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1.68 KWP (2.2 HP) DC OPERATED SOLAR WATER PUMPING SYSTEM WITH AUTO TRACKER: A NEW ERA

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Abstract: *With the experience of the global energy crisis attempts are being made throughout the world to harness alternate sources of energy. In this respect photovoltaic (PV) technology stands out as one of the potential alternatives. In Bangladesh several PV systems have been installed for various common purposes. Initial investment for this technology is very high, while operation and maintenance cost is very low. However, for mass-scale commercial operation this needs to be economically viable compared to its conventional alternatives. In this paper attempt has been made to analyze the practical data for the purpose of water pumping. In response to this, 1.68 KWp Solar water pumping plant with auto tracker has been installed at Bangladesh Atomic Energy Commission, Head Office Building and Atomic Energy Centre premises to run one 2.2 HP pump whose discharge capacity is 40,000 Liters/Day at 100 ft static head. These plants are used for direct application of solar energy and other related R&D activities. It is expected that if many more solar power plant projects like Prime Minister Office, Bangladesh Bank, BAEC could be taken by other government and private organizations that will strengthen the utilization and development of solar technology and would have been possible to get at least 10% of the total energy supply from the renewable sources by 2020.*

Key Words: PV technology**,** solar pumping plant, Auto Tracker, Discharge**.**

1. Introduction

Bangladesh is an agricultural country here irrigation is most important for cultivation. But only 35 % cultivable land under irrigation, 65% is not perfectly irrigate. Solar pump can perform important role for irrigation system. So the Government of Bangladesh has rightly focused on the development of renewable sources of energy mainly solar power for irrigation purpose. To analyzed solar pumping process there are two units of 1.68 kW submersible multistage centrifugal pumps with DC motor-controller for water-discharge capacity of 40 m^3/hr (40,000 Liters/day) each at 100 feet static head with auto tracker is installed work at BAEC Head office building and Atomic Energy Centre, Dhaka.

2. Description of 2.2 HP (1.68 kWp) Solar Pumping Plant at Head Office building of Bangladesh Atomic Energy Commission

1.68 KWp Solar PV Module with auto tracker has been installed at Bangladesh Atomic Energy Commission, Head Office Building and Atomic Energy Centre premises to run one 2.2 HP pump whose discharge capacity is 40,000 Litres/Day at 100 ft static head. The total system has been designed with best components and proven experience in Bangladesh local weather condition. The system has been designed with Maximum Power Point Tracking (MPPT) charge controllers from Lorentz, Germany. It has also auto tracker which increases array power yield up to 30% compared to non-MPPT controllers.

Figure of 2.2 HP solar pumping Plant (Head Office Site of BAEC)

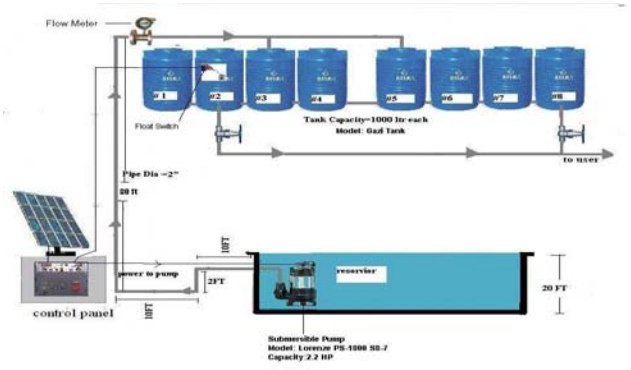


Fig 2.1: 2.2 HP solar pumping Plant (Head Office Site of BAEC)

In this figure, a solar driven submersible pump is located on underground reservoir which is controlled by a sensor float on tank #2. This pump lifts water to eight no of tanks, each having capacity of 1000ltr is situated on the roof top of the Head office building. Tank# 3&5 is for input and Tank# 2&8 for output.

Table 2.1: Major Components of 17.5 kWp Solar Electricity Generation Plant at HO of BAEC

Name Of Device	Capacity	Type of Devices	Efficiency
Solar PV Module	1.68 KWp	120Wp@12V, Monocrystalline	14 to 15%
MPPT Motor Controller	Nominal 80A	Maximum power point tracing	92%
Submersible DC Pump Motor	Discharge capacity: 40,000 Liters/Day	Submersible pump, Brushless DC	92% or better
Automatic Sun Tracker	Elevation angle: 0 – 45 degree,	Single axis solar tracking system	

Wiring diagram for ETATRACK active1500-A controller for 2.2 HP submersible pumps

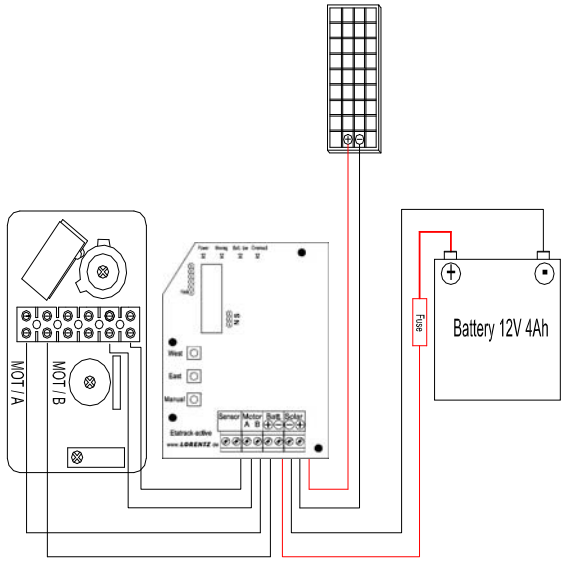
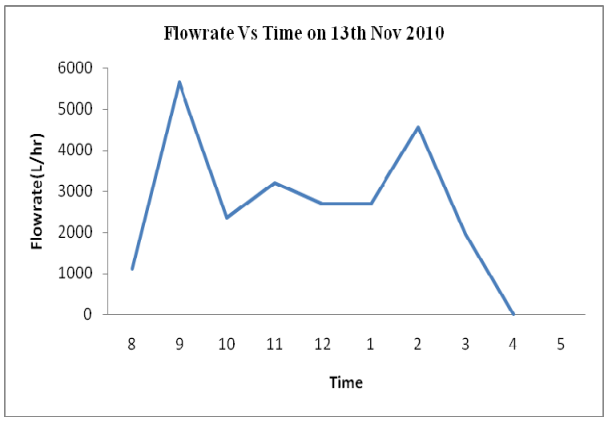


Fig 2.2: wiring diagram of auto tracker

3. Performance Studies

Table3.1: Flow meter reading on a sunny day of 13th Nov 2010

Time	Flow meter reading (m^3)	Solar Intensity (W/m^2)	Flow rate (L/hr) without tracker	Flow rate (L/hr) with tracker
8.00	580.50	480	1120	1456
9.00	581.62	620	5640	7332
10.00	587.26	680	2370	3081
11.00	589.63	570	3210	4173
12.00	592.84	510	2690	3497
13.00	595.53	480	2700	3510
14.00	598.23	380	4570	5941
15.00	602.80	350	1950	2535
16.00	604.75	180	0	0
17.00	604.75	10	0	0



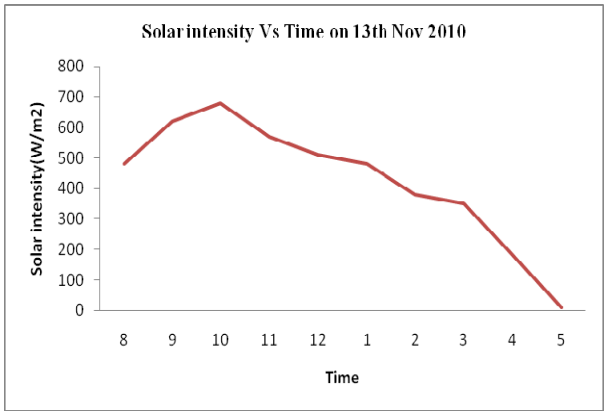
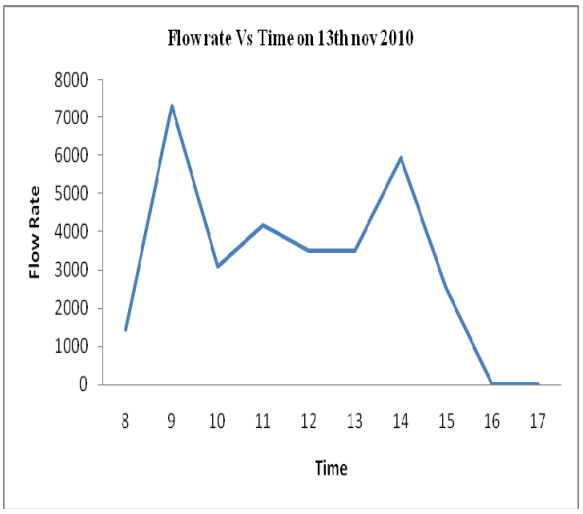


Fig 3.1: Flow rate and solar intensity Vs Time on (13th Nov 2010) on BAEC 2.2 HP solar pump without auto tracker.



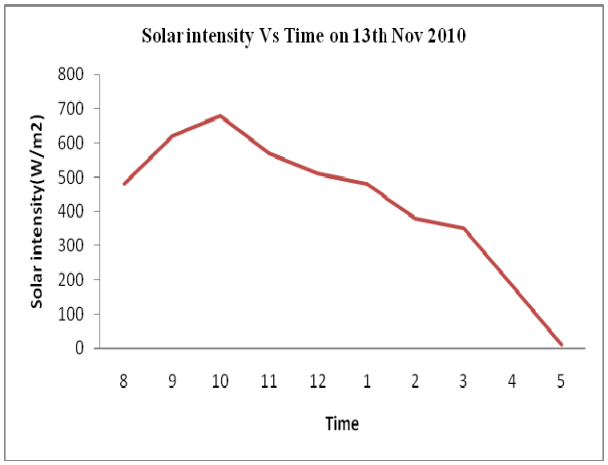


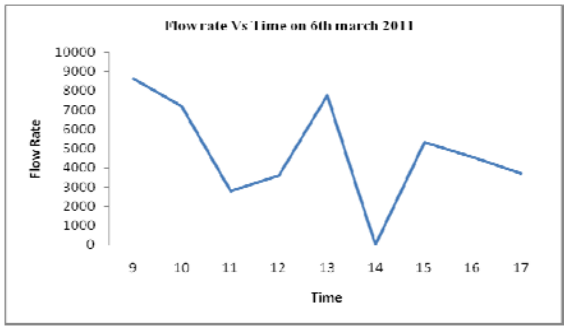
Fig 3.2: Flow rate and solar intensity Vs Time on (13th Nov 2010) on BAEC 2.2 HP solar pump with auto tracker

Figure 3.1 shows the flow rate and solar intensity data with respect to time collected from the BAEC 2.2 HP solar pump without any tracker. First curve of the figure contains the time of a day in its X axis and flow rate in L/hr on Y axis. On other hand the second one shows the solar intensity on different time of a day. These data are collect in November 2010, which is small day time that is why at 4pm solar intensity tens to zero and flow rate is absolutely zero.

While Figure 3.2 shows the flow rate and solar intensity data with respect to time collected from the BAEC 2.2 HP solar pump with auto tracker. The most important findings is that the auto tracker increase the flow rate i.e. the solar pump's performance up to 30%.

Table3.2: Flow meter reading on a sunny day of 6th March 2011

Time	Solar intensity (W/m^2)	Flow rate(L/hr) without tracker	Flow rate(L/hr) with tracker
09:00	770	8640	11232
10:00	774	7200	9360
11:00	800	2800	3640
12:00	917	3600	4680
1:00	861	7760	10088
2:00	880	0	0
3:00	810	5320	6916
4:00	690	4560	5928
5:00	513	3720	4836



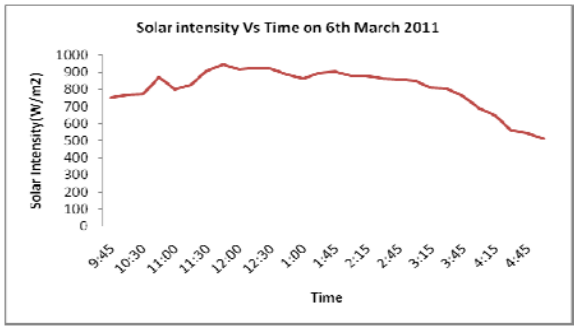


Fig 3.3: Flow rate and solar intensity Vs Time on (6th March 2011) on BAEC 2.2 HP solar pump without auto tracker

Fig 3.4: Flow rate and solar intensity Vs Time on (6th March 2011) on BAEC 2.2 HP solar pump with auto tracker

Figure 3.3 shows the flow rate and solar intensity data with respect to time collected from the BAEC 2.2 HP solar pump without any tracker. First curve of the figure contains the time of a day in its X axis and flow rate in L/hr on Y axis. On other hand the second one shows the solar intensity on different time of a day.

While Figure 3.4 shows the flow rate and solar intensity data with respect to time collected from the BAEC 2.2 HP solar pump with auto tracker. The most important findings is that the auto tracker increase the flow rate i.e. the solar pump's performance up to 30%

These data are collect in March 2011, which is medium day time that is why at 4.00 pm solar intensity and also water flow rate are better than comparatively November 2010

4. Conclusion:

Initial investment for solar pumping technology is very high, while operation and maintenance cost is very low. However, for mass-scale commercial operation this needs to be economically viable compared to its conventional alternatives. If the farmer uses solar pumping system in irrigation purpose then load of the notional grid will slow down and will save CO_2 emission from our atmosphere.

5.References:

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