SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

Accredited by NBA-AICTE and Accredited by NAAC – UGC with A+ Grade

Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME: 19EEO305 /Renewable Energy Generation Technology

III YEAR / VI SEMESTER

UNIT 2- SOLAR ENERGY

Topic 2 – Flat plate for domestic water heating application

SUCCESSFUL STUDENT

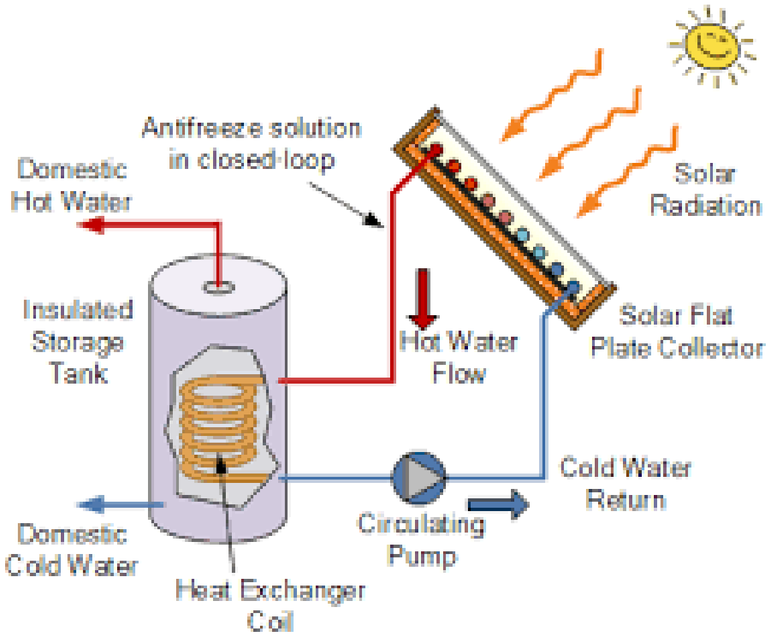
Positive Attitude

Professionally Groomed

Socially Interactive

Technically Skillful

A flat plate solar collector (FPC) is a device that converts solar energy into heat to heat water for domestic use. FPCs are a common choice for domestic water heating because they are simple, effective, and economical. They are also versatile and can be used for other applications, such as space heating and industrial process heating



Environmental Benefits

- Solar water heaters do not pollute.
- Solar water heaters help to avoid carbon dioxide, nitrogen oxides, sulfur dioxide, and the other air pollution and wastes created when the local utility generates power or fuel is burned to heat domestic water.
- When a solar water heater replaces an electric water heater, the electricity displaced over 20 years represents more than 50 tons of avoided carbon dioxide emissions alone.

Economic Benefits

- Many home builders choose electric water heaters because they are easy to install and relatively inexpensive to purchase. However, research shows that an average household with an electric water heater spends about 25% of its home energy costs on heating water.
- It makes economic sense to think beyond the initial purchase price and consider lifetime energy costs, or how much you will spend on energy to use the appliance over its lifetime. The Florida Solar Energy Center studied the potential savings to Florida homeowners of common water-heating systems compared with electric water heaters. It found that solar water heaters offered the largest potential savings, with solar water-heater owners saving as much as 50% to 85% annually on their utility bills over the cost of electric water heating.

Long-Term Benefits

- Solar water heaters offer long-term benefits that go beyond simple economics.
- In addition to having free hot water after the system has paid for itself in reduced utility bills, owners could be cushioned from future fuel shortages and price increases.
- Solar water heaters can assist in reducing this country's dependence on foreign oil.
- It is estimated that adding a solar water heater to an existing home raises the resale value of the home by the entire cost of the system.

Peak Power Benefit

A typical residential solar water heating system (SWHS) for a family of four delivers 4 kilowatts of electrical equivalent thermal power when under full sun and when the temperature of the water in the storage tank is about the same as the air temperature. Such a system typically has about 64 square feet of solar collector surface area and produces approximately the same peak power as 400 square feet of photovoltaic panels.

Energy Production Benefit

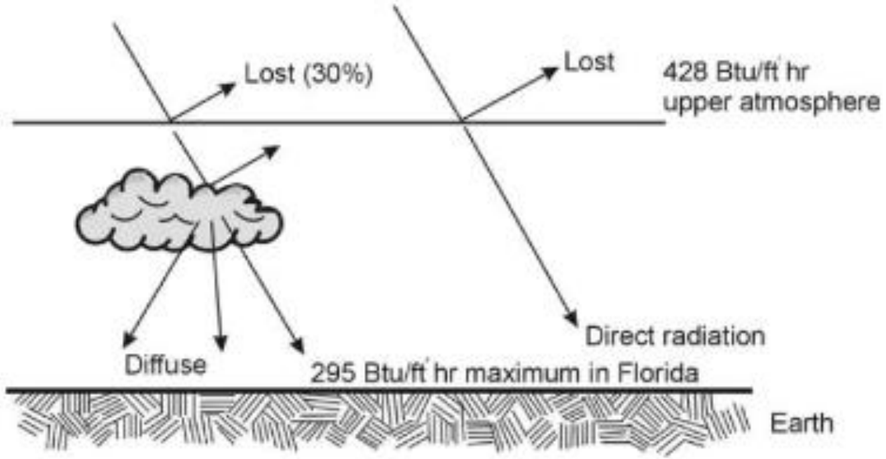
- Because peak performance occurs infrequently, a more realistic indication of solar thermal system performance is the rated daily energy output of the collectors or system.

- Using this method, a typical solar water heating system contributes 7 to 10 kilowatt-hours per day, depending on the solar resource and type of collector.

- Electric water heating for residential applications typically consumes about 12 kilowatt-hours per day, depending on ground water temperature.

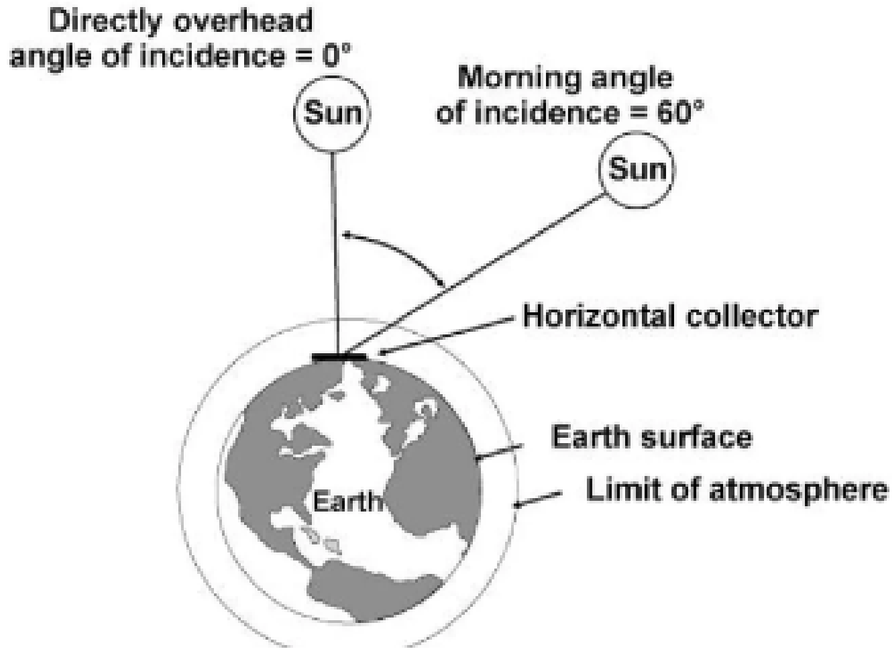
- Annual site-specific energy savings for domestic water heating systems are available at www.solar-rating.org for all systems certified by the Solar Rating and Certification Corporation (SRCC).

- Using this data, a typical solar water heating system produces about 3,400 kilowatt-hours per year, depending on local conditions and type of collector.

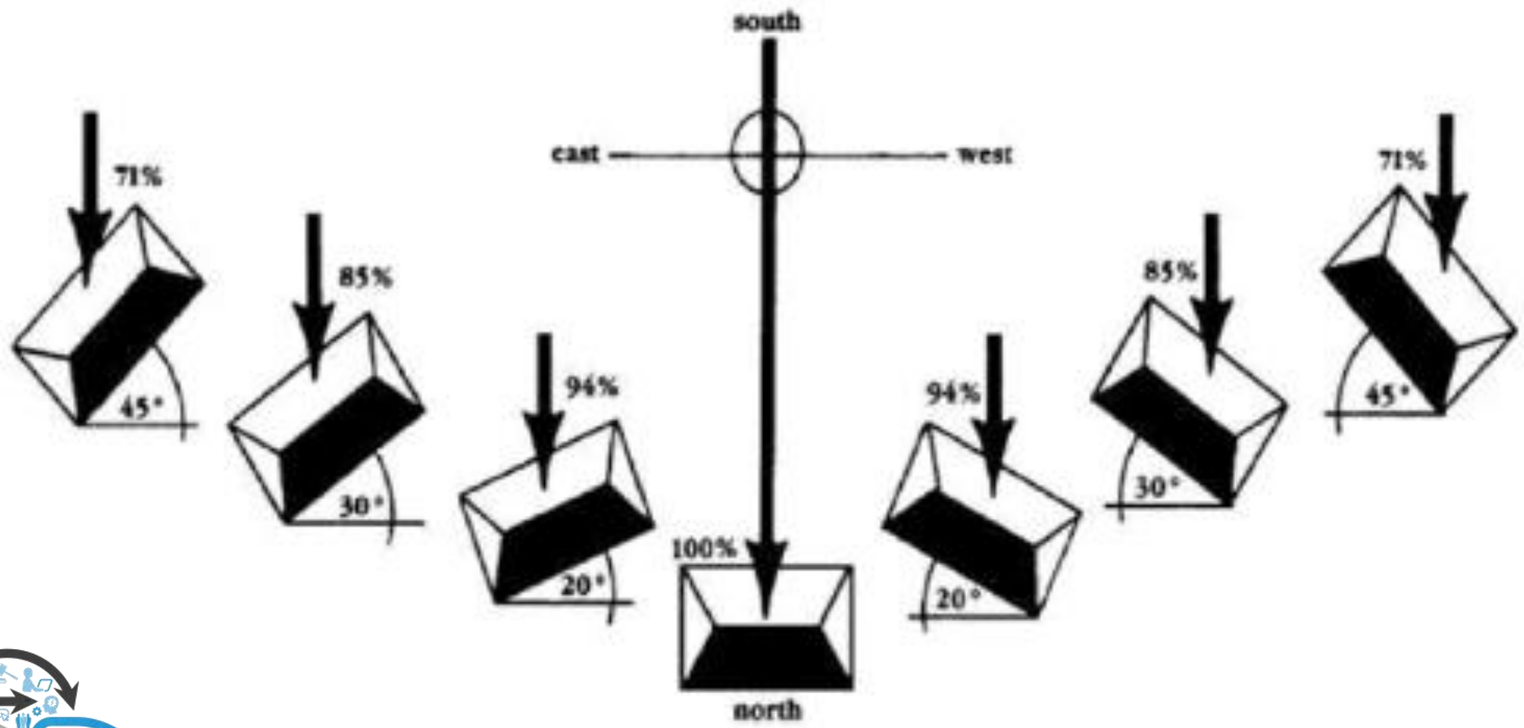


Angle of Incidence

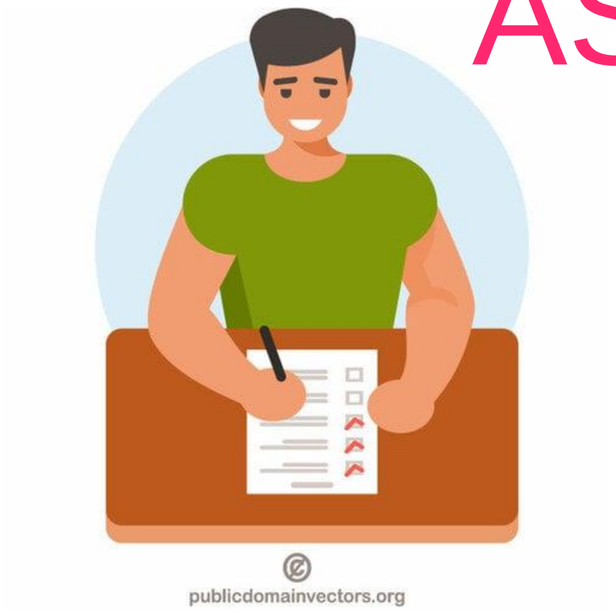
The sun's electromagnetic energy travels in a straight line. The angle at which these rays fall on an object is called the angle of incidence. A flat surface receives more solar energy when the angle of incidence is closer to zero (i.e. perpendicular) and therefore receives significantly less in early morning and late evening. Because the angle of incidence is so large in the morning and evening on earth, about six hours of "usable" solar energy is available daily. This is called the "solar window."



Actual Collector Orientation Possibilities



ASSESSMENT



REFERENCE

Reference Book:

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2. G.N. Tiwari, ‘Solar Energy – Fundamentals Design, Modelling and applications’, Narosa Publishing House, New Delhi, 2002. (UNIT II)

3. S.M. Muyeen,” Wind Energy Conversion Systems: Technology and Trends”, Springer 2012. [UNIT III]

Text Book:

1. G.D. Rai, ‘Non Conventional Energy Sources’, Khanna Publishers, New Delhi, 2006. (UNIT I - V)

2. D.P.Kothari, K.C.Singal and Rakesh Ranjan,”Renewable energy sources and Emerging Technologies”, PHI Pvt. Ltd., 2009. (UNIT I-V)

THANK YOU!!