Chapter 3

Solar PV Panel: Components Details and Fabrication

Background

After deciding the idea of position of Solar PV Panel, the next step is to conceptualize and fabricate one module and deploy it on terrace of HPL for testing. Before filling a report it is necessary to test the performance of the system and to check whether it matches to desired outputs or not.

To proceed with the fabrication following materials with required specifications are needed. The sequence of operation is as follows:-

3.1 Solar PV Panel

Solar modules use light energy (photons) from the sun to generate electricity through the photovoltaic effect. The majority of modules use wafer-based crystalline silicon cells or thin-film cells based on cadmium telluride or silicon. The structural (load carrying) member of a module can either be the top layer or the back layer. Cells must also be protected from mechanical damage and moisture. Most solar modules are rigid, but semi-flexible ones are available, based on thin-film cells.

Electrical connections are made in series to achieve a desired output voltage and/or in parallel to provide a desired current capability. The conducting wires that take the current off the modules may contain silver, copper or other non-magnetic conductive transition metals. The cells must be connected electrically to one another and to the rest of the system. Photovoltaic modules use MC3 or MC4 connectors to facilitate easy weatherproof connections to the rest of the system.

3.2 Specification of solar PV Panel:

In Literature review, solar PV Panel specification is given.

For maximum output electric power from Solar PV Panel, there is one graph Voltage vs. Current As shown below

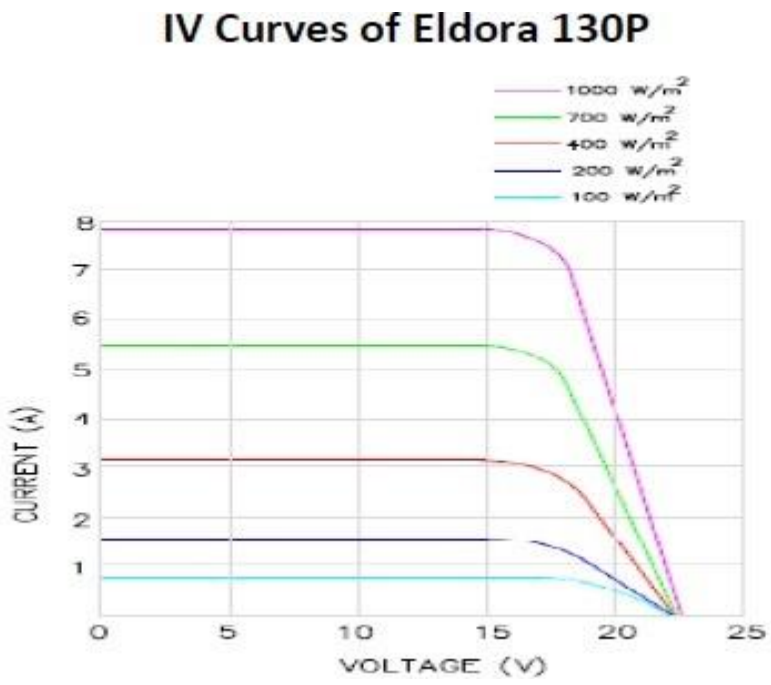

Figure 3.1: Solar Panel I vs. V

So, maximum output of Eldora – 130p is at 18 V.

3.3 MC- 4 Connectors

MC4 connectors are single-contact connectors commonly used for connecting photovoltaic panels.

While small solar panels used for battery charging for example, may not require special connectors, larger terrestrial arrays for power generation involve higher currents and voltages, and place special demands on both cables and connectors for safe operation. The MC4 connector incorporates a flexible watertight seal and is supplied as 'male' and 'female' type to minimize the chance of wrong connections.

For a proper seal, MC4s require the usage of a cable with the correct diameter. Normally double-insulated (insulation plus black sheath) and UV resistant (most cables deteriorate if used outdoors without protection from sunlight). Connection is made by use of a special crimping tool, alternatively by soldering.

Specification:

Table 3.1: Specification of Solar Connectors

Type	Conductor cross section	Diameter range of cable gland	
Male Cable Couplers	4 mm², 10 AWG	3 to 6 mm	
Female Cable Couplers	4 mm², 10 AWG	3 to 6 mm	
Male Receptacles	4 mm², 10 AWG		
Female Receptacles	4 mm², 10 AWG		
Branch Socket			
Branch Plug			

Figure 3.2: Solar MC-4 Connectors

3.4 DC Energy Meter

Energy meter is a device that measures the amount of electric energy consumed by a residence, business, or an electrically powered device.

In HPL, DC Energy meter is used of Technomax Company.

Specification:

Table 3.2: Specifications of DC Energy meter

Type	DC Energy Meter
Max. Input Voltage	48 V DC
Max. Current	5 A
Consumption Voltage	0-24 V DC (Max-24 V DC)

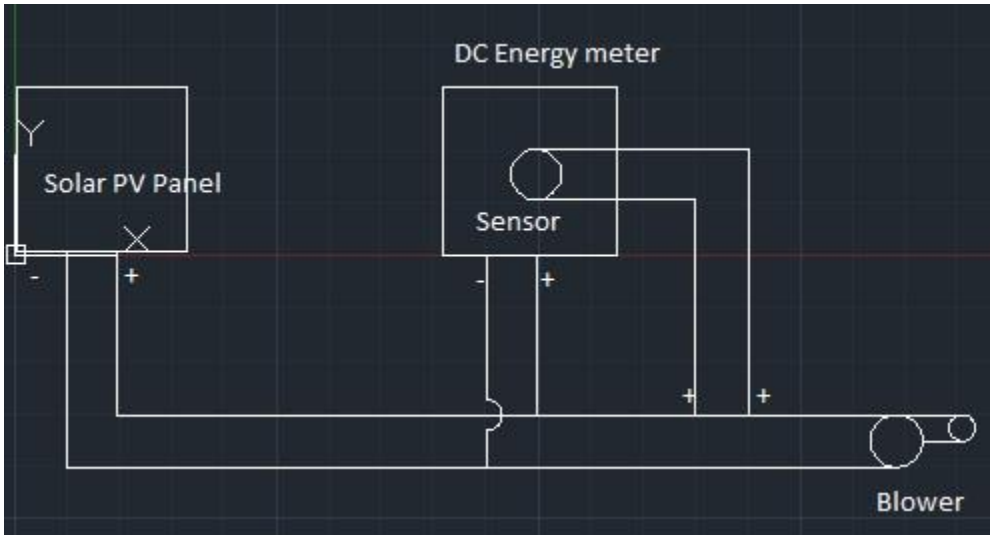

Figure 3.3: Schematic diagram Of Solar Electric circuit

3.5 Blower:

Air blowers generally use centrifugal force to propel air forward and inside a centrifugal air blower is a wheel with small blades on the circumference and a casing to direct the flow of air into the center of the wheel and out toward the edge.

Specification:

Table 3.3: Specifications of DC Blower

Type	DV 6224
Dimensions	172 Ø x 51 mm
Nominal Voltage	24 VDC
Nominal Voltage range	9 – 29 VDC
Power input	40 W
Min. ambient temp.	-20 ˚C
Max. ambient temp.	75 ˚C
Air Flow	540 m^3/h
Mass	0.820 kg

3.6 Experimental Setup:

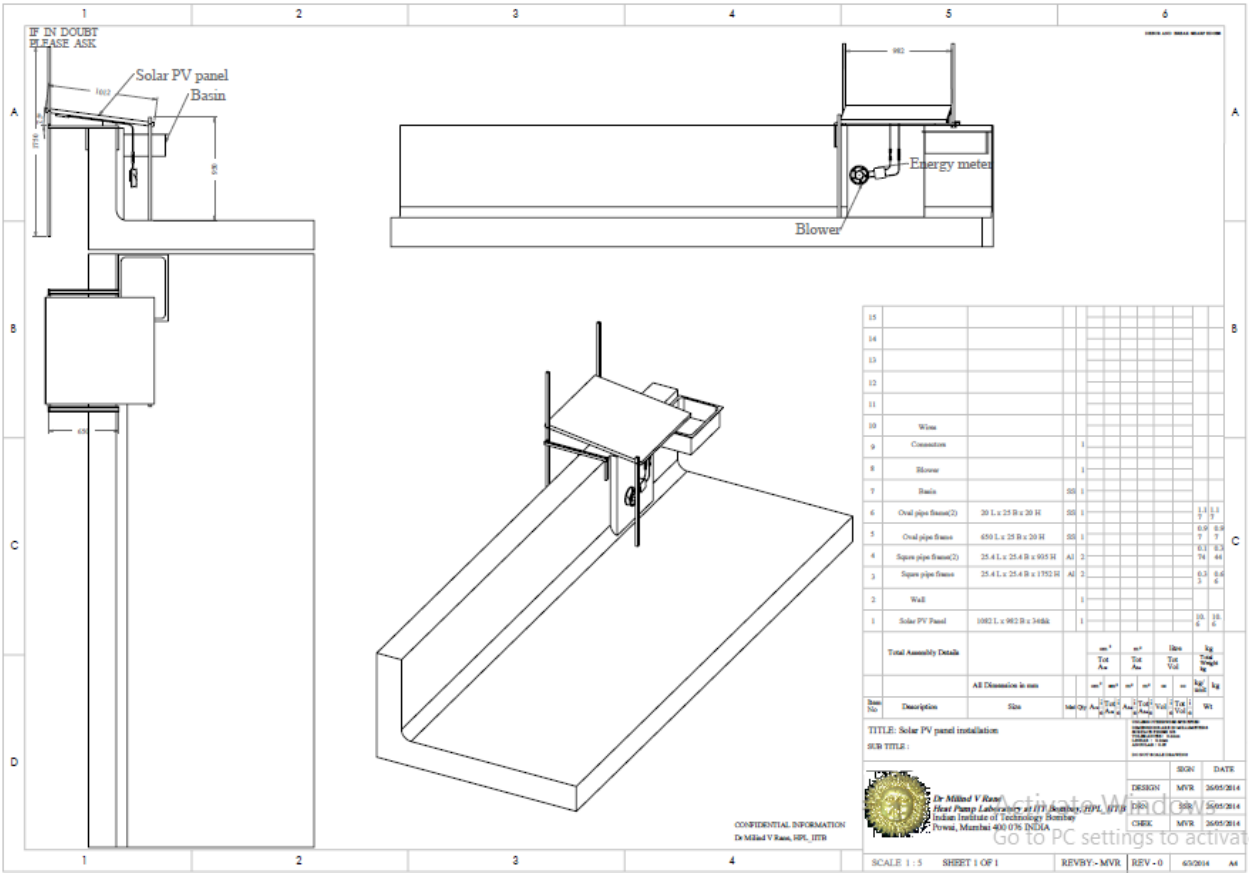

Figure 3.4: 2-D Design in solidworks of Experimental set-up

3.6.1 Procedure:

As shown above figure solar PV Panel is assembled with aluminum frame to the wall.

Male and female connectors are crimped with wires and connected it to blowers.

For testing of solar PV Panel output, DC Energy meter is connected parallel for voltage measurement and connected series for Current measurement.

Voltage, current, Power could be display on display screen.

3.6.2 Observation Table:

Table 3.4: Observation of Experimental Set-up on 11/06/2014

Solar PV Panel Installation							Date:	11/6/14							Name:	Yashkumar Rajeshbhai shah					
							BLOWER(Left)Velocity								Blower(Right)Velocity						
Time	Voltage	Current		1	2	3	4	5	6	7	8	9		1	2	3	4	5	6	7	8	9
12:00	18.59	2.54		3.5	4.8	6.3	3.2	5.2	5.3	4	5	4.5		7.4	6.3	6.4	7.4	4.4	6.3	5.7	4.1	6.3
12:30	18.65	2.6		4	6.5	5.8	4.4	5.4	3.2	4.7	4.8	6.3		7.1	6	5.2	6.7	4.8	6.4	7.9	4.4	6.2
1:00	18.69	2.55		4.3	5.9	4.6	6.1	5.5	2.7	4.2	5.3	6.2		7	6.1	4.7	6.3	4.2	4.7	7.5	4.2	6.2
1:30	18.66	2.59		5	5.5	4.6	3.6	5.8	4.5	4.9	5.3	4.8		6.4	4.6	4.2	5.5	4.3	5	6.5	4.3	5.8
2:00	18.52	2.61		3.9	5.3	4.5	3.9	5.6	2.3	4.9	5.2	5.5		6.6	4.5	4.7	5.7	3.7	3.9	6.4	4.4	6.2
2:30	18.54	2.51		4	6.2	7.6	4.7	6.1	4.2	5	5.6	5.9		6.6	5.4	5.9	7.2	4.6	6.4	8.4	4.5	5.4
3:00	14.4	1.78		4.7	4.5	3.7	4	5.5	4.1	5.5	4.7	5		6	5.3	4.7	7	4.2	6.4	8.1	3.5	5
3:30	18.4	2.56		3.4	4.7	7.1	4.5	5.8	5.7	4.4	5.4	4.3		6.7	4.9	6.4	7.4	4.3	5.7	7.8	4.7	5.8
5:00	13.38	1.38		2.3	2.4	4.1	1.9	3	3.4	2.9	3.2	1.8		4.7	3.5	4.5	3.3	4	4.2	5.5	1.9	3.2
5:30	13.1	1.11		1.4	2	3.4	2.2	2.3	2.6	1.2	2.5	2.9		3.8	2.6	2	3.4	2.4	3.1	4	2.4	3.5
6:00	8.49	0.52		1	1.4	1.1	1.1	1.6	0.6	0.8	1.7	2.1		2.6	2.5	1.7	2.3	1.2	1.3	2.2	1.5	2.3
6:30	5.5	0.32		0.9	1.3	1	0.8	1	1.2	1.1	1	0.9		1.3	1.1	1.2	0.9	1.3	1	1.4	1.5	1.7

Table 3.5: Observation of Experimental Set-up on 12/06/2014

Solar PV Panel Installation							Date:	12/6/14							Name:	Yashkumar Rajeshbhai Shah					
							BLOWER(Left)Velocity								Blower(Right)Velocity						
Time	Voltage	Current		1	2	3	4	5	6	7	8	9		1	2	3	4	5	6	7	8	9
11:30	18.4	2.56		4.1	5.8	5	5.5	6.9	4.8	5.5	4.9	5.9		6.1	5.1	5.1	7.5	4.4	6.5	7.8	4.9	5.4
12:00	18.58	2.58		4.4	6	5.1	5.3	6.4	4.2	5.4	6.4	6.2		6.4	5.9	5.6	7.6	4.6	6.1	7.2	4.8	5.8
12:30	18.52	2.51		4.8	7.1	5	6	7.1	4.2	5.1	5.4	6.6		5.8	5.1	7.8	5.4	5.7	5.9	7.6	4.9	6.1
1:00	18.6	2.64		4.8	6.1	4.7	5.6	6	7	3.6	6.1	5.6		7	5.8	6.6	7.5	5.1	6	8.2	3.4	6.1
1:30	18.64	2.66		4.4	6.1	3.8	4	5.3	3.1	4.7	4.9	6.9		4.7	4.5	5.3	3.7	4.4	6.1	4.8	3.3	7.5
2:00	18.36	2.59		4.3	6	4.4	5.5	5.6	2.9	4.3	5.4	5.9		6.1	4.9	4.3	4.7	4.5	4.3	5.9	3	6.6
3:00	18.75	2.65		4.6	5.4	7.1	4.9	6.3	7.3	4.1	5.1	5.6		6.6	6.3	4	7	4	6.4	7.8	4.4	5.9
3:30	18.61	2.59		4.2	5.2	7.1	4.6	5.1	7.4	5.3	5.8	5.3		6.6	5.9	4	5.2	3.8	NA	NA	NA	NA
4:00	13.14	1.37		2.6	3.1	4	2.4	3.1	4.4	2.1	3.8	3.2		6.4	6	4.3	6.2	3.1	4.2	5.1	3	4.3
4:30	10.49	0.96		1.5	2.6	2.7	2.5	2.8	1.7	2.5	2.9	2.9		4.4	3.2	2.4	4.5	3.6	4.6	3	3.9	3.6
5:00	14.1	1.65		2.3	3.6	2	3.7	2.9	3.1	3.6	3.4	3.5		4.4	3.8	4	3.7	4.2	5.5	2.1	3.9	4.2
5:30	13.4	1.39		1.5	3.7	2.2	3.6	3.3	2.1	3.3	3.4	2.7		4.9	3.4	3.7	5.6	3.5	4.4	5.1	2.9	3.8
NA= Suddenly sun light intensity goes down																						

3.7 Result

Result from observation is discussed below in table 3.6. Two blower connected in parallel connection to solar PV panel and the value in table is approximated with tome period.

Table 3.6: Result of Experiment

Time period	Observation Data
11.30 AM – 3.30 PM	Voltage - 18.5 VDC
	Current – 2.6 A
3.30 PM – 5.30 PM	Voltage – 13 VDC
	Current – 1.3 A

Chapter 4

Conclusion and Future Work

From the results and literature obtained till now, Output of PV Panel is very low nearly 31W because of load connected to it is not at full load condition and for max. Output from panel to blower required panel output is at 24 V but panel output at 18.75 V as mentioned in observation table 3.4 and table 3.5. This Electric energy from PV Panel is very useful where Grid Supply is not very good and also helpful to experiment fully on solar system because Blowers, Pumps etc. Electric component in experiment require electric energy as input. However a lot of work still needs to be done in order to estimate the system performance more effective. The future work to be carried out can be divided into following sub-parts:

a. Procure and install voltage regulator for Blower working operation. Which output must be 24 V DC from Solar panel input.
b. Connect the whole circuit and check if Maximum power of blower came from solar PV Panel or not.

c. Solving issues of power input which is required to operate the blower so that it can perform on off-grid location with Maximum Power input.

d. To find different alternatives to reduce down the weight and cost of the system.

e. Economic analysis of the system.

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