A solar tracker has been developed to orient solar devices towards Sun for maximizing solar energy gain. The tracker comprised of electronic circuit and a mechanical unit. The electronic circuit senses light through LDR (Light Dependent Resistance) and small PV cell and trigger circuit, which mobilizes tracking platform towards maximum light with the help of a 12 V DC motor and battery. The mechanical unit, having a warm gear assembly, rotates platform of tracker as well as hold (self-lock) it to overcome wind load. The device has a facility to make it to turn towards the Sun in morning by first beam of Sun light. The rotation angle of tracking platform was found 4-10 degree in each light sensed. The performance of experimental tracker was evaluated for a solar cooker on it and compared with a non-tracked solar cooker. Peak temperature in the solar cooker was achieved about two hours prior to non-tracked cooker. Further, in the tracked cooker the peak temperature remained maintained for longer duration compared to non-tracked solar cooker. On an average 25% higher output is obtained with the tracked solar cooker.
as a voltage regulator for battery charging. Arora (1997) has conducted an experiment on 900W Photovoltaic Solar Pump in the month of March, 97. Intensity of solar radiation was measured from 8:15 AM to 4:30 PM with the help of pyrometer. Performance of the Photovoltaic Solar Pump was compared with and without Sun tracking by measuring water discharge rate. Sun tracking was done manually by moving PV array @ 15° per hour, so that radiations may fall normally on the top surface of the PV array system. Enhancement in water discharge rate up to 300% was found with Sun tracking, specially in the morning and evening. Prasad and Mazumdar (2000) further presented the overall effectiveness of intermittent tracking scheme in a more general and effective fashion through use of a single composite tracking index, termed as system utility factor, which when multiplied with beam component of solar radiation intensity gives total solar energy available to collector surface per unit area at any instant of time coming both from direct incidence on the collector and that due to reflection by mirror. The collector surface was tilted from horizontal downward at an angle such that the direct Sun rays become perpendicular to it at solar noon. The tracking scheme consisted of simultaneously orienting the collector-reflector unit and setting the reflector angle with horizontal, at beginning of each tracking period, in such a manner that wall azimuth angle of the complete system coincides with solar azimuth angle at the mid of time span and contribution from the reflector was also maximum at the same instant. The treatment takes into account the variation of mirror reflectance and collector absorptions as the function of respective incidence angles. This mode of tracking is called here as two fold tracking. The results of a study (Sakhadeo, 2002) indicated that theoretically use of tracking system could increase annual power output of a solar PV panel by upto 30 to 35% under Indian conditions. Prasad (2002) has described three fold periodic tracking of the Sun by a flat plate solar collector with a specular reflector unit where the complete system tracked the Sun for azimuthal variations as a single unit; while both the collector and the reflector track is for changes in altitude. System utility factor, measure of net capability of the collector surface to receive beam component of solar radiation at any instant of time coming both from direct incidence and through specular reflection, was maximized at the mid of each time span though a computer program using ray analysis in accordance with laws of geometrical optics. Three fold tracking further enhances beam energy input to collector surface than the case of fixed collector tilt and thus, extends the scope of using flat plate collector-reflector units more efficiently. Therefore, efforts are required to design and develop a low cost effective solar tracking device both for solar PV and solar thermal system.

RESULTS AND DISCUSSION

An experimental light sensitive solar tracker has been developed to orient solar devices towards Sun for maximizing solar energy gain and finally it turns itself towards the Sun in the morning by first beam of Sun light. The experimental tracker was evaluated along with non-tracked solar cooker. Tracking at different sensitivity settings of light showed that the rotation angle of tracking platform varied from 4 to 10°. In case of tracked solar cooker peak temperature was achieved about two hours prior to non-tracked cooker. Further, the peak temperature remained maintained for longer time (about double) on a typical day (29 Dec., 04) compared to under non-tracked solar cooker (Fig 2). On an average 25% higher output is obtained in case of tracked cooker.

METHODOLOGY

An experimental light sensitive solar tracker (Fig. 1) has been developed to orient solar devices towards Sun for maximizing solar energy gain and finally it turns itself towards the Sun in morning by first beam of Sun light. A pair of LDR (Light Dependent Resistance) with PV cells and potential divider circuit has been used to sense Sun rays and orient the solar appliance toward the Sun with the help of the mechanical unit. In this unit the LDR with PV cells works as an electronic-eye. Sensing components have been fixed in a box both side of compartments. As the light source (Sun) is sifted a bit away from center of the LDR and PV cell, shadow sifted on the LDR affecting its resistance and potential difference in PV cells. The electronic circuit senses light through LDR and small PV cell and trigger circuit, which mobilizes tracking platform toward the maximum light with the help of a 12 V DC motor and battery. The mechanical unit consisting a warm gear assembly, rotates platform of tracker as well as hold (self-lock) it to overcome wind load.

Fig 1 Testing of electro - mechanical solar tracker
CONCLUSIONS

- Tracking at different sensitivity the rotation angle of tracking platform varied from 4 to 10°.
- Tracked solar cooker peak temperature was achieved about two hours prior to non-tracked cooker.
- The peak temperature remained maintained for longer time in tracked solar Cooker.
- An average 25% higher output is obtained in case of tracked cooker.

Reference


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