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SOLAR WATER HEATER: A REVIEW

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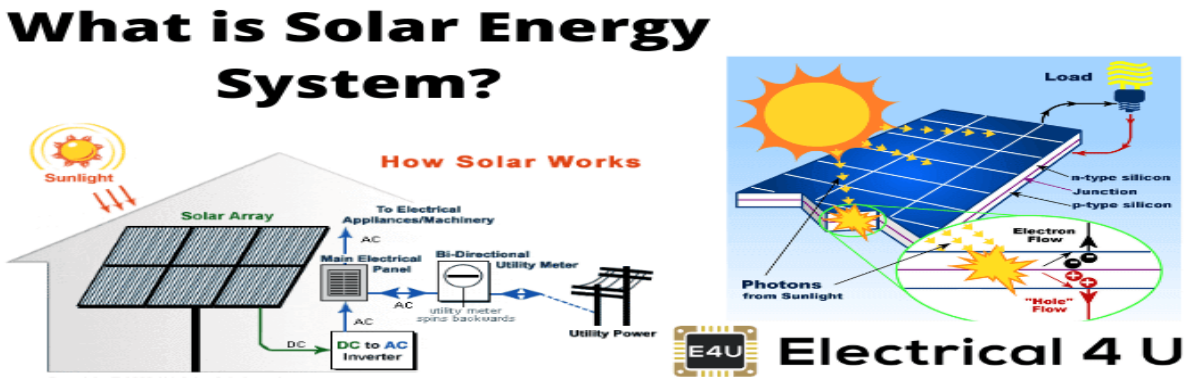
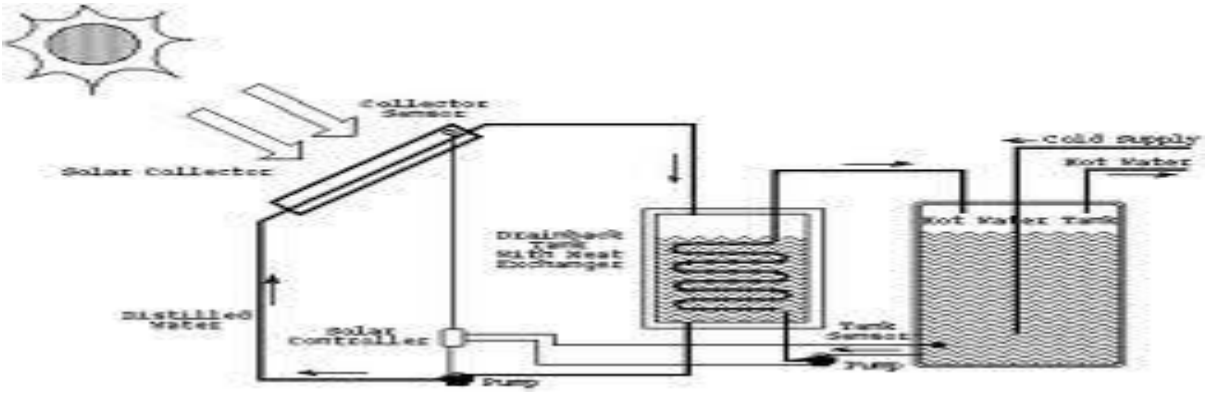
Abstract: In the present review paper, the existing solar water heating systems are studied with their applications. Solar energy is free, environmentally clean, and therefore it is accepted as one of the most promising alternative energy sources. The effective use of solar energy is hindered by the intermittent nature of its availability, limiting its use and effectiveness in domestic and industrial applications especially in water heating. Now a day, plenty of hot water is used for domestic, commercial and industrial purposes. Various resources i.e. coal, diesel, gas etc, are used to heat water and sometimes for steam production. Solar energy is the main alternative to replace the conventional energy sources. The size of the systems depends on availability of solar radiation, temperature requirement of customer, geographical condition and arrangement of the solar system, etc. Therefore, it is necessary to design the solar water heating system as per above parameters. The available literature is reviewed to understand the construction, arrangement, applications and sizing of the solar thermal system.

Keywords: collectors, solar energy, renewable energy, loops and solar water heaters.

Introduction: The sun is an incredible and renewable resource that has the power to fuel life on earth and provide clean, sustainable energy to all of its inhabitants. In fact, more energy from the sun reaches our planet in *one hour* than is used by the entire population of the world in *one year*. The sun's energy can be converted into electricity through solar photovoltaic (PV) modules (photo = light, voltaic = electricity). PV modules absorb sunlight and convert the energy into a usable form of electrical current. The sun shines all over the world, making solar electricity viable anywhere. Because solar can be paired with batteries for energy storage, solar electric systems can be independent of the utility grid, making them cost-effective for remote locations. Solar modules have no moving parts making maintenance costs low, and they are highly reliable with a long service life of 25+ years of guaranteed electricity. Solar electricity relies on the sun as its fuel source, so there is no need to drill for petroleum-based fuels, refine them, or deliver them to the site. As you can see, there are a lot of advantages of solar energy.



Solar water heating system: The Sun rays fall on the Solar Collector. A black absorbing surface (absorber) inside the collector, which absorbs solar radiation and transfers the heat energy to water flowing through it.



Heated water is collected in a tank which is insulated to prevent heat loss. Then Circulation of water from the tank through the collector and back to the tank continues automatically.
A Solar Water Heater consists of a Collector panel to collect solar energy and an Insulated Storage Tank to store hot water.

Applications: Water heating is one of the major use of solar energy, It is implemented for providing hot water for showers, dishwashers and clothes washers etc.

Application of SWHS

- Solar Water Heating System (SWHS) can be used for Homes, Community Centers, Hospitals, Nursing Homes, Hotels, Dairy Plants, Swimming Pools, Canteens, Ashrams, Hostels, Industry etc.
- Use of Solar Water Heater (SWH) can reduce electricity or fuel bills considerably.
- Among all the solar energy devices available in the market, Solar Water Heater is found to be one of the most reliable and durable.
- Solar Water Heater has longest warranty period of all other solar energy devices.
- Solar Water Heater is known to has the fastest repayment of investment.

Solar thermal collectors

Low-temperature collectors:

Unglazed mats for water heating.

Mid-temperature collectors:

Glazed and insulated collectors.

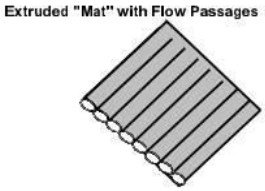
High-temperature collectors:

Evacuated tubes.

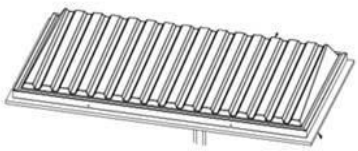
Focusing collectors.

Collector Types:

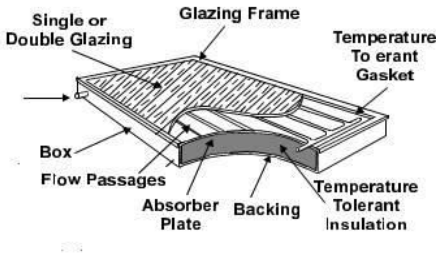
1. Unglazed



2. Low-Cost Plastic Flat Plate

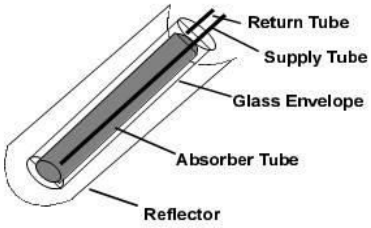


3. Glazed, Insulated Flat Plate

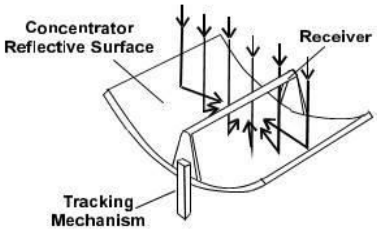


4. Integral Collector Storage (ICS)

5. Evacuated Tube



6. Parabolic Trough



Types of solar water heater:

Unglazed EPDM

Glazed Flat Plate

Evacuated Tube

Parabolic Trough

Collector Efficiency:

Energy Collected = optical gains - thermal losses

Q useful = $\tau \alpha$ I Ac - Uc Ac(Ts-Tamb)

Efficiency = Energy Collected / Incident Solar

ηsolar = Quseful / I Ac

= $\tau \alpha$ - Uc (Ts-Tamb)/I,

(a line of slope Uc and intercept $\tau \alpha$)

I= incident solar radiation (W/m2) τ = transmissivity of cover glass α = absorptivity of absorber plate Ac= collector area (m2) Quseful = useful heat from collector (W) Uc= thermal loss coefficient of collector (W/C) Ts= storage water temperature (C) Tamb= outdoor ambient temperature (C).

Conclusion : At Present, Solar water heating systems are installed with different configurations and arrangements. The basic technology concrete of these systems are studied and it is found that there is a need to work on the generated design procedure to select, install and monitor the solar water heating system as per the availability of solar radiation and local geographical condition.

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