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An efficient of estimation the load profile analysis of photo voltaic system with different shading of local city

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ABSTRACT

In this paper, we analysis the last technology of photovoltaic (PV) system and the main effective factors of operation in unique efficiency and optimize performance. the first of all we take the general view of physical aspects of sun light and motion of earth with respect of sun position, and analysis of light spectrum and its effect for each regen from spectrum on PV. We illustrated the results of variation of irradiance from deferent sites and show size system for same energy demand. We start by analysis of load-by-load profile working and go through to specify the economic azimuth degree and altitude degree depend on load profile and final put some technical suggestions to minimize the effect of shading and benefit from using a new technology by face shield (half cut cell). These calculations are proposed to make available well originated and equivalent important information so as to allow PV strategies to change quicker obsessed by arenas of application with different shading of local city in AL-Mausaib Babylon, Iraq. The ratios of shading conditions (10%, 25%, 50%, 75%) and without shading were used as effectiveness restrictions. The outcomes confirmation that the performance of PV system is extensively reduced and the system can't control the batteries, if the shading close 75% or additional for single panel.

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1. INTRODUCTION

Photovoltaic (PV) energy amounts are surrounded by the maximum mature renewable energies at present available. On the other hand, two problems continue in the technique of its huge utilization all over the world: efficiency and obscurities [1]. Effectiveness is the difficult of exactly how to create PV sections transform more light into electricity, despite the fact that shadows is the badly-behaved of how to take full advantage of their introduction to light once positioned.

By filtering the light that sheens over a PV, shadows decrease its obtainable existing [1]. This outcome is improved as soon as only share of the PV is shaded, affecting modifications among cells associated in sequences, making hot spots, and possibly destructive the PV [2]. This be able to be diminished by the use of BPD, on the other hand these reason additional difficulties. BPD do not resolve the problematic of irregular current construction between the sunny and unshaded PV [3], [4]. A number of scientists have calculated methods to replace BPDs and stability the current fabrication, leading to a prosperity of information and resolutions presently available in [4]. In this paper we will gone to take several mothed and soft wear to optimize the max power point with respect to load profile analysis and design shaded - fault detector circuit.

A prototypical is applied to designate the power produced by the PV panels PPV, which be influenced by fundamentally on the measured radiation (G) & (T_a) [5]. The classical system agrees to the generated current Ipv to be achieved in (1) and (5). At that moment, the value PPV is achieved by increasing the (V with I) [5], [6].

$$I_{pv} = n_p\left(I_{ph} - I_r\left(exp\left(\frac{V_c+I_{PV}R_s}{V_t-T_a}\right) - 1\right)\right) \tag{1}$$

$$I_{ph} = \frac{G}{G_0}I_{sc} \tag{2}$$

$$I_{sc} = I_{sc} - T_{ref}\left(1 + \left(a\left(T_a - T_{ref}\right)\right)\right) \tag{3}$$

$$I_r = I_r - T_{ref}\left(\frac{T_a}{T_{ref}}\right)^{\frac{3}{n}} e^{\left(\frac{-qVg}{nk}\left(\frac{1}{I_a}-\frac{1}{I_{ref}}\right)\right)} \tag{4}$$

$$I_r - T_{ref} = \frac{I_{sc}-T_{ref}}{\frac{qV_c}{e^{nkT_{ref}}_{-1}}} \tag{5}$$

- I_{pv}: the assessed PV current (A)
- I_{ph}: the generated photo-current at an agreed irradiance G (A)
- I_{sc}: the short circuit current for an assumed temperature T_a (A)
- I_r: the reverse saturation I for a given temperature T_a (A)
- I_r-T_{ref}: the reverse saturation current for the reference temperature T_{ref} (A), Then, the system is used to track the maximum power point (MPP) & MPPT.

The system is designed and analyzed PV, we have taken characteristic of light come from sun and effects the first effect is spectrum of beam light consist the three regen (UV) which have short long wave it mean cause of degradation in silicon and plastic material, (visible) light which it the useful band to generate electric by PV panel it have medium long wave, and third one is (IR) which have longest long wave the [5] mean effect of (IR) is heat this effect not usefully for traditional (PV) panel because increase in temperature let to descries in efficiency as Figure 1.

Show classification for PV schemes with extra purpose in the resulting we contemporaneous the maximum significant factors. On scheme level a number of percentages can be measured to rate a PV scheme´s parameters. The parameters percentage PR of a standard PV scheme is assumed [7], [8]:

$$PR = \frac{\sum_i EN_{AC,i}}{\sum_i P_{STC}\left(\frac{G_{POA}}{G_{STC}}\right)} \tag{6}$$

- EN_{AC} = dignified AC electrical generation (kW)
- P_{STC} = summation of installed modules' power rating (kW)
- G_{POA} = dignified irradiance in the plane of array (POA) (W/m^2)
- i = guide a group of quantity outcomes at the identical period.
- G_{STC} = irradiance at normal test conditions (STC) (1000 W/m^2) [9].

Used for remaining joined PV schemes with or without battery-operated the grade of intake is specified:

$$E_{selfsuf} = \frac{\sum_i P_{PV-self-con,i}}{\sum_i P_{PV-AC,i}} \tag{7}$$

and the grade of self-sufficiency is assumed as a result of:

$$E_{selfsuf} = \frac{\sum_i P_{PV-self-con,i}}{\sum_i P_{AC-Load,i}} \tag{8}$$

The system efficiency (ηSys) defines in (9):

$$\eta_{Sys} = \frac{E_{used}}{E_{supplied}} \tag{9}$$

The second aspect effect on performance of (PV) air mass (AM) this expiration is explaining the angle of insolation (w/m^2) it varying with seasons and it's come from variation angle between earth and sun in another word (cos α) effect as shown in Figure 2 [10]. For purpose, PV was improved and used for an optimal method of the energy in the network in the presence of PV power plants and battery energy storage systems [11].

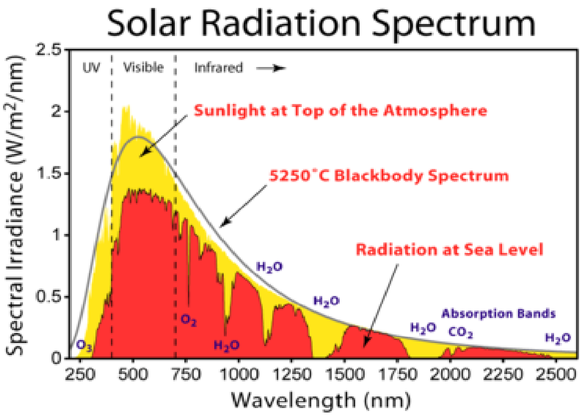


Figure 1. Insolation spectrum

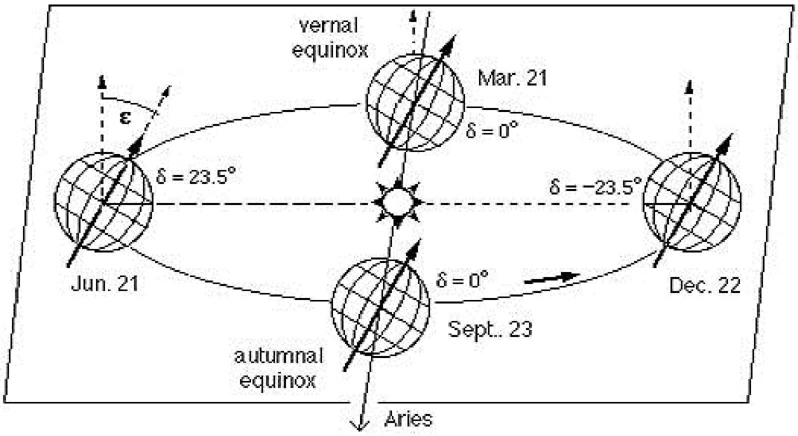
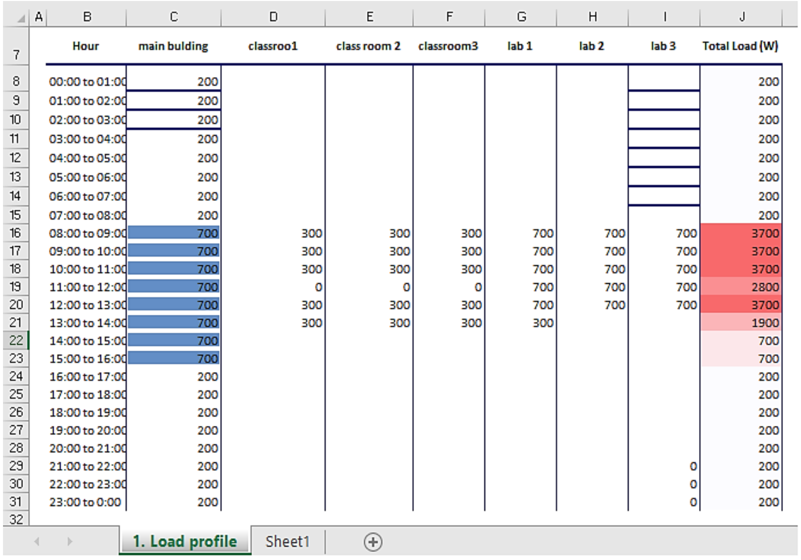


Figure 2. Variation of angle earth with sun

2. RESEARCH METHOD

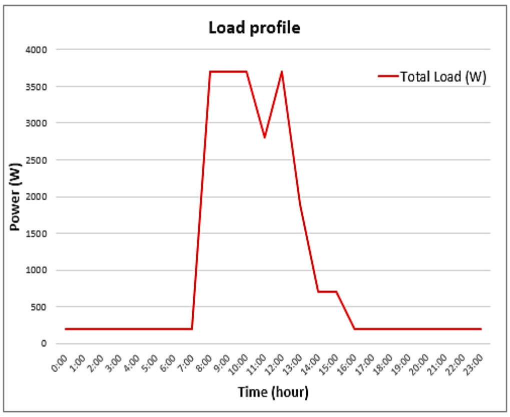
From above when we want to design a (PV) system, we have to compute and analysis the load profile it contains a masseur the load and time of operation with respect of sun time in Figures 3(a) and 3(b) and Figure 4 schedule of load kw/time operation in this paper we take a simple assumes to design (Pv) system in AL-Mausaib Technical college (GPS:32.78/44.39) Due to make analysis of load profile and matching it with solar irradiation specification at site of college. We can see that peak load at (8:00 am to 11: 00 am) so it will be useful to shift the azimuth degree +15 to ESTE to optimize with peak load and avoid unnecessary operation at peak sun because there is high amount of infrared and UV that Couse fast degradation for a long time of working [12]. If we have high subsets of tariff from local network and high fed in tariff, we can cell energy and for that case we can shift azimuth to -15, after 2:00 pm where there no load in building the overall power generation in PV goes to as fed tariff, from above cures we suggest to shift azimuth angle by +15 degree from 0 degree and 45 degrees for altitude.



	Hour	main bulding	classroo1	class room 2	classroom3	lab 1	lab 2	lab 3	Total Load (W)
8	00:00 to 01:00	200							200
9	01:00 to 02:00	200							200
10	02:00 to 03:00	200							200
11	03:00 to 04:00	200							200
12	04:00 to 05:00	200							200
13	05:00 to 06:00	200							200
14	06:00 to 07:00	200							200
15	07:00 to 08:00	200							200
16	08:00 to 09:00	700	300	300	300	700	700	700	3700
17	09:00 to 10:00	700	300	300	300	700	700	700	3700
18	10:00 to 11:00	700	300	300	300	700	700	700	3700
19	11:00 to 12:00	700	0	0	0	700	700	700	2800
20	12:00 to 13:00	700	300	300	300	700	700	700	3700
21	13:00 to 14:00	700	300	300	300	300			1900
22	14:00 to 15:00	700							700
23	15:00 to 16:00	700							700
24	16:00 to 17:00	200							200
25	17:00 to 18:00	200							200
26	18:00 to 19:00	200							200
27	19:00 to 20:00	200							200
28	20:00 to 21:00	200							200
29	21:00 to 22:00	200						0	200
30	22:00 to 23:00	200						0	200
31	23:00 to 0:00	200						0	200

1. Load profile | Sheet1

(a)



Complete the load profile and find the following values

Maximum Load	3,700	w
Minimum Load	200	w
Average Load	1,004	w
Daily Energy Demand	24,100	Wh
Production Days *refer to productivity of site	154	days
Annual Energy Demand	3,711,400	Wh

(b)

Figure 3. The system analysis and evaluation depend on (a) load profile AL-Mausaib technical college and (b) load profile analysis

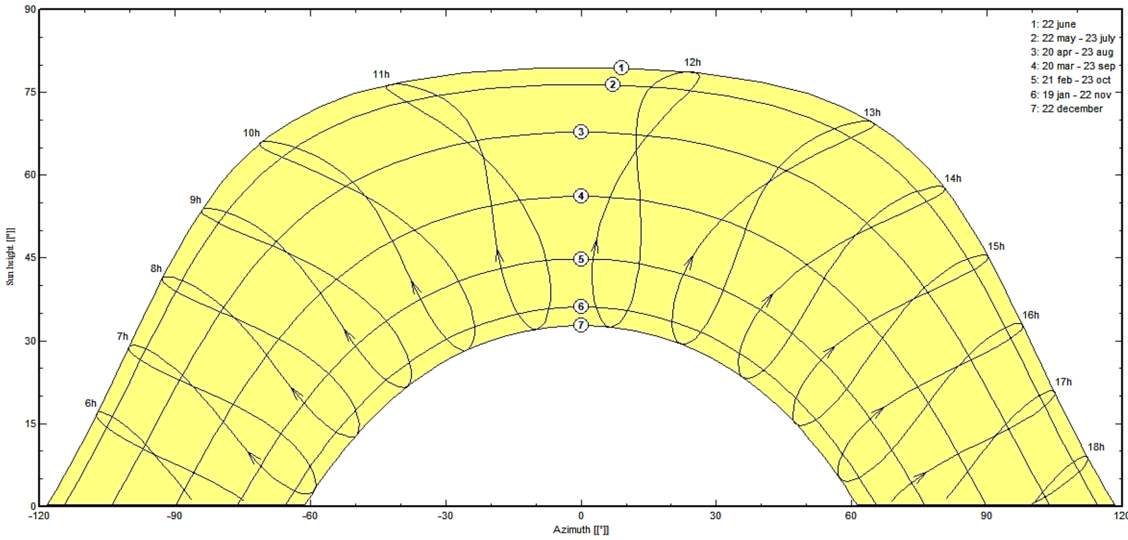


Figure 4. Altitude and azimuth curve [10]

3. RESULTS AND DISCUSSION

By using PVS soft wear we get the rustle of performance and compare with the traditional way to install at (0-30) degree azimuth altitude the idea is to optimize the operation of PV and load and minimize the degradation of panel, Figure 5 shot screen of analysis from Pv sys soft wear that show performance of system at 30 altitudes 0 azimuth compare with Figure 6 same system at 45 altitudes and 15 azimuths to show the effect of amount of irradiance ($kw.h/m^2$) for different area. We take Berman north of Germany the Figure 7 show performance of system for same size [13]–[17].

The most important true that not all time need to fit tracker in actually it depends on purpose of operation and your site on earth that will be clear if we take same assume of project to Germany were the less quantity of irradiation compare to Iraq or middle east in Figure 7. For this resolve, the optimal location, size, and type of DG units and the load profile analysis of photo voltaic system with different shading and the process approach of SVCs were determined with reference to the local city [18].

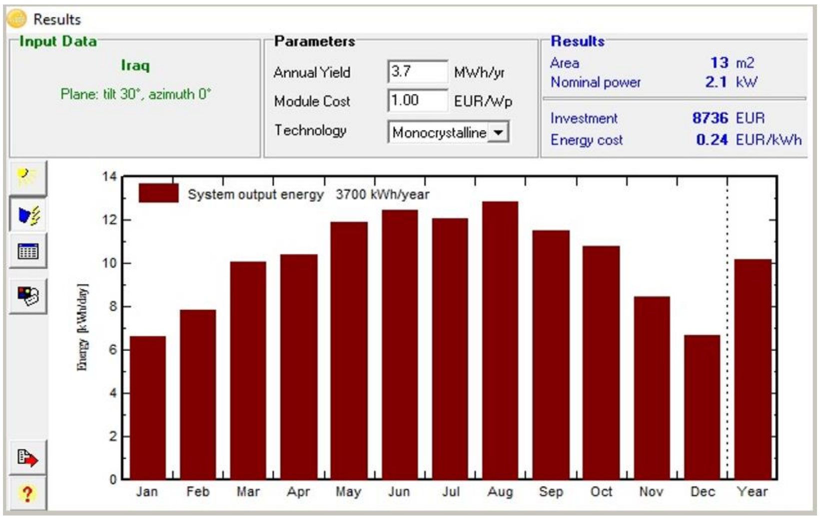


Figure 5. The analysis from Pv system soft wear with different cases

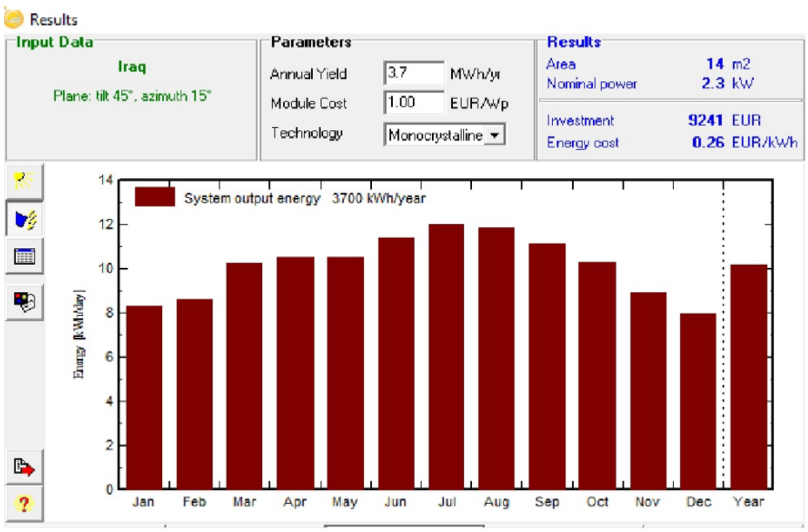


Figure 6. The analysis from Pv sys soft wear with different parameters and angles

The second obstacle facing (Pv) is shading come from natural impact like cloud of dust or un natural impact like rapture in panel the solution suggests to minimize effect of shading are [16]–[21]:

- Use soft wear like sketch up to optimize the best location of the panel and avoid natural shadow during all season by change time during day over all months of year we can see the effect shadow come from local

building or (PV) panels itself the benefit from program it's you can make simulation of distribution of panels with local environment in same geographical point Figure 8.
- By using face shell panel (half cut cell) to reduce aria of effect of shadow as Figures 9(a) and 9(b) and reduce losses because current will divide into two parts inside panel that men less power losses.

Where:

$$p = I^2 R \quad (10)$$

This type of cell using both sides to produce energy depend on ELPEDO effect that increase efficiency by 5% [12]. For collectively energy transformation path, ηSys is found at full and partial load cases (100%, 75%, 50%, 25%, 10%, 5% of maximum power) [22]–[25]. The power flow in the Micro grid can be achieved, the THD can be improved, and the voltage profile can be controlled. A graphical interface was also technologically advanced to show all the results prepared by the algorithm, and additional data for the states of power systems, voltage profiles, and modification system [26]. Table 1 shows the radiation data in Iraq with different months and days to reach the maximum values of an irradiation power (KWh/m^2) with different tests and cases for experimental part.

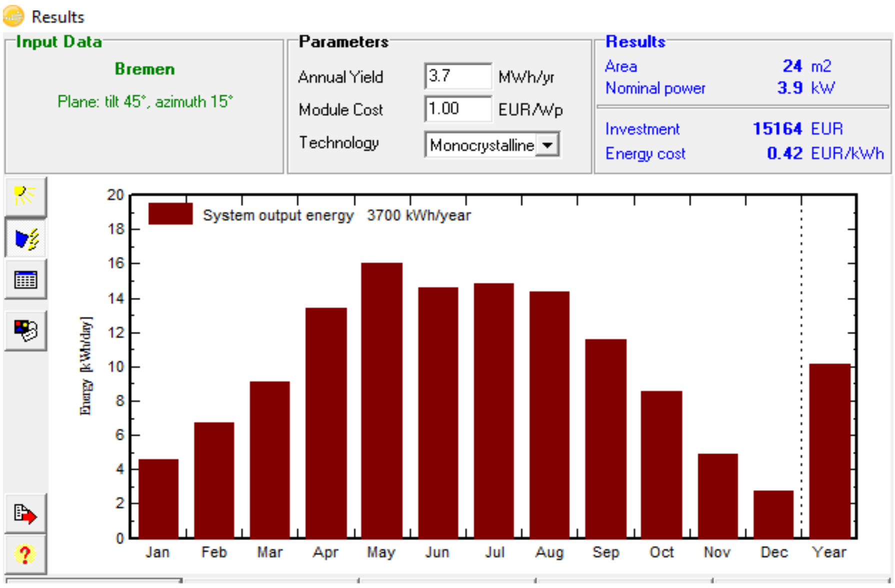


Figure 7. The system output energy analysis for Berman north of Germany

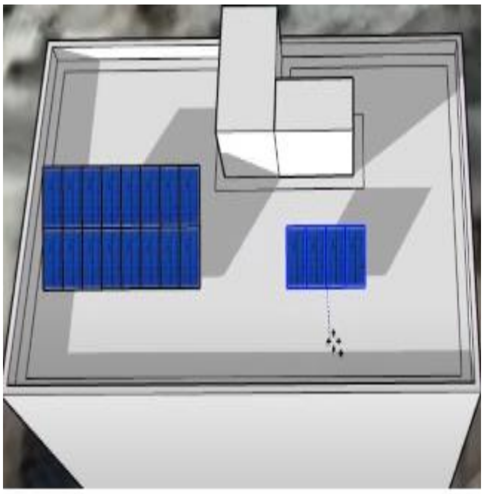
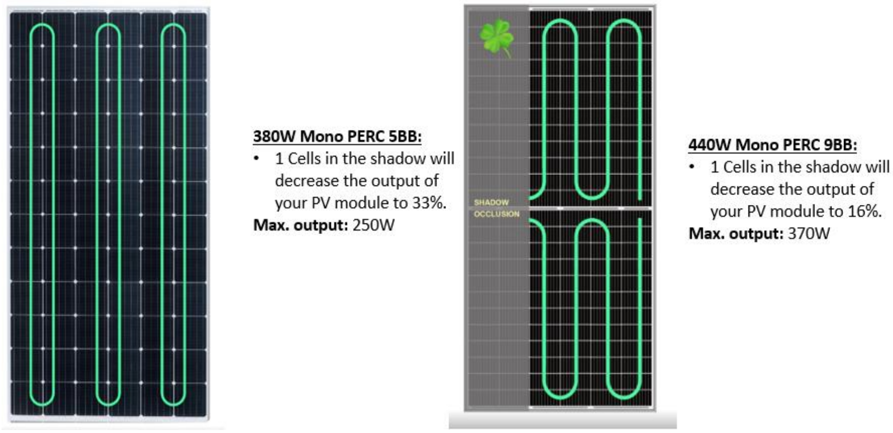
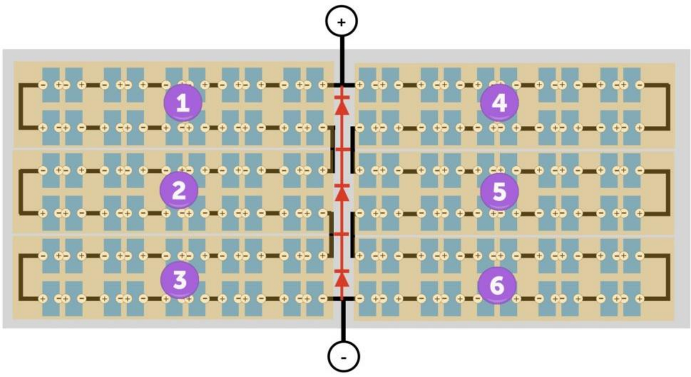


Figure 8. Processing shadow on the site by the sketch up soft wear



(a)



(b)

Figure 9. The setup of a panel solar cell with (a) shell panel of half cut cell and (b) half cut cell with H section

Table 1. Radiation data in Iraq

Month	Irradiation data on the horizontal plane (KWh/m^2)	Irradiation data on the optimal plane (KWh/m^2)	Direct irradiation (KWh/m^2)
January	78.7	122.5	110.3
February	119.2	134.88	134.87
March	159.33	186.3	201.33
April	205.67	214.2	208.9
May	220.67	219.9	237.3
June	233.44	229.1	250.89
July	245.34	240.9	292.9
August	228.22	223.9	266.8
September	190.33	215.4	234.8
October	182.2	202.66	210.08
November	112.33	159.45	133.4
December	84.66	111.23	90.98

4. CONCLUSIONS AND FUTURE WORK

To enhancement the performance and efficiency of (PV) system there are two topics the first one is understood the physic of sun light and the effect of earth motion with respect to sun and the second is proper design of PV which come from proper analysis of load profile and high quality of (PV) panel. As we seen in compart between deferent area for same system required there are big variation in system size come from amount of insolation where in case of Iraq the average annual per day irradiance is 5.5 KWh/m^2 while in north of Germany -Berman the average annual per day irradiance 3 KWh/m^2 the core problem facing operation (PV) is middle Este is heating come from high insolation witch content 52% infrared radiation that led to descries efficiency, so that will be useful to research in cooling system for PV panel. To calculate the control factors, the suggested system considers power stability restraints for example, availability, storage element state of charge, and load. In conclusion, a parameter is planned to reduce the outcome of different environmental and functioning features to enhance the performance of solar PV system.

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