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Advance Hybrid Solar Energy Saver Heater with Electrical backup

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ABSTRACT:- A Solar Water Heater is a device which provides hot water for any purpose using Sun's thermal energy for heating the water. It is generally installed at the terrace or where sunlight is available. The water gets heated during day time and is stored in an insulated storage tank for use when required including mornings. Solar water for the domestic purpose are very popular as they suffice the need of hot water for bathing, washing, cleaning etc., particularly on cold days, But during rainy or cloudy season alternate solution is that installation of the electric heating device. It is the heating and non-heating of the thermostat through the on and off. The general concept of insulation is short-time heating. When heating, the rated power of the water heater is still used. After the circuit is connected, if the water temperature is lower than 50 °C, the temperature controller is automatically turned on, the water heater is heated at the beginning, and the water temperature reaches the preset temperature of the water heater (75 ° C to 85 ° C), the thermostat is disconnected, and the water heater stops heating. The energy of the sun, the light of the sun, is composed of heat and sunlight. Both can be captured, converted and used at home to add hot water. The thermo siphon solar water heater consists of a tank (accumulator) and a solar collector connected to the tank.

KEYWORDS:- Temperature, SWH, solar energy, thermosiphon

I. INTRODUCTION

Solar Water Heating (SWH) is the process of converting sunlight into renewable energy to heat water using a solar thermal collector. Solar water heating systems comprise of various technologies that are increasingly used worldwide. Solar energy is diurnal and seasonal in nature. Solar energy can be used for heating water / air for any process applications and generating electricity using photovoltaics. Solar Domestic Hot Water System is not entirely new. In 19th century, black painted metal tanks filled with water were used to absorb solar energy. It had the disadvantage of rapid loss of its heat because it had no insulation. In 1891, Clarence Kemp patented by adding a metal panel to the tank in order to improve the efficiency of the solar tank. In 1909, William Bailey started selling day and night solar water heater with a coiled pipe collector inside a glass covered box and a separate insulated indoor water storage tank mounted above the collector thereby allowing hot water circulation by natural convection. By 1960s, simple solar water heater with a basin and top glass cover were used in large numbers in Japan. Usage 2 of Solar Water Heaters increases globally to meet out the energy crisis, deficit and increase in cost of fossil fuels. This attempt to utilize renewable solar energy also reduces the carbon emission into the atmosphere. A solar water heater unit consists of components such as solar collector, storage tank, heat exchanger, circulation pump, connecting pipe lines etc. The solar collector transforms the solar radiation into thermal energy. The following are the advantages of FPC: Simple construction and relatively low cost, and there is no mechanism for tracking the diurnal motion of sun, both direct and diffuse radiation are used which is very important owing to the fact that approximately 40% of the total radiation is diffuse radiation

II.TYPES OF SOLAR WATER HEATERS

The two major types of collectors are Non-concentrating / Flat Plate Collectors (FPC) and concentrating (parabolic / cylindrical) collectors. FPC is the most effective and simplest of solar energy collection for low temperature applications, and concentrating types are used for high temperature applications like solar furnace, etc. The technology of heating water using solar energy is used successfully for large scale process heat applications in industries and small scale for domestic needs in order to preserve fuel reserves and avoid using high grade electrical energy for heating. A Conventional Solar water heater is provided with a solar collector and storage device separately. A compact Solar Water Heater is provided with a storage device well below the collector as an integrated unit thereby minimizing the material usage, space and consequently cost. A compact Integrated Collector – Storage type Flat Plate 3 Solar Water Heater (ICSFPSWH) has its own disadvantage of poor retention of heat during night. There is a lot of scope for improving the performance of solar water heaters by optimizing different design parameters. The objective of this research is to minimize the losses that take place from the absorber plate surface during day and night using Phase Change Materials, to improve the surface geometry of the absorber plate, to optimize the geometric parameters, and to use Phase Change Materials not as a thermal energy storage medium, but as an insulator at night, thereby to enhance

the thermal performance of Integrated Collector Storage Type Flat Plate Solar Water Heaters (ICSFPSWH). Further aim is to investigate the effect of depth, melting temperature and latent heat of fusion of different PCMs on heat transfer characteristics in ICSMFPSWH. Comparison of performance of ICSMFPSWH with different combination of parameters under similar input and environmental conditions can be performed to further conclude the optimum parameters for best performance. These novel methods are tested both theoretically by way of simple designs using Computational Fluid Dynamics, mathematical modelling and experimentally using three single glazed Integrated Collector – Storage type Movable Flat Plate Solar Water Heaters (ICSMFPSWH).

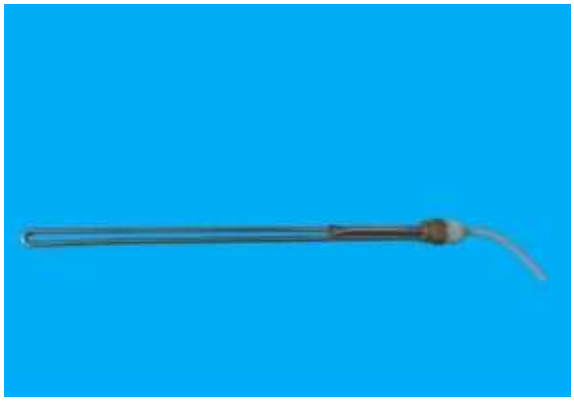
Since solar energy systems require sunlight, the bulk of production will take place under sunny conditions only. The output is directly proportional to the amount of infrared sunlight available at any given moment. A system can generate 50-70% of its typical output under bright overcast conditions. When rain or excessive days of cloudy conditions exist, the use of auxiliary backup where conventional energy will be needed. The energy emitted by the sun, the sun's rays is formed of warmth and daylight. Each is often captured, remodeled and utilized in your home to heat water.

A thermo siphon solar storage tank consists of a tank (accumulator) and a reflector that is connected to the tank.

The transfer between tank and collector is ruled by gravity (hot water density is below cold water density). Rather than a pump, the pressure differential between hot and cold is employed as propulsion energy. This is often the "thermo siphon principle". So as to work, the collector (heat generator) should be placed below the tank.

The heat transfer medium is heated within the reflector. The recent liquid within the collector below is lighter than the cold liquid within the tank higher than the collector. As shortly because the lighter hot liquid rises, gravity circulation starts

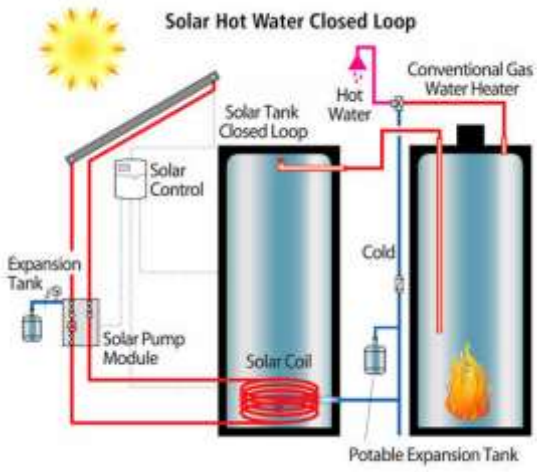
The installation of the electric heating device can perfectly solve the method of low water temperature in winter



III. Water heater auxiliary electric heating working principle:

Solar water heaters can operate in any climate. Performance varies depending, in part, on how much solar energy is available at the site and also on how cold the water comes into the system.

However on cloudy days also, if it is for a day or two, you still get warm water as water gets heated due to diffused radiation available in the atmosphere. The system, therefore, should be either connected to an electric geyser in the house or an electrical back-up should be provided in the storage tank of the system which is switched on when water is not sufficiently hot. So, you get hot water all the time even on rainy days.



It is the heating and non-heating of the thermostat through the on and off. The general concept of insulation is short-time heating. When heating, the rated power of the water heater is still used.

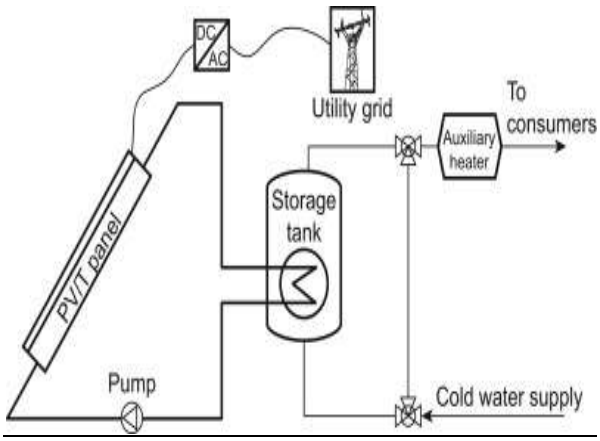
After the circuit is connected, if the water temperature is lower than 50 °C, the temperature controller is automatically turned on, the water heater is heated at the beginning, and the water temperature reaches the preset temperature of the water heater (75 ° C to 85 ° C), the thermostat is disconnected, and the water heater stops heating.

The energy of the sun, the light of the sun, is composed of heat and sunlight. Both can be captured, converted and used at home to add hot water. The thermo siphon solar water heater consists of a tank (accumulator) and a solar collector connected to the tank.

IV. Rainy season and evening solar hot water solution

If you run out of solar heated water or the water is not hot enough, your solar storage tank has a single quick recovery electric element located near the top of the tank. If it's cloudy or raining and you run out of hot water, this element will heat the top twenty gallons of water to the desired temperature.

On a cloudy day when the solar heated water is not hot enough, perhaps one hundred degrees, the upper element works like a hybrid heater and boosts the top twenty gallons to the desired temperature.



The hybrid solar system is designed to produce DHW for a single family household and to supply the electricity generated by its PV component to the grid. The hybrid solar system consists of liquid glaze inverter, a single cylindrical water storage tan d flat-plate PV/T collectors, an k with a capacity of 300 L and an immersed heat exchanger from the solar collector circuit located at the bottom of the tank, a pump, tee-piece, flow diverter, controllers, and insulated piping. Each PV/T collector has an aperture area of 1.42 m^2 and consists of 72 mono crystalline solar cells. The absorber of the PV/T collectors is constructed of copper tubes, ultrasonic welded on a copper sheet in contact with the rear panel of the PV module. The collector is suitably insulated and enclosed in an aluminum box supporting the absorber plate, the PV module, and the transparent cover. The transparent cover is a low-iron tempered glass with a thickness of 4 mm.

The pump is controlled by a differential thermostat that automatically starts the pump when the temperature difference between the output of the solar collector and the water at the bottom of the storage tank exceeds 5°C. The HTF used in the closed loop of the collectors is a waterglycol mixture of 40% by volume to prevent freezing and its flow rate is the same as the recommended by the manufacturer (45 L/(h m^2)).

An auxiliary heating unit is present as part of the system. It simply is a heater placed between the storage tank and the consumption in order to supply the auxiliary energy required to heat the water, if necessary. As all of the installation sites examined in this study are in Europe, the orientation of the solar collectors is facing toward the true south, while its tilt angle is taken equal to the latitude of each city.

The PV/T collector used for the means of this study is a commercially available product that has been experimentally tested by an approved center for the solar collector testing. Most of the system's components are identical at all three of the locations in this study, with the exception of two—the number of the PV/T collectors and the PV system inverter.

So when you run out of hot water the backup electric heating element kicks in. It's only heating the top twenty gallons, not the entire tank. When the sun returns there is cold water for a collector to heat.

V. Do solar water heaters work at night?

Solar hot-water tank sometimes systems go with a backup unit the solar water heater system is sometimes paired with a backup gas or electrical hot-water tank, Heat up water on days that don't give enough day light. Augment heating the water just in case it's not hot enough. So, if the water isn't hot enough after you want it in the dark, the backup unit helps out. You'll perpetually have quandary not matter what it's like outside.

VI. Conclusion

Hybrid solar heater with electrical backup is power saving heater as compare to normal electrical heaters or gas heaters, its best solution in rainy as well as cloudy season for solar based heater. It saves thermal energy as well as electrical energy, its very economical project for domestic use.

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