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Research Article

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Project practice in Iraq for house use of 6 kW power system by solar source

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Abstract By 6kw power system with photovoltaic (PV) source. This project first practice in Iraq for house use. This system has three parts, first part the source side include solar power system (DC power), second part the inverter to converter DC to AC power and third part the AC load. In the first part was using call of 250w & 12v with series connection one time and parallel in another time to get the voltage and the current required. In the second part was using inverter with controller to stably system. In final part the test of this system, which need load for different load, by using the system in efficient 50, 60% &70. The result of this project show in Iraq can use solar source for house use.

Keywords Solar, power electronic, Inverter

1. Introduction

Renewable and clean energy like a photovoltaic (PV) energy, they can contribute in decreasing the electric energy cost. It uses the aim of minimizing the total cost and ensuring the energy available. The power generation by solar cell, the change of temperature and radiation which effect in values of power generation [1, 2]. Solar, The transform incoming sunlight into electricity by Photovoltaic (PV) cell that made from silicon [3, 4]. Solar-powered PV, one for the safest form of renewable energy that available and cleaned. It use to get the power for your house. It panels transform the sun's radiation into electric power by the electrons in silicon cell for using a photons of light sun. This electric power used to supply renewable energy to your house. Contributing green, clean generator power from PV electric system reduce impact on the environment. In the PV system that tied to grid, the power generation in DC from the PV, it converted by inverter to AC power before fed directly into the utility power distribution system of the building[5,6].

2. Photovoltaic (PV)

In most PV system that panels of placed on the roof without shade in this place during the sunlight hours of 9 a.m. to 3 p.m. currently in operation PV system produced power that will be consumed by the electrical loads and connected the electricity net meter, electricity production meter and inverter. The balance of power produced by PV system passes through your electrical panel and out onto the electric grid. Whenever it is producing more electricity from PV system than it is immediately consuming, your electric utility meter will turn backwards!

Technical specification, for Solar panel, Solar panels are collection of many types as 80w India panels, Philips panels …etc.

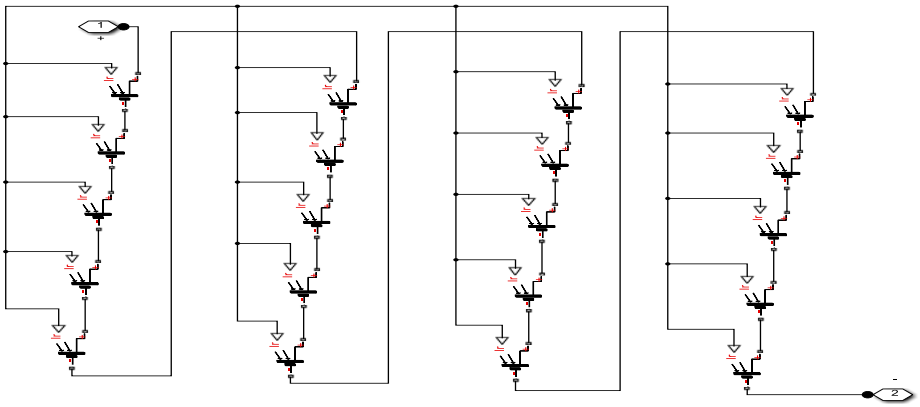

Figure 1: Sample of connection 20 panels in series in one group

Technical specification, the mech panels consist of four rows as follow:
Two rows of 24 panels with 12V, 80W India panels each row with 1920W.
One row of 24 panels with 12V, 80W Taiwan panels with overall power1920w.
One row of 12 panels with 24V, 250W china panels with overall power 3000w.
The Panels total overall power is about 8760.
Total no-load system voltage is about 474V
Output panels currents is depend on inverter output power.

Figure 2: Panels of Solar-powered PV

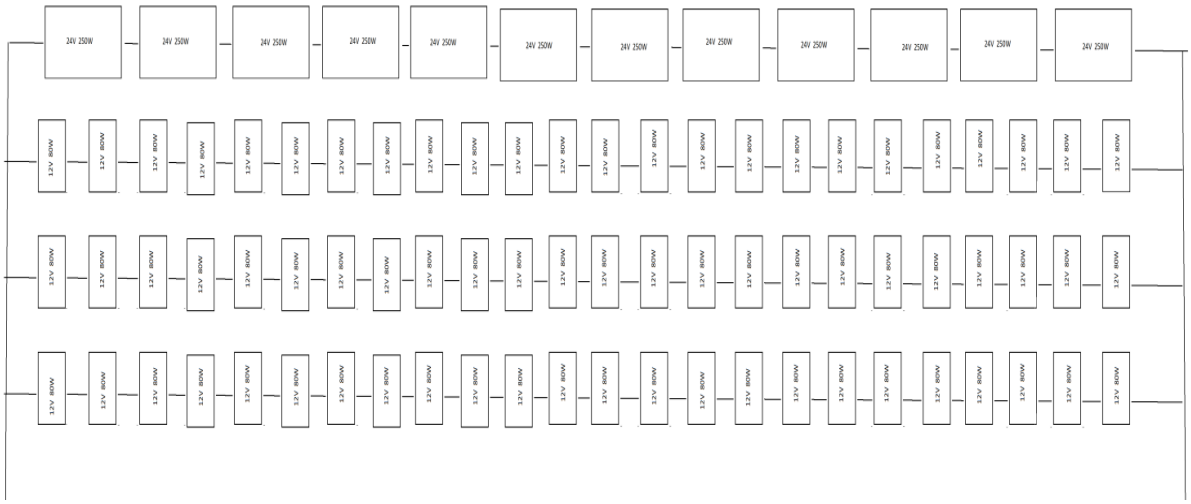

Figure 3: Mech panels of the four rows

3. Power electronic

Power electronic converter include four types, rectifier (AC-DC), inverter (DC-AC), and converter (DC-DC or AC-AC). The power electronic device is building by using diode, thyristor, insulated gate bipolar transistor IGBT...etc. Grid side (three phase AC source) [7, 8]. In this work will be used the Power electronic converter type inverter (DC-AC). In figure (4) show the general structure for power system, it has first input power included Photovoltaic (PV), Wind power, Fuel Call and UPS. Second Power Conversion Unit included Inverter (DC-AC), Converter (AC-AC), Rectifier (AC-DC) and Converter (DC-DC). Third Output power included Utility Grid and Local Load. Finally, main Controller included Input Side Controller and Grid Side Controller [9-12].

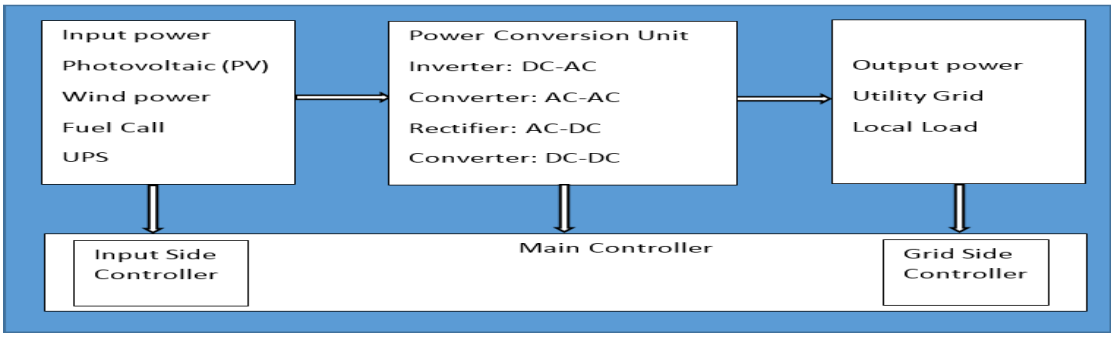

Figure 4: The general structure for power system

4. Inverter

Inverter (DC-AC), it use in the system has AC- load and DC source. To solve it that need conversion the DC power to AC power, it mean add Inverter (DC-AC) with the DC source and AC load to complete that system. In figure (5) show the block diagram for Photovoltaic (PV) and Inverter with AC-Load. Technical specification, On-Grid inverter Made in Germany Type (SMA) Model (SMC 6000L) & Inverter maximum Capacity 6kw. Input power characteristic, Maximum DC voltage 700V, Maximum DC Voltage at optimum performance 333V-500V & Maximum input current IDC= 19A. Output AC power characteristic, AC output voltage =230V, Frequency 50-60 Hz, Maximum output current 27A & cos θ =1.

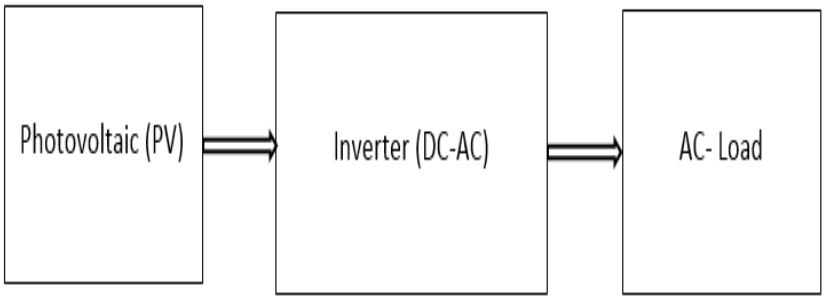

Figure 5: Block diagram for Photovoltaic (PV) and Inverter with AC-Load

Figure 6: on Grid 6KW Inverter Model (SMC)

Math. and calculation for PV system design
In theoretical PV system design, to show how can design it:
1) Total power for this system 6kw.
2) For using four groups that mean 6kw/4=1.5kw.
3) For using each cell has 250w that mean 1.5kw/250w=6cels
4) Total voltage for this system 480v.
5) For using cell that has 12v that mean 480/12=40 cells for each group.
6) For using cell that has 24v that mean 480/24=20 cells for each group.
In practical PV system design, to show how can design it:
1) Total power for this system 8760W.
2) First type for three groups, by using 24 cells, each cell has 24V & 80w that mean 24*80=1920W
3) Second type for the fourth group by using 12 cells, each cell has 24V & 250w that mean 12*250=3000W
4) Total voltage for this system 480v.
5) For using cell that has 12v that mean 480/12=40 cells for three group.
6) For using cell that has 24v that mean 480/24=20 cells for fourth group.
Description system of PV, it has four groups connected in parallel. Each group has many of cell that connected. In the following will be show that system connection:
First, series connection:
This stat value in theoretical, there are 24 cell connected in series, each cell has voltage and power (12V &80W) that mean total voltage and power equal (24)*(12) for voltage and (24)* (80).
But in practical value, each group has 24 cell power and voltage equal (80W&12V)for three groups and the fourth one has 12 cell connected in series, each cell has voltage and power (250W&12V).
Second, parallel connection:
There are four groups that connected in parallel, each group has 1920W for three groups and the fourth one has 3000W that mean total power equal (3*1920)+(3000)=8760W

5. Results

The results by use this system with two way, first with total load power less than the total generation power, the system has 6KW generation in source side, in this part just use three part to show the work system with different load like (50%, 60% &70%). Second with total load power more than the total generation power, the system has 6KW generation in source side, in this part just use three part to show the work system with different load like (12KW, 18KW&24KW):
Experimental results, Power production for one day at 15/5/2018 was about 33.6kw. The system power production (kw/h) with the time and the accumulative power along the day is show in fig. (7).

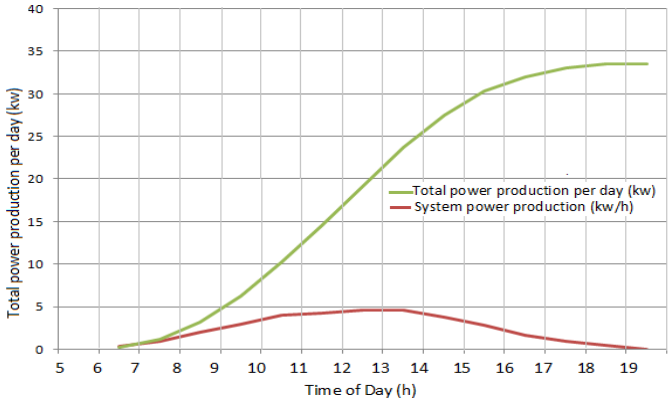

Figure 7: Power production for one day

The total power production at May 2018 was about 960kw.
The total power consume at May 2018 was about 1200kw.
So the total power consume from the grid at this time was 260 kW.
Therefore, 80% of the total power is satisfaction by on our grid system.

5.1. Results for total load power less than the total generation power

The system has 6KW generation in source side; in this part just use three part to show the work system with different load like (50, 60% &70%):

1st the results for 50% , by use 3KW in the load required but the generation power more than the required power that mean the system has add power in this time the system by on grid will be used to solve this state. 2nd results for 60%, by use 3.6KW in the load required but the generation power more than the required power that mean the system has add power in this time the system by on grid will be used to solve this state. 3rd results for 70%, by use 4.2KW in the load required but the generation power more than the required power that mean the system has add power in this time the system by on grid will be used to solve this state.

5.2. Results for total load power more than the total generation power

In this part just use three part to show the work system with different load like (12KW, 18KW&24KW):

First, the results for 2*100%, by use 12KW in the load required but the generation power less than the required power that mean the system has not enough power in this time the on grid will be using to solve this state. Second results for 3*100%, by use 18KW in the load 18KW in the load required but the generation power less than the required power that mean the system has not enough power in this time the on grid will used to solve this state. Third results for 4*100%, by use 24KW in the load 24KW in the load required but the generation power less than the required power that mean the system has not enough power in this time the on grid will used to solve this state.

6. Conclusion

Solar source for house, the result of this work show in Iraq can use it. For the experimental result, Power production for one day at 15/5/2018 was about 33.6kw, so 80% of the total power is satisfaction by on our grid system. Also, the system has 6KW generation in source side, for total load power less than the total generation power in this part just use three part to show the work system with different load like (50, 60% & 70%). In this stat the generation power more than the required power that mean the system has add power in this time the system by on grid will be used to solve this state. However, for total load power more than the total generation power that mean the system has not enough power in this time the on grid will used to solve this state.

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