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Hybrid Power Generation using Solar Panel and Peltier Plates

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Abstract:
Solar energy is a renewable energy heat source available free of cost everywhere all through the year. A peltier cooler is a solid-state active heat pump which transfers heat from one side of the device to the other, with consumption of electrical energy, depending on the direction of the current. In this project, we are going to produce power using solar energy and peltier plates. Such hybrid systems can give small, mobile, transportable and off-grid power and heating devices for small industry or domestic applications. This paper reviews some of the works conducted on the solar /peltier hybrid system.

Keywords:
Peltier plate, solar panel

1. Introduction:

Solar applications are classified under the categorizies of solar thermal or solar photovoltaic. Several texts are available on the subject of solar energy. Thermoelectric (TE) is the direct conversion of difference in temperature imposed in between the junctions of two dissimilar materials to electricity. This is known as the Seebeck effect and attributed to Thomas Seebeck in the 19th century. The same is sometimes referred to as TE power generation (TEG). Later, Scientist called Peltier showed that the converse is true. By imposing a voltage across or passing a current through two unlike materials, a temperature gradient is created between them. A hot surface in contact with the cold junction of the TE will be cooled and vice versa, a cold surface in contact with the hot junction will be heated up. This effect can be used for TE cooler (TEC) heat pump heating and cooling applications.

2. LITERATURE SURVEY

Technologies and resources

Solar energy means sources of energy that can be directly ascribed to the light of the sun or the heat that sunlight generates. Solar energy technologies can be categorized as following: 1) passive and active; 2) thermal and photovoltaic; and 3) concentrating and non-concentrating. Passive solar energy method merely collects the energy without converting the heat or light into other forms. It includes maximizing the use of day light or heat through building design. In contrast, active solar energy method refers to the controlling of solar energy to store it or convert it for other applications and can be broadly classified into two separate groups: (i) photovoltaic (PV) and (ii) solar thermal.

The PV technology converts radiant energy included in light quantum into electrical energy when light falls upon a semiconductor material, causing electron excitation and intensely enhancing conductivity. Two types of PV technology are currently present in the market: (a) crystalline silicon-based PV cells and (b) thin film technologies made out of a range of different semi-conductor materials, containing amorphous silicon, cadmium-telluride and copper indium gallium diselenide1. Solar thermal technology makes use of solar heat, which can be used directly for either thermal or heating application or electricity generation. According to that, it can be classified into two categories: (i) solar thermal non-electric and (ii) solar thermal electric. The former has applications as agricultural drying, solar water heaters, solar air heaters, solar cooling systems and solar cookers ; the latter refers to use of solar heat to produce steam for electricity generation, also called as concentrated solar

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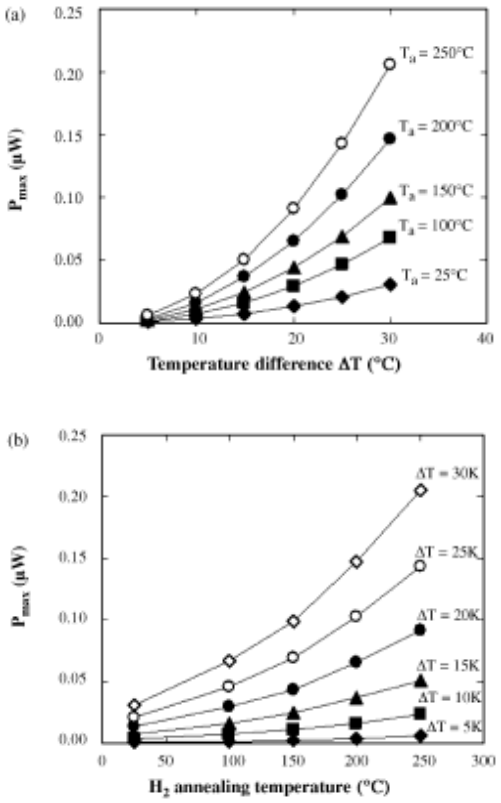
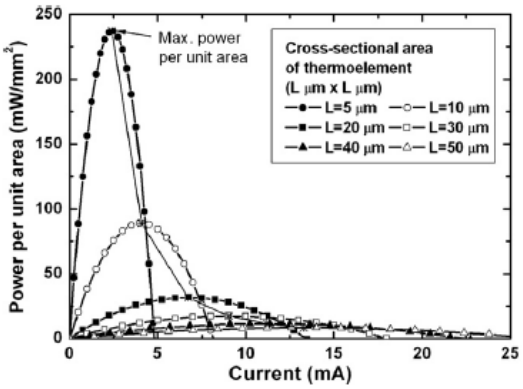
power (CSP). M.Takashiri(2007) et al. has been done Bismuth–telluride-based alloy thin film thermoelectric generator was fabricated by a flash evaporation method. The maximum output power of the thin film thermoelectric generator in this study is still not enough to apply as a power source for microelectronic devices. And for improving the performance of the generator they used hydrogen annealing process [5].



Bongkyun Jang et al. represented (2011) using countable element analysis he concluded, as the substrate becomes thicker the thermoelectric performance declines due to thermal loss from the substrate. The thermo constituents have an optimal length with the highest power. Highest efficiency is obtained when the length of the thermo parts is large.



3. IMPLEMENTATION:

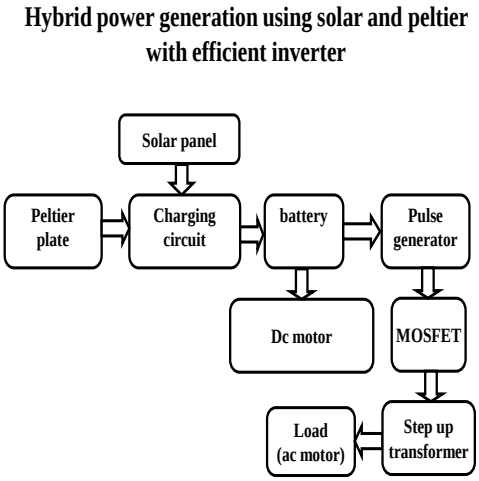


Fig- Block diagram

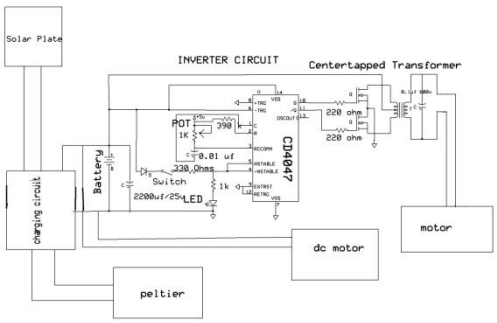


Fig circuit diagram

From the above figure, we can see that the energy that is obtained from solar panel (45V,5W) and peltier plate(12V,10W) are given as input to the charging circuit which in turn charges the battery which can be used to run a DC motor(40W) and also as input to an

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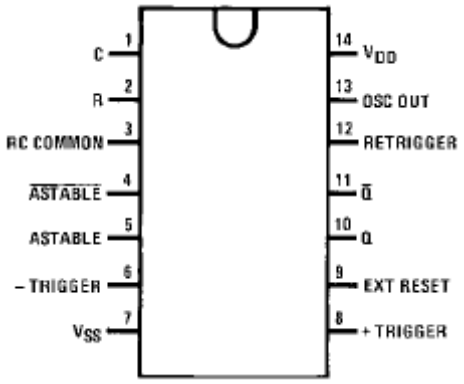
inverter consisting of pulse generator IC,(CD4047 IC) MOSFET and Step up transformer with which we finally get AC output that can be used to switch the AC loads.

4. CONCLUSION

CD4047:



IC CD 4047 is especially used in an Inverter circuits. It is very compact in design and has a better life using inverter circuits. The values of these components determined by the output pulse width in the Monostable mode and output frequency is used in the Astable mode. Multivibrator produces an electrical signal that changes its state on a regular basis (astable) or on demand (monostable). One of the benefits of 4047 is being able to do so well, and with fewer external components also.

Features

1. Lower power consumption: special CMOS oscillator configurations
2. Monostable (one-shot) or astable (free-running) operations
3. True and complemented buffered outputs

Description:

This is the circuit of a simple 40W, 12 volts to 220 Volts inverter. The heart of the circuit is an IC CD 4047 which is wired as an astable multi vibrator here. The Resistance and Capacitance at pin 1&2 determines the output frequency. Here it is set to 60Hz. Due to this a two 180 degree out of phase ,120 Hz , 50% duty cycle waveforms will be appeared at pin 10 & 11.These waves are amplified by the supporting symmetry amplifier.The circuit diagram is the typical application of the IC CD4047 in the Monostable mode. These timing elements are the capacitor C1 connected between the pins 1, 3 and the resistor R1 between pins 2, 3. When a low to high pulse is applied to its pin 8, 12, output pulse will be available from pins 10, 11. Output pulse widths are totally depend upon the values of R1 and C1 which can be determined by the formula 2.48 R.C. R1 should be between 10k and 10M. The CD4047B is capable of operating in either monostable or astable mode. It needs an external capacitor (between pins 1 and 3) and an external resistor (between pins 2 and 3) to determine the output pulse widths in the monostable mode, and the output frequency in the astable mode.There are three outputs, Q, and OSC out. Q is the normal output, is the inverse of Q – that is if Q is high, then it is low – at the same frequency. OSC output givess a signal that is very close to twice the frequency of Q.

4047 IC Applications

- Frequency discriminators
- Timing circuits
- Time-delay applications
- Envelope detection
- Frequency multiplication
- Frequency division

MOSFET:

The metal–oxide–semiconductor field-effect transistor (MOSFET, MOS-FET, or MOS FET) is a transistor used for amplifying or switching an electronic signal. In this paper going to be used IR540N model is use. Although these MOSFET's are four-terminal devices with source (S), gate (G), drain (D), and body (B) terminals, the body (or substrate) of the MOSFET often is connected to source terminal, making it as a three-terminal device and like other field-effect transistors. When these two terminals are connected to each other (short-circuited) then only three terminals appear in the electrical diagrams. The MOSFET is termed as far as the most common transistor is used in both digital and also at analog circuits using the

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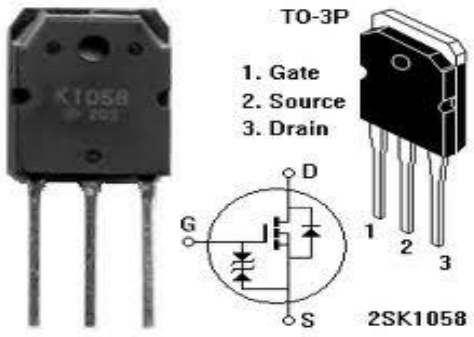
bipolar junction transistor was at one time with much more common.



AC Motor:

An **AC motor** is an electric motor run by an alternating current (AC). Here using AC induction motor with having the 80W ratings. The AC motor commonly consists of two basic parts, an outside stationary stator having coils supplied with alternating current to produce a rotating magnetic field, and an inside rotor attached to the output shaft resulting in a second rotating magnetic field. The rotor magnetic field may be produced by permanent magnets, reluctance saliency, or DC or AC electrical windings.

Rarely, linear AC motors operate on similar principles as rotating motors but have their stationary and moving parts arranged in a straight line configuration, producing linear motion instead of rotation.

Fig-AC MOTOR

DC Motor:

A dc motor makes use of electrical energy to produce mechanical energy, very generally through the interaction of magnetic fields and current-containing conductors. The reverse process, producing electrical energy from mechanical energy, is carried out by an alternator, source or dynamo.

Many types of electric motors can be run as sources, and vice verse. The input of a DC motor is current/voltage and its output is torque (speed). Here using the 40W PMDC motor with having the 300 rpm speed.

DC Motor:

Figure shows a DC motor, From the picture you can see the armature is made of coils of wire wrapped around the core, and the core has an covered shaft that rotates on charges. You should also notice that the ends of each coil of wire on the armature are finished at one end of the armature. The outcome points are called the commutator, and this is where's brushes make electrical contact to bring electrical current from the stationary part to the rotating part of the machine.

ADVANTAGES:

- Gives simultaneous DC and AC output
- Improved efficiency
- Reduced cost
- Environment friendly
- No moving parts so no maintenance is required
- Recycles wasted heat energy
- Reliability source of energy
- Has long operating life

APPLICATIONS:

- Employed in micro grid applications.
- Employed in modern smart residential electrical power systems.
- Electric vehicles
- They can be employed in Industries

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