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Design and Fabrication of Solar water Heater with PV Electric Generation System

Neha M. Thakre*[1] | Prof. K. N. Wagh[1]

[1]Department of Mechanical Engineering,, Guru Nanak Institute of Technology, Nagpur, Maharashtra, India.

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ABSTRACT

The solar energy option has been identified as one of the promising alternative energy sources for the future. The solar energy supply is variable in the daytime. It is zero at night, so, it is necessary to store a considerable amount of solar energy during the day time to meet the demands at night. In today's generation, we needed Electricity every hour. Solar energy is generated for electricity generation and water heating by as per applications like industrial, commercial, and residential. It cans easily energy drawn from direct sunlight. In this project, we have reviewed the advanced solar water heater with an electricity generation system and discussed their future trends and aspects. The project also tries to discuss its power generation, water heating, working, and its analysis, emphasize the various applications and methods to promote the benefits of solar energy. The solar water heater is one of the most widely known solar thermal applications. In terms of installation expenditures and energy cost over the total life of the system found cheaper, solar power generation and water heating technology has proven to be cost-effective for several domestic and industrial applications. The technological practicability of these systems has long been recognized and it is presently employed in commercial sectors of many countries.

KEYWORDS: *Solar energy, water heater, battery, power generation, heating filament etc.*

I. INTRODUCTION

Nowadays, due to the decreasing amount of non-renewable energy resources, the research in the last ten years becomes more important for the per-watt cost of solar energy. It will be efficient and grow as better technology in terms of both cost and applications. Everyday earth receives sunlight above (1366W approx.) This is an unlimited source of energy that is available at no cost. One of the most important benefits of solar energy over other conventional power generators is that it is free of cost and can be directly converted into electrical energy with the use of the smallest photovoltaic (PV) solar cells. There have been a large number of research activities to combine the sun's energy into electrical energy by developing solar cells/panels/modules with a high conversion factor.

In this research, the solar water heating function is added to its generation. The most advantages of solar energy are that it is free reachable to common people and available in large quantities of supply compared to that of the price of various fossil fuels and oils in the past ten years. Moreover, solar energy requires considerably lower manpower over conventional energy production technology. In today's climate of growing energy needs and increasing environmental conceal, alternatives to

the use of non-renewable and polluting fossil fuels have to be investigated. One such alternative is solar energy. Solar energy is a clean and abundant energy resource that can be used for electricity generation and heat, such as advanced solar water heating & power generation system. it is trying to make an advanced level to commercialize it in many countries of the world including India. Their technical feasibility and economic viability has been still carried to research.

It is now recognized as a reliable product that saves substantial amongst of electricity, heating or other conventional fuels, leads to peak load reduction and prevents the emission of carbon dioxide as a major greenhouse gas. Thus in the principle, solar energy could supply all the present and future energy needs of the world on a continuing basis. Professionals are trying their level best to make the efficient design of advanced solar water with electricity generation system set up.

II. LITERATURE SURVEY

1. Collectors used in modern heating systems

Solar thermal collectors capture and retain heat from the sun and then transfer this heat to a liquid. Two important physical principles that govern the technology of solar thermal collectors are used to supplement many of our energy needs.

• Any hot object ultimately returns to thermal equilibrium with its environment, due to heat losses from the hot object. The processes that result in this heat loss are conduction, convection, and radiation. The efficiency of the solar thermal collector is directly related to the heat losses from the collector surface (efficiency being defined as the proportion of heat energy that can be retained for a predefined period of time). Within the context of a solar collector, convection and radiation are the most important sources of heat losses. Thermal insulation is used just to slow down the heat loss from a hot object to its environment.

• Heat is lost more rapidly if the temperature difference between the hot object and its environment is more. Heat losses are predominantly governed by the thermal gradient between the temperature of the collector surface and the ambient temperature. Conduction, convection as well as radiation occur more rapidly over large thermal surface gradients.

The simplest approach for solar heating of water is to simply mount a metal tank filled with water in a sunny place. The heat from the sun would then heat the metal tank and the water inside too. Indeed, this was how the very first SWH systems worked more than a century ago However, this setup would be highly inefficient due to an oversight of the equilibrium effect, above: once when the tank and water have started to gain up the heat, the heat gained would be lost back to the environment, ultimately until the water in the tank would be equal to the ambient temperature. The challenge is therefore to limit the heat losses from the tank, thus delaying the time until thermal equilibrium is attained.

2. A CARRILLO ANDRE´S and J. M. CEJUDO LO´PEZ†: Investigated on the experiment on new TRNSYS model for solar domestic water heaters with horizontal storage and a mantle heat exchanger has been developed. Some new features have been added to the standard cost, a cx specific heat capacity of the fluid TRNSYS model Types 45 and 38. Heat transfer inside the tank can be treated with a fixed node approach or a plug-flow approach, including all possible combinations of both approaches. The mantle heat exchanger is modeled by setting the heat balance between the nodes of a discretized external annulus and the storage W/m2 /K tank. The resulting system is solved by a second-order implicit method. Inlet mixing is allowed by the definition of a mixing zone around the inlet,

3. Y.C. Soo Too, G.L. Morrison *, M. Behnia: Performed on the experiments on the characteristics of a solar water heater incorporating a vertical mantle heat exchanger with a narrow annular spacing of 3 mm and a two-pass arrangement has been studied. The measured overall heat transfer coefficient-area product of the narrow gap mantle heat exchanger was found to be 150–213 W/K for flow rates of 2–3.8 L/min.

4. H. Sheng Xue: Investigated on the experiments on the domestic solar water heater with solar collector coupled phase-change energy storage. Due to the low thermal conductivity and high viscosity of the PCM, and absent intensification of thermal conductivity and heat transfer, heat transfer in the PCM module is repressed; thermal performance of the DSWHSCPHES underexposure is inferior to that of the TWGETSWH with an identical collector area and to the collector running at a constant flow rate test. Radiation and initial water temperature have impacts on system performance; increasing the proportion of diffuse to global radiation and initial water.

5. Ajay Kumar, Department of Electronics Engineering, IIITDM, Chennai, India. The given project deals with the design of the Reverse Flat Plate Collector which increases the efficiency of the solar water heating system. A normal flat plate collector that is available in the market has less efficiency due to various losses. Major losses being convection losses from absorber plate to glass which is 20 to 30 %. RFPC eliminates this loss and also we have used the same area for producing electricity using the solar voltaic plate. The experimental result is found to be that RFPC is better in efficiency.

III. PROBLEM DEFINITION

Solar radiation can be widely used for the generation of electricity and water heating purpose, as well as a supporting energy source for central heating installations. Commonly, water heating integrated systems for buildings have two parts: a solar energy collector and a water storage tank. The solar collector is the key component of solar heating systems. They collect the energy from the sun, transform its radiation into heat, and then transfer that heat to a fluid. Solar water heating mechanism can be either active or passive, but the most commonly used is an active mechanism. The active mechanism relies on pumps to move the liquid between the collector and the storage tank, while the passive mechanism relies on gravity and the tendency for water to naturally circulate as it is heated. The performance of this solar system depends on the collector. The collector absorbs the maximum amount of heat from the sun and this energy is used for heating the water. But in our recent research project, we can obtain both water heating and power generation system. Now a day's many compact design of solar water heater is available but optimize this technique it may very useful for future application.

The research is still continuing in this system to improve its efficiency. We also try to make our research-oriented topic into the fabrication of the working model. It may have some approximate consideration while its implementation. And in output, we get a considerable amount of power generation and heated water through it.

IV. OBJECTIVES

In the present scenario, the demand for power and heat is more. To fulfill this demand is required to maintain or increase the power generation for residential and commercial use. The existing, conventional sources like Coal, Oil, water, and uranium may not be sufficient to meet this need of people and industrial growth or explosion. So we are in concern that the technology to obtain power and heat from renewable energy sources are to be developed in scope to minimize the power generation and heat lost and with a low capital loss and also low running cost. We have to study and analyze the solar water heater with a PV electric generation system, whatever the difficulties, derived output, and an error is come out, we have to minimize it as possible we can.

- A clean energy source for the system
- Advance level of technique is added to derive the desired output
- Solar power generation with the photovoltaic cell is added
- Solar water heating technique is to replace with this new technology
- Output power generation and the water heater are to be measure and tested.

V. PROPOSED PLAN OF WORK

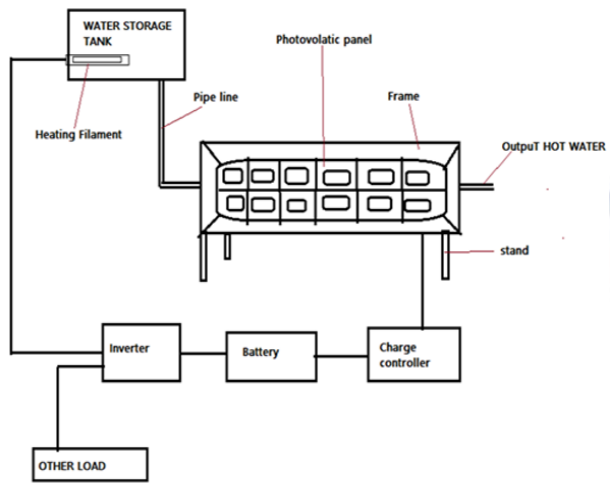

Fig 1: Solar water heater with PV electric generation

VI. WORKING

- The system comprises a water tank, frame, PV panel, copper tube, heating filament, charge controller, battery and inverter.
- The water tank is used to store cold water. The frame used in the system consisting of the photovoltaic panel and copper tubes as a solar energy absorber. We have constructed the frame in this manner; it increases the heat capturing efficiency of copper tubes and photovoltaic panel.
- The photovoltaic panel is responsible for the generation of electricity. This generated electricity is passed through the charge controller then it

stored into battery. The inverter circuit board is attached to the battery, by which heating filament is operated. This heating filament is inserting into the water tank to heat the water.

• The outlet pipe of the water tank is passed through a frame in which the copper tube is attached. The solar energy absorber is a heat exchanger capable of using solar radiation to increase the internal energy and temperature of a working fluid. Simply it consists of a copper tube exposed to solar radiation. The temperature of the tube wall increases until the heat loss from the tube to the surroundings is equal to the solar energy absorbed. And at the final stage, we obtained hot water at the output.

• Also, we obtained electricity, which further used for other work like to operate water pump motor, lights, etc.

VII. Scope

• We can construct a large system for a better large output of hot water and electricity generation

• We can add a tracker to track the sun rays to increase more efficiency of the heating systems and power generation. Also, improve the automatic tracking system with stepper motor can also be used to track the sun with more precise steps. Problem-related to solar radiation discontinuity due to clouds during automatic tracking can also be eliminated, using more advanced electronics.

• The solar radiation is available sufficiently over the country. Solar water heating has enormous scope within domestic and industrial sectors of India especially in textile industries where hot water accounts for as much as 70% of the total energy demands.

• To improve the performance of the solar water heating system, solar water heating systems with various heat transfer enhancement techniques include collector design, collector tilt angle, coating of pipes, fluid flow rate, thermal insulation, integrated collector storage, use of phase change materials, and insertion of twisted tapes.

VIII. Conclusion

The review of the modified solar water heater with PV electric generation, widely investigated both analytically and experimentally. A modified solar water heating system is a great way to reduce energy costs associated with heating water. A remarkable increase in the efficiency of the current study in comparison with an existing solar water heater can be achieved such as reducing the thermal energy loss and cost. Some modified solar water heating design has been introduced in the market and is more commonly utilized in the tropical regions of developing countries.

• Most of the people are aware of non-renewable energy resources. Solar energy has become increasingly more popular due to its economic benefits. By on Battery Backup, solar power can even provide Electricity 24x7, even on cloudy days and in the dark. This also used with an inter-grid System with Continuously Power supply. It has more benefits compared to other forms of energy like fossil fuels and petroleum deposits. It is an alternative that is the promise and consistent to meet the high energy demand. Research on solar cell and solar energy is promising has a future worldwide

References

[1] Saleem Raza Samo, Asif Ali Siyal"Analysis Of An Active And Passive Solar Water Heating System", Sixteenth International Water Technology Conference, IWTC 16 2012, Istanbul, Turkey, Volume 3 May 2003.

[2] Mr.Govind Singh Chouhan, Mr.Ram Kumar Agarwal " Experimental Analysis Of Batch Type Solar Heater With Integrated Collector Storage Tank", International Journal of Emerging Technology & Advanced Engineering, Volume 3, Issue 5, May 2013.

[3] B.K.Gond, M.K.Gaur, C.S.Malvi "Manufacturing And Performance Analysis Of Solar Flat Plate Collector With Phase Change Material", International Journal of Emerging Technology & Advanced Engineering, Volume 2, Issue 3, March 2012.

[4] Dilip Johari, Ashok Yadav " Study Of Solar Water Based On Exergy Analsis", National Conference on Trends and Advances in Mechanical Engineering, volume (3) 4, 139-147,2007.

[5] Samara Sadrin, Maherin Hossain "Alternative Solar Water Heater for Domestic Purpose" Journal of Mechanical and Civil Engineering, 64-70, 2014.

[6] R.Herrero Martin, A.Gracia Pinar "Experimental Heat Transfer Research In Enhanced Flat Plate Solar Collectors", World Renewable Energy Congress Sweden May 2011.

[7] Ajay Kumar, Vinay Yadav "Advanced Solar Water Heating With Electricity Generation" Journal of Engineering, Computer& Engineering Science, Volume 1(2), November 2012.

[8] BAA Yousef " Performance Analysis Of Flat Plate Collector With And Without Porous Medium" Alternative and Renewable Energy Laboratory, Institute of Advanced Technology University Putra Malaysia Renewable Energy, 28 (2003), 1325-1339

[9] Pravin N.Gajbhiye, Rupesh S Shelke "Solar Energy Concentration Technique in Flat Plat Collector". International Journal of Mechanical Engineering and Technology (IJMET), Volume 3, Issue 3, September – December 2012.

[10] Arun Venu, Arun.P "Simulation Studies On Porous Medium Integrated Dual Purpose Solar Collector", International Journal of Renewable Energy Research, Vol.3 No.1 2013.