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SURVEY BASED ECONOMICAL STUDY ON SOLAR WATER HEATING SYSTEM FOR BUILDINGS AND RESIDENTIAL AREAS

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ABSTRACT: *This paper is based on solar water heating system. The most important and costly portion of conventional solar water heating system is solar panel which contain slightly evacuated tubes and glass coating. Many categories of storage are necessary for individual launching based on type and mounting of solar power system itself, quality and its combination among traditional service setups. For scalding and its warm water operation, water and its phase shift materials (PCMs) compose assumption saving media. Rock, clay and different materials are used. Water have got the opportunity of round about 80 percent fewer quantity than water for temperature change of 10C, that is the main change among temperatures of fully charged and discharged saving tanks. Water temperature might be increased from 30C to 60C taking place in the average sunshine among outside temperature at 33C, replacing the solar panels through concrete slab resulted in the decline in price of solar water heating system through 75 percent in association with conventional solar water heating system. This paper also described that solar energy is the most capable energy source that might give the reduction of its energy utilization mainly in residential areas. It also investigates the energy efficiency and cost estimation for solar water heating systems.*

Keywords: Solar water heating system,Solar Collectors,Heat pump,Storage Tank

INTRODUCTION

Solar water heating systems have a well known usage and applications in both industrial and domestic sectors. Nowadays the energy crises is a big problem in all over the world [1]. Solar water heating system is environmental friendly but require minimum maintenance and procedure cost compared to new solar energy applications [2]. Renewable energy is the energy that comes from normal assets i-e sun light, wind, tides, rain and geothermal heat which are physically replenished (renewable) [3,4]. The mainly extensive share solar energy that covers residential areas in different countries. Transmission of solar water heating system for supplying hot water at necessary temperature for aquaculture system. The major component of the system include horizontal plate collector, auxiliary heater and storage tank [5]. Solar water heating systems were also useful to engineering practice, the outcome are quite good. The balance among routine and techno-economics indicators of solar water heating systems, it is fulfilled that the benefits of solar water heating systems varies from 2 to 8 years [6]. The energy transferred by a forced flow solar system might increased considerably. In addition the lower collector flow tariff substantial saving in system cost, essentially during decrease in plumbing costs [7]. Suitable plan for heating system was significant to declare large advantage to consumer, particularly in huge setups. Planning heating system involve suitable filler of dissimilar parts depends upon estimated cosmic insolation as well as warm water needs [8]. The thermal performance on an essential solid water heater is numerically analyzed and compared with tentative data. In the planned system the collector and the water tank are made into one part with flow of water caused by thermosyphonic force [9,10].

SOLAR WATER HEATING SYSTEMS BUILDING CODES AND REGULATIONS.

Ahead of installing solar water heating systems you should examine general building codes,zoning ordinances and sector covenants, in addition to individual management relevant to the site. We shall probably need a frame work allowing to set solar power organization against the presented framework. Neither every society and town primarily welcomes housing renewable energy installation. Even it is frequently due to lack of knowledge or the relative innovation among the endless power set up, one have to accomplish the presented framework by permitting actions for scraping the set up, framework material's cryptograph as well as bounding contract in consideration of solar setup launching was usually a territorial problem. Still assuming that stewed framework cryptograph is achieved. This is typically imposed closer to the city, country and rural community. General harms for home owners have encountered with building codes contains the following,

- Beyond Roof load.
- Improper Heat exchangers.
- Indecent Wiring.
- Illegal Tampering with clean water stores.

Motion Your Solar Water Heating System

After one purchase as well as fix a cosmic water warming setup,first of all one have to judge our cosmic supply location,more over the best possible direction and slope of our solar collector. The competence and purpose of cosmic water warming setup rely upon a huge amount of comic power approaching one living area. Cosmic water warming setup using disperse as well as focused cosmic rays. Hence one do not reside in a place where the weather is mostly hot. If ones living area has uncovered sites as well as usually confronts south, so this is high quality applicant for cosmic

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water warming setup. Our confined cosmic setup provider or else fixation may execute a cosmic area investigation.

Collector Location

Solar warm collection agency should incline physically for the accomplishment of the amount each day as well as the solar power one achieves. Likewise most appropriate direction for a solar collection agency located in north hemisphere be really south. Although recent researches reveals the point relying upon our position as well as collection agency gradient. The collection agency should confront to 90 degree of East or West of the actual South not including a lot of decreasing its routine. We also wish for consider factors for example roof orientation(if we mount the collector on roof), confined land features to facilitate collector every day,likewise periodically as well as territorial weather settings(hazy dawn or else overcast post meridian), because such elements might change our collectors direction. Fig.1

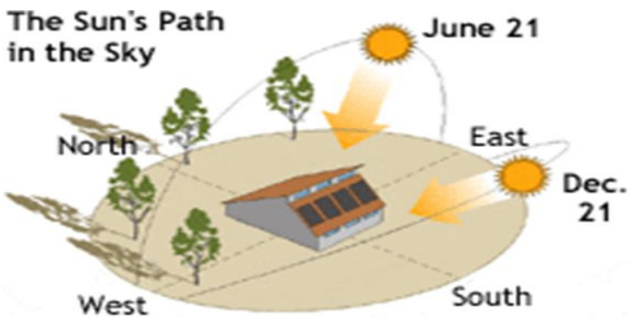

Fig.1

Collector Tilt

Nowadays the majority of Cosmic aqueous warming collecting agencies are seated horizontally on the top. This is more aesthetically better rather when they are rack seated collection agencies that sum up from the top at change angels. Therefore mainly collection agencies have similar incline as of the top one. Whereas the better inclination for collection agency similar with ones angular distance, setting up ones collector agency horizontally on inclined top does not affect huge decrease in system presentation. We will therefore want to acquire roof angle in to description while sizing our system. Fig.2

Fig.2

SOLAR WATER HEATING SYSTEM FOR HEAT EXCHANGER

Comic water heating setup utilizes heat converters to convert solar power immersed in solar power collection agency to the aqueous or else wind used to the warmth water or else the gap. Warmth converters could put up complete steel, copper, bronze, stainless steel ,Aluminum or else Cast iron. Cosmic heating setup generally utilize as it's an excellent thermal manager with better resistance to collision.

TYPES OF HEAT EXCHANGER

Heat Exchanger uses the following types.

Liquid to liquid

A liquid to liquid heat exchanger uses a heat transfer fluid that circulates during solar collector absorbs heat and then flow during heat exchanger to shift its heat in storage tank. Heat transfer fluid for example anti freeze, keep the solar collector from freezing in cold weather. Liquid to liquid heat exchangers contain one or two barriers(Single or Double Wall) among heat transfer fluid and domestic water supply. A single wall heat exchanger is a tube bounded by fluid. Moreover the fluid transient during the tubing or the fluid adjacent the tubing can be heat transfer fluid,even as other fluid is clean water.

Double wall heaters exchangers contain two wall among two fluids. Two walls are regularly used when heat transfer fluid is lethal, for example ethylene glycol (antifreeze). Dual walls are frequently necessary as safety compute in case of leaks, serving ensure that the antifreeze does not merge with the clean water provide. The example of double wall liquid to liquid heat exchanger is the loop around heat exchanger,in which a tube is wrapped about and bonded to the faint of hot water tank. The tube should be effectively insulate to decrease heat losses. Although double wall heat exchanger boost safety. They are less competent since heat must move during two surfaces slightly than one. To convey the same quantity of heat,a double wall heat exchanger must be superior than a single wall exchanger.

Air to Liquid

Solar heating systems through air heaters collectors generally do not require a heat exchanger among the solar collector and the air circulation system. Individual systems with air heater collector that heat water, utilize air to liquid heat exchanger which are related to liquid to air heat exchangers.

Sizing

Heat exchanger should be be measured rightly for becoming effective. Many elements are there to consider for suitable measuring as well as the perusing,

- Category of heat exchange.
- Heat transfer fluid individuality (viscosity, density and specific heat).
- Surge rate.
- Cove and vent temperatures for every fluid.

Generally makers may provide warmth exchange ratings for ones warmth converters (in btu /hr) for change solvents temperature along with increased rates. Although the amount of warmth conversion surface area affects the competence and

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speed, huge surface area converts warmth quickly and capably.

Implementation

Top recital and for ever pursue the manufacturers setting recommendation heat converter. Be confident for choosing a heat converter fluid which should be in concordance with the type of heat converter one will be utilizing. But one wishes to build ones personal heat converter, be cautious while utilizing different metals in heat conversion set up can lead to collision. Since various metals may be having dissimilar thermal expansion and reduction qualities, cracks, leakages could expand . Moreover these situations can decrease the life time of one heat converter.

TRANSFER HEAT SOLVENTS FOR SOLAR WATER HEATING SETUPS

Heat transfer fluid bears heat during solar collector and heat exchanger to heat storage tank in solar water heating systems. While selecting heat transfer fluid, our solar heating service provider must think the following criteria.

- Transmittance of expansion , incomplete variation in length (often in capacity whereas nominal of the substance of the unit variation in temperature .
- Glutinosity of solvent often conflicts to absolute pressures.
- Thermal ability, the capacity, focus on stock heat.
- The icing point, a degree below which a solvent is changed to solid.
- The vaporizing point at which a solvent boils.
- The activating point is when a solvent is made into ignition in air at a lesser temperature.

For a better description in low degree temperatures the cosmic water warming systems require the solvents of low icing points. The substances features higher temperature in hot weather should have vaporizing points. Glutinosity as well as heating ability verify amount of encampment power needed. Lesser viscosity solvents as well as more appropriate heat is effortlessly pumped up because its defiant to surge to a lesser extent and converts excess heat. Fig.3

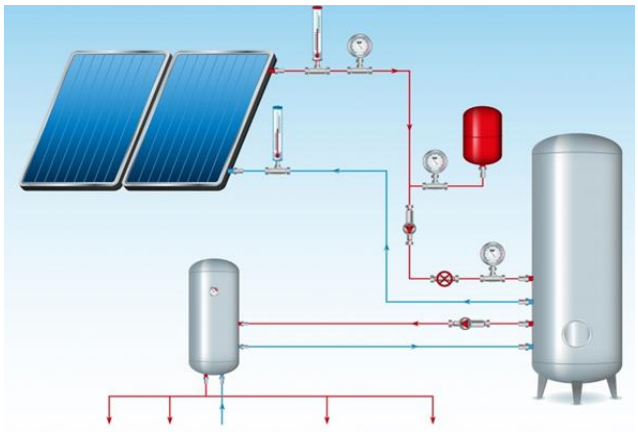

Fig.3

TYPES OF HEAT TRANSFER FLUIDS

Several commonly utilized heat exchanger fluids as well as its characteristics are explained. Describe a cosmic heating analyst or else the territorial energy having domination to assortment of the needs for heat exchange fluid in cosmic water heating set up in ones area .

Air

Air do not have the ability to vaporize or else glaciate as well as it is non erosive. Despite that air has a very little heating ability that renders to elude out of the collectors, suppressors, as well as tubes.

Water

Water is not costly and do not cause any harm. Between a high specific heat as well as a lesser viscosity to run out is easy. Less likely water vaporizes at a lower degree and freezes at a higher temperature. When the water PH (Acidity / Alkalinity) is not kept at the partial level it can become corrosive. There is a very excess amount of mineral consistency (hard water) that could crush the mineral banks to remodel in collecting duct as well as plumbing set up.

Glycol/Water Mixtures

The mixture of glycol/water is composed of 50/50 ratio or else a 60 /40 glycol to water ratio. Propylene glycol as well as ethylene glycol was made antifreeze .These mixtures are having efficient icing screen as long as the appropriate antifreeze observation is kept. These antifreeze solvents reduce over time and are rather changed every 3 to 5 years of time period. Such kind of set ups are hurried as well as should be only be employed by a skilled cosmic heating expert.

Hydrocarbon Oils

The hydrocarbon oils possess much greater glutinosity and a lesser specific heat than water. More power is required for encampment. Such kind of oil is cost effective having a low icing point. The necessary groups of hydrocarbon oils comprises of artificial hydrocarbons, paraffin hydrocarbons and scented purified mineral oils. The temperature range of paraffin hydrocarbon is between the icing point and vaporizing point of water, in spite the fact that these are dangerous as well as needs a closed loop, doubled wall heat converter.

Refrigerants/Phase Change Fluids

Such substances are utilized in the form of heat converter fluids in air conditioners,refrigerators as well as heat pumps. These usually possess a lower vaporizing point and a higher heat capability. So this empowers a lesser quantity of refrigerant to shift a greater quantity of heat most effectively. These freeze items responds promptly to solar heating setup, making them highly efficient than other converting fluids in cloudy weather. The heat incorporation happens after the freeze items vaporize in cosmic collector. It releases the collected heat occurring when the gaseous freeze item condenses into liquid form again in heat converter or condenser.

Silicones

The silicones possess a very lesser degree of icing point,as well as a greater degree of vaporizing point. Silicones are non erosive as well as chronic. Silicones consists of greater glutinosity as well as lesser heat capability, higher amount of energy is needed for handling. They are leaked easily in microscopic holes in cosmic loop.

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MAINTENANCE AND REPAIR FOR SOLAR WATER HEATING SYSTEM

Moreover often the components must require revamp or else renovation . One must get manoeuvres too for avoiding measures, freezing as well as corrosion. One has to possess ability to grip few scrutiny as well as protection procedures in ones control. Except other must need a skilled technician. Request for cost approximation in script by having completed the task anyhow. In certain setups, they might have been cost efficient for changing, close up or else take out cosmic setup as compared to be restored.

Survey Points

These are few recommended inspection of solar mechanisms. Moreover, study ones own operating instructions in a recommended reparation program.

Collector Covering

Optically ensure the collectors covering through out whole twenty four hours (dawn , twelve noon as well as high noon) as an yearly ground work. Covering preserves great influence on functioning of cosmic collecting agencies. The plants vegetation as well as any renovation in ones home or someone else home land must create a covering which has not been present where collectors were launched.

Collector Contamination

Soiled as well as contaminated aggravators may not execute properly. Cyclic clean up might be essential for hot dust covered weather.

Collector Coating and Packing

Check out the breaks of collector coating as well as make sure for checking the breaks may be in fine form. If plastic coatings extremely rusted might require being replaced.

Plumbing and wiring connections

Pipe should be irrevocable along adhesive component. Every circuit connection must be closely constrained.

Roof Penetrations

Irregular and sealant about roof penetration must be in excellent condition.

Pressure Relief Valve (on liquid solar heating collectors)

We have to make sure that the entire valve used is not stuck open or closed.

Pumps or Blowers

Confirm that supply pumps or blowers are in service. Pay attention to observe if they move towards as the sun rays fall on the collectors at mid noon. But one might not pay attention to push or else blow dryer working,moreover the collecting agent may be out of order.

Heat Converting Solvents

Anti icing mixtures in solvent cosmic collectors required replacement occasionally. This is a job for capable technician,but water through high mineral substance (lime water) spreaded over collectors. In organic substances rising in piping might required detachment through addition of de scaling agents as well as a low PH acidic solutions periodically.

Saving Setups

Make sure that saving gallons are not cracked, leaked or having symbols of erosion.

Protecting Mounting And Erosion

Among the main factors one is the disturbing routine of suitably located as well as launched cosmic water heating systems contain mounting in solvents or hydronic based setups and erosion in hydronic and air setups.

Mounting

Local water which is greater in minerals content (lime water) might root out build up or mounting of minerals (calcium) collection in hydronic solar setup. Collected amount decrease set up routine to a numeral way when water is used as heat transfer solvent by once set up, scaling might happen in collector, sharing piping as well as heat converter. Set ups utilize further kinds of heat converter solvents (glycol, antifreeze) mounting might take place over the surface of heat converter which converts heat from cosmic collector to local water.

Corrosion

Mainly well made solar systems practice minimal corrosion. While they do,it is typically galvanic corrosion, an electrolytic method caused by two different metals in contact with each other. One metal has stronger helpful electrical charge and pulls electrons from the other,resulting one metal to corrode.

ENERGY EFFICIENCY AND COST ESTIMATION IN SOLAR WATER HEATERS

The cosmic water heating set up usually is costly to acquire as well as attached easily than the casual water warming setup. Merely a cosmic water heater could in a typical manner by making one's money in the long term. The amount of money one preserves contingent on these factors.

- Amount of warm water one utilizes.
- Ones setup efficacy .
- Ones geological site as well as cosmic supply.
- The already present fiscal as well as motivator.
- The price of general fuel resources (oil , electricity as well as gas).
- Fuel is much costly one utilizes for the reserve water heating setup , one have.

Usually when one set up a comic water warming heater, ones water warming cost reduces 50 to 80 percent.

Energy Efficiency of Solar Water Heater

One has to use Solar Energy Factor (SEF) as well as Solar fraction (Sf) for searching out the cosmic water heater's power effectively. The solar energy factor which is described as the power transferred by the setup subdivided through the electricity or gas resources settled in the setup. When the quantity is greater it should be of higher power capacity. The comic energy characteristics spectrum comprises from 1 to 11. The set up with cosmic energy factors of 2 to 3 are more common.

Solar fraction is the part of total conventional hot water heating load (shifted energy and standby tank losses). Higher the solar fraction value, greater the role to water

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heating,which reduces the energy essential by backup water heater. Solar fraction varies from 0 to 1. Usually solar factors are 0.5 to 0.75.

Annual Cost Calculations

Mean while shopping a cosmic water heating setup,approximately an yearly working prices as well as matching up with several setups. These assist one to decide power saving as well as profit time for leveraging in greater power effective setup. Before you select and contrast the cost of different systems,you required to make out this set up measures for ones living areas. For calculating yearly operational charges of cosmic water heating setup, one should need a setup cosmic Energy Factor (SEF) as well as a support fuel reservoir types (Electric or else Gas) as well as values (territorial service may give the existing prices).

For secondary Gas Tank System

For gas tank system we have to take unit fuel cost in BTU or in therm (1therm=100,000BTU).

For yearly calculation:

365*41000/SEF*Fuelcost = Annual estimation cost.

Where 41000 is the gas tank capacity

If calculated in unit therm,

365*0.41/SEF*fuel cost = Annual estimated cost.

Let suppose SEF = 1.1 and Gas cost = 1.10 dollar/therm,

365*0.41/1.1*1.10 = 149.65 Dollars.

Everyday power utilization as stated earlier equation depends upon DOE test procedure of water warmers which is estimated as internal 58F degrees, warm water temperature of 135F degrees as well as a sum up of warm water producing 64.3 gallons each day that gives approximate utility of a living area having 3 persons.

With Furnished Electric Tank System

In electric tank system we take electricity unit cost per day in kilowatt hour (kwhr).

365*12/SEF*electricity cost = Annual estimated cost.

Let suppose SEF = 2.0 and electricity cost = 0.08/kwhr

365*12/2.0*0.08 = 175.2 dollars

When one realizes to achieve, the yearly functioning charges of cosmic water warming setups one needs for evaluation, one could discover an associated charges along with traditional water heating setup as well as managing both of them.

CONCLUSION

Solar water heating system is the successful technologies that changes Cosmic Energy to Thermal power as well as it have employed for residential as well as commercial practice. Current development of heat handling comprised upon cosmic collecting practice that shows capability architecture for execution of solar power depending on warming supply of solar water warming utilization. Solar water heating system based on heat pump is partial by different factors with the environment of refrigerant. Refrigerants contains environmental concerns by means of high global warming potential approach beneath analysis and different phased out. The option of working fluid, there might be a main research focus in civilizing performance of different components in solar water heating system. These developments could further cover a way to boost its market value beside by providing important ecological and economic benefits.

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