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OPTIMIZING THE EFFICIENCY OF SOLAR PHOTO VOLTAIC SYSTEM BY RETROFIT DESIGNING OF MODULES

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ABSTRACT

In day today life because of lack energy resources man move towards renewable energy source .When we go towards solar system it can use the sun energy to boil water or to generate electricity. Our aim is to develop a system which uses solar energy in both form thermal and solar form. The Hybrid Solar Solution is able to produce more electricity than PV, more reliable hot water than solar thermal, and heating at a better CoP than most conventional heat pumps - all with little or no CO_2emissions. Current projections suggest that a PV-T will produce sufficient electricity over the course of the year to cover the demand of the heat pump, which will meet a reasonably insulated building's total annual heating and hot water requirements. Further to this the incorporation of a solar thermally charged. The efficiency of the system to a point that it outperforms any thermal system or solar system.

KEYWORDS: RENEWABLE ENERGY, HYBRID SOLAR THERMAL, CoP

INTRODUCTION

The trend with photovoltaic (PV) installations is towards building integrated systems, and while this is advantageous in many regards, there are problems associated with conventional methods of integrating PV directly into a building. The main problem with building integrated photovoltaic systems is heat buildup under the PV modules. The heat produced can be as much as 50°C (90°F) over ambient temperature resulting in two concerns. The first is the possible structural damage from heat if panels are not vented or if heat is not recovered[1]. The second is the lower efficiency of most PV modules with increasing temperature. Crystalline cells are affected by temperature and the performance drops as cell temperature rises. It has been shown that for each °C increase in temperature, the power production drops by ~0.5%. This means that a 37 W crystalline module at 65°C is only delivering 34 W of power compared with the 25°C name plate rating. A PV module can have a stagnation temperature of 50°C above ambient if the heat is not removed. If ambient temperature is 30°C, the actual module temperature can be 80°C, or even higher, on some tiled roofs. Another issue facing installers and customers is competition for roof space and deciding on which solar technology should have priority. Covering a roof with PV modules only uses 10% to 15% of available solar energy [2]and eliminates the possibility for future solar thermal systems with much higher solar conversion efficiencies. A client may not be able to install solar panels to heat water, a pool or the building when the roof is already covered with a solar electric technology. Grid tied PV systems have a high initial cost and are generally sold only with generous incentive programs. A possible solution to the long payback situation is to see whether the "waste" solar heat can be recovered and used to lower heating costs.

THEORY

The Hybrid Solar Solution is able to produce more electricity than PV, more reliable hot water than solar thermal, and heating at a better COP than most conventional heat pumps - all with little or no CO2 emissions.

Current projections suggest that a PV-T will produce sufficient electricity over the course of the year to cover the demand of the heat pump, which will meet a reasonably insulated building's total annual heating and hot water requirements. [5]Further to this the incorporation of a solar thermally charged. ground loop increases the efficiency of the system to a point that it outperforms any heat pump based system.

This is the only integrated heating solution available on the market from which the owner can benefit from Feed In Tariff revenues whilst meeting the heating requirements of a building[3].

If we don't need warmed water in that case, the warmed water is either used immediately or is stored in a separate tank for later use

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- In night, The stored warmed water is passed through the heat pump which will have to work harder to bring the water up to temperature
- if we don't get any sun, Worst case scenario the heat pump cannot cope and so there is an electrical element in the cylinder to bring the temperature up and ensure a permanent hot water supply

PHOTOVOLTAIC PANELS (PV)

These electricity-producing panels have been available for several years and with the introduction of Feed in Tariffs are a very cost effective way of producing electricity and generating revenue. One little-mentioned drawback with PV is that as the surface temperature of the panel rises, the output drops.

SOLAR THERMAL COLLECTORS

Traditional solar thermal installations collect the sun's heat and convert this into hot water, typically meeting a property's summer hot water requirements. A major drawback is that in times of little or no sun there is little or no hot water].

HEAT PUMPS

Heat pump technology has been available for many years and installations of both ground-source and air-source systems are meeting heating demands all over the world. However, whilst these devices are potential greener than burning fossil fuels, they do still use large amounts of electricity.

THE HYBRID SOLAR SOLUTION

The Hybrid Solar Solution combines all three of the above technologies in such a way that the aggregate system outputs are far greater than those produced by the components individually[6].How? PV, as already mentioned, has a linear drop-off in efficiency as the surface temperature of the panel rises. Given that PV panels are typically black and mounted in such a way as to get maximum exposure to the sun, this rise in panel temperature is inevitable. PV panels typically lose efficiency of up to 0.5% per degree rise in panel temperature[4]. However the Hybrid Solar Solution combines both the PV and Thermal elements onto a single panel - a photovoltaic thermal (or PV-T) collector[3]. This has two main advantages; firstly, by drawing heat away from the panel the electrical output is maintained at a higher level for a longer period, and secondly, with the PV and Thermal elements combined on a single panel less roof area is required, allowing for greater outputs on equivalent roof space.

EQUIPMENT

WEATHER MONITORING STATION, WATCH DOG

Solar Irradiance and ambient temperature is measured by using a Weather Monitoring Station

FIG.1 WATCHDOG IN RGPV

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MULTI-METER

A digitalmulti-meter which is able to take voltage in dc in volts and current in Ampere.

PYROMETER

Pyrometer is provided in the Weather Monitoring Station. It is used to measure Total Solar radiation.

Perforated metal panels

FIG.2 PYRANOMETER IN RGPV

Sun light

Fig.3 SPECIALLY DESIGN SOLAR PANEL

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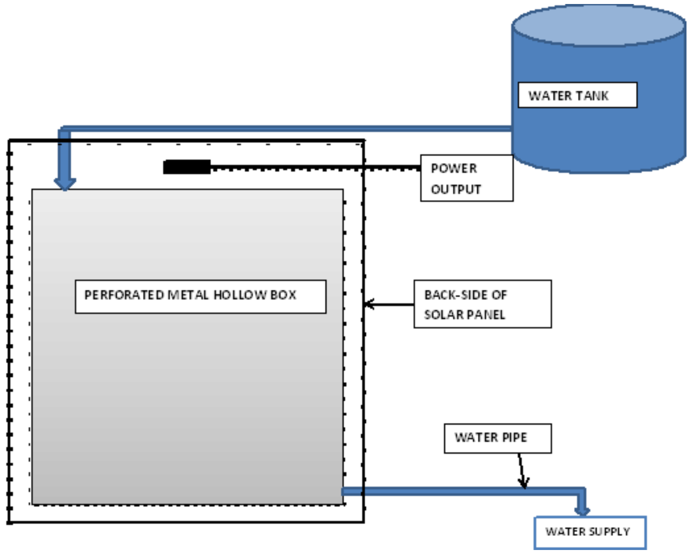

FIG.4 WORKING LINE DIAGRAM OF PROJECT

WORKING

In PV system because of sunlight huge amount of heat is produce at the back and front of the solar panel and temperature is raised up to 70degree at the back of the solar panel. And because of that reason the efficiency of the panel is decrease to certain level according to heat. Hence I put the metal sheet in direct contact with the solar panel at its back and result of that it absorbs all the heat of solar panel. And water is flowing through the metal sheet take water and get out. And back of the panel is not heated up, as result of that eff. Of panel is not decrease and the heat produce at the back of panel is utilized to heat up the water flowing through it.

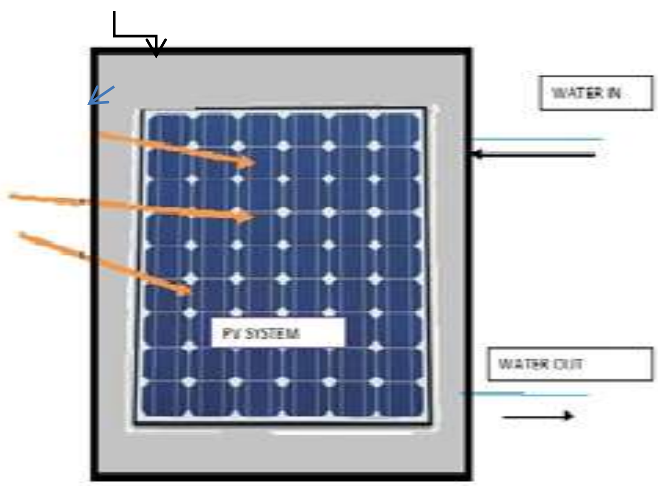

Fig .5.ARRANGEMENT OF SOLAR PANEL, PERFORATED METAL PANEL AND NOZZLES

TABLE-1:-OBSERVATION TABLE

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DATE OF EXPERMENT 2014	WATER FLOW	SOLAR FLUX Watts/m^2	CURRENT AMPS	VOLTAGE VOLTS	POWER WATTS	EFFICIENCY %
19-FEB	ON	540	1.53	18.01	27.55	17.25
19-JAN	OFF	545	1.49	17.98	26.19	16.25
27-FEB	ON	890	1.79	19.2	34.36	19.96
27-FEB	OFF	560	1.41	17.67	25.97	15.68
03-MAR	ON	540	1.68	18.49	31.06	19.45
03-MAR	OFF	150	0.26	17.4	4.52	10.20
27-MAR	ON	600	1.81	19.1	34.57	19.48
27-MAR	OFF	560	1.35	18.66	25.19	15.20
3-APRIL	ON	620	1.81	19.35	35.02	19.09
3-APRIL	OFF	590	1.28	18.58	23.78	13.62
22-APRIL	ON	440	1.42	17.25	24.49	18.82
22-APRIL	OFF	360	1.05	16.4	17.22	16.170
5-MAY	ON	820	1.82	19.8	36.04	14.85
5-MAY	OFF	720	1.68	17.66	29.66	13.93
16-MAY	ON	780	1.84	19.89	36.59	15.86
16-MAY	OFF	560	1.42	18.30	25.99	15.68
30-MAY	ON	200	0.68	17.25	11.73	19.82
30-MAY	OFF	460	1.23	16.89	20.77	15.26

Area of solar PV panel "A_c":-0.2958m^2
Formula used to calculate the efficiency "**η**":-

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$$\eta = \frac{V \times I}{E \times Ac}$$

where,

η=Efficiency,**V=**Voltage,**I=**Current,
E=Solar Flux,**$A_{c=}$**Area Of Solar PV Panel

TABLE-2:-Efficiency data with water circulation and without water circulation

S/NO.	WATER CIRCULATION	EFFICIENCY"%" (AVG. DATA OF VARIOUS READINGS)
1	Off	14.068
2	On	19.28

SALIENT POINTS OF THE OBSERVATIONS

The following points were salient points of the observations.

(a) Solar Irradiance (radiation) is time varying.

(b) Conversion efficiency of varies with the panel temperature as well as the cooling system is not running or running i.e.water circulation status – OFF or ON.

(c) Therefore it is a matter of great interest to establish the causal effect of panel temperature and cooling action on the conversion efficiency. The conversion efficiency at different panel temperatures and water circulation status – OFF and ON, is tabulated at above table.

(d) With the time without water circulation efficiency of panel is dropping and with the water circulation the efficiency is almost constant.

CONCLUSION

Hence with this we are able to achievedalmost 5.212 % of efficiency improvement in the solar system of 0.2958m^2area, at a maximum of 1060Watts/m^2 of irradiation and 19% efficiency this should produce up to37W of electrical power. (at the same time this means that about 40 W of thermal power could potentially be harnessed).

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