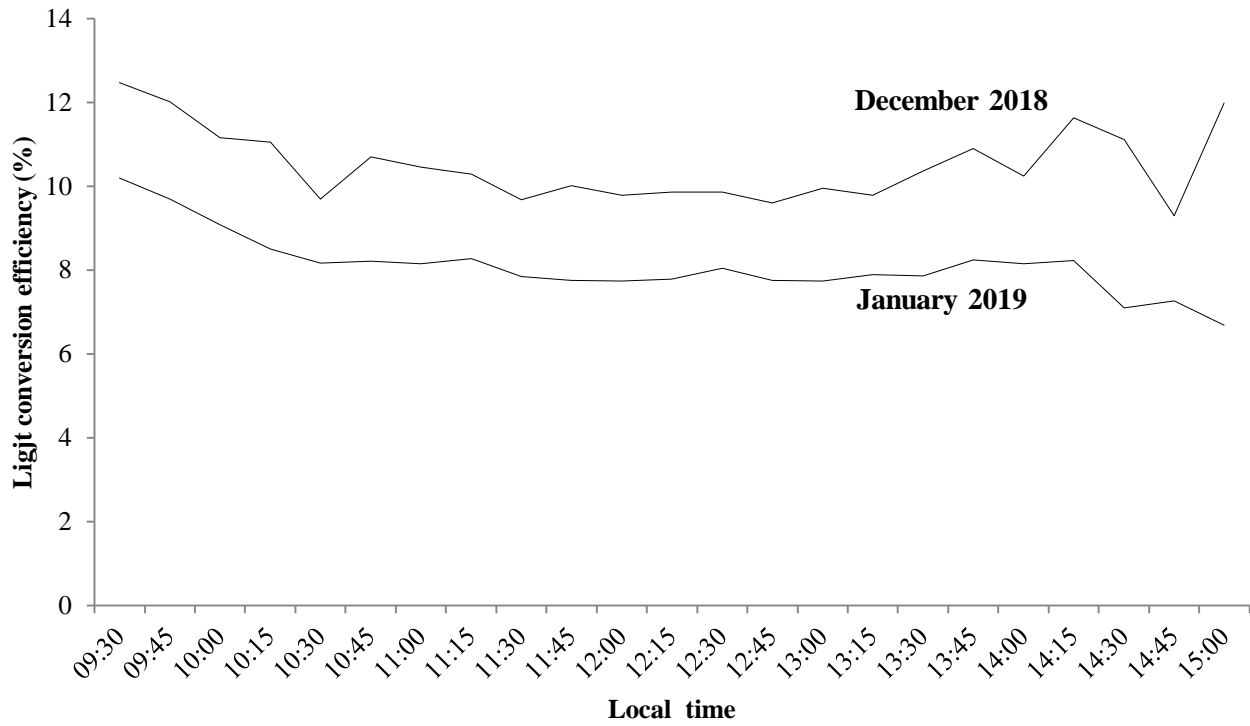


Figure 4: Variation of light conversion efficiency of 20kW P-V solar system during December 2018 and January 2019

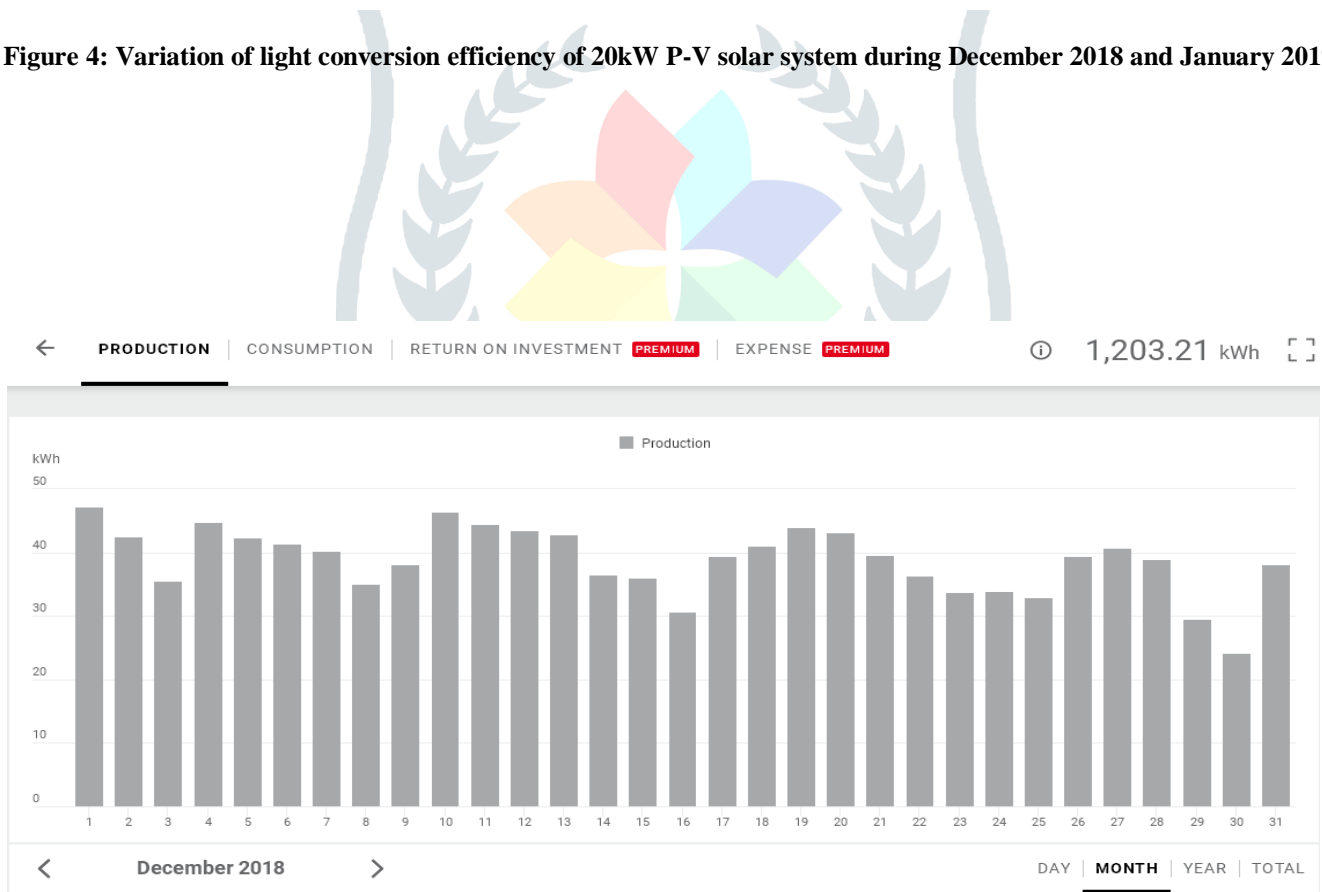
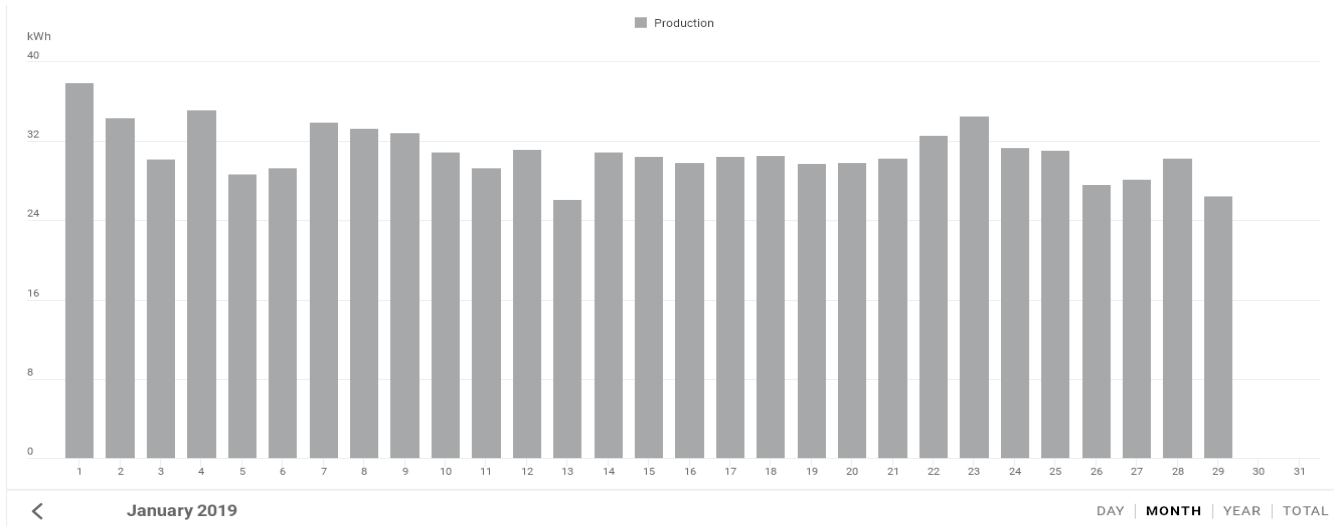


Figure 5: Output response of 20kW solar system in December 2018



**Figure 6: Output response of 20kW solar system in January 2019**

### Results and conclusions

The results shown in fig 2 shows maximum value of solar flux in December 2018 is  $470\text{w/m}^2$  which has been increased to  $606\text{w/m}^2$  in January 2019. Figure 3 shows the utilization efficiency in December 2018 is 27.15% increases to 28.24% in January 2019. This change is very small because weather and dust particles reduce electricity power generation of the solar system. It has been observed that dust particles affect more on the light conversion efficiency of solar system. In December 2018 it is about 10.5% which has decreased to 8.0% in January due to dust particles. Average generation per day in December 2018 is 40 units (kWh), which has decreased to 30 units in January 2019. These all results shows that dust particles affects more on the generation of electricity power of solar system. This indicates cleaning of solar panel is necessary once in a month.

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