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SOLAR OPERATED THERMO-ELECTRIC HEATING AND COOLING SYSTEM

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ABSTRACT: *In the last many years Electricity crisis is main problem for India and other world. So we need the use of the renewable energy from the nature. Because Solar energy is the world's most rich stable and clean source of energy. so in our project we use the solar energy.*

In our project the solar energy to run a heating and cooling system. Also we used thermo-electric system which is fabricated and it's made by using thermo -electric module. the main aim of our project is that any possibility of heating and cooling air by connecting peltier circuit. we designed an experimental prototype of solar operated thermo - electric system or mechanism.

It is Eco-friendly system. in this system no use of refrigerant. No wastage of any power in other word no wastage of energy. it's not noisy system and light weighted system.

C.O.P. is less as compared to conventional refrigeration system and it has low cooling capacity.

This project is based on the solar energy so this is not working properly in monsoon. This is the limitation of our project, but this problem can be solved by giving direct electric supply.

Our project is useful in food preservation, pharmaceutical,automobile engineering,medicaleqipment,milirary, Aerospace,computers, video cameras, etc.thus, we hope that it proves to be very helpful.

Keywords-*Solar Panel, Thermo-Electric module, Peltier circuit,cooling and heating effect.*

INTRODUCTION

Now a days India and the world face electricity crisis. so the storage of Medicine and Food Preservation is not possible. And also in space is not possible for storing food. So we need alternative option. so that's why in this project we used solar energy. Solar energy is clean, free and easily available. in this project we used solar energy with thermo-electric module. Thermo-electric module made of Semiconductor material. We try to develop a working thermo-electric refrigeration that utilized the peltier effect to refrigeration and maintain a temperature between 5°C to 25°C.The thermo-electric module required DC power. so we need a solar panel for power supply. Also we need battery. It system is different from the conventional refrigerator. It do not need compressor, pump, evaporator, and condenser. It is Eco-friendly system. Light in weight and silent in operation. The main advantage is the cost is less.

It is not used in monsoon because of environment that is main limitations. Peltier module is quite compact. Application of our project are electronic, Military, medicine, in space, scientific and laboratory equipment, climate devices, In Computer, Automobile Engineering.

RESEARCH METHOD:

When sun rays incidents on the solar plate then photovoltaic cell produced heat and its generate electricity. The photovoltaic cell made by the semiconductor. Solar cell bounding together p-type and n-type semiconductor. The produced electricity is supply to charge controller for charge the battery. Battery connected with thermo-electric module and here produced the cooling and heating effect. this is a simple plan of working system.

Design Methodology:

1] Source of solar energy:

The Sun is a main source of solar energy so we can get solar energy from sun and it is free and easily available.solar irradiation in Bhavnagar in April about 6.43 KWh/㎡/day.

2] Solar Panel:

Solar cell place on a metallic plate to from solar panel. Solar cell has photovoltaic cell. it is manufacturing by semiconductor like silicon. many types of silicon used in cell like crystalline silicone which thickness is approximate 100-300µm,poly crystalline silicone which thickness is approximate 1-10µm.

when sun rays put down on solar panel the silicon material produced electric current. it means the direct conservation of solar energy into electricity.

Figure-2

3] Thermo cooling Box:

It providing insulation from temperature difference to place inside temperature constant or at required temperature. the total box divided into three section.

Figure-3

1) for heating 2) for cooling and 3) storage the thermo-electric circuit and cooling fans.

4] Charge Controller:

It is one type of regulator. it controls the flow of current. it has electronics circuit and also have resister and diodes. it gives overload protection. it is blocking reverse current.

Figure-4

5] Battery:

Battery is a electrochemical device. it is converted chemical energy into electrical energy. supply of current for operating electrical unit it is main function. we used in this project DC battery.12 V battery used for this system.

Figure-5

6] Thermo-electrical module:

It has two junction one is P-type and second one is N-type. Both are connected electrically in series and thermally in parallel between the ceramics. while P-type and N-type materials are alloys of Bismuth and tellurium.

The current treats the P-type material as a hot junction needing to be cooled and the N-type as a cold junction needing to be heated. It means in P-type junction has hole electron comes and this junction becomes hot and N-type junction has electron it remove to p-type junction so it becomes cold. the polarity will switch the hot and cold sides. Reliability is one of the major criterions of thermoelectric module (TEM) selection

Specification of TEM:

Product	*TEC-12706*
Operational voltage	*12V DC*
Current max	*6 Amp*
Voltage max	*20.4 V*
Power max	*92.4*
Dimensions	*40 x 40 x 3.5 mm*

DESIGN OF COMPONENTS:

Thermo cooling Box Design:

For insulation purpose require low thermal conductivity material.

Dimension of box:

20 ㎝*10 ㎝*5 ㎝ for 1lit.

We take ceramic porcelain (k= 1.1 w/m k)

Heat Loss Q= k*A*dt/dx

Thermo electric module:

Efficiency:

$$\eta = m(Cp*Tout - Cp*Tin)/Idn*A*\cos\theta$$

Where,

m=mass of water
Cp=Specific heat of air
Idn= solar irradiation
A=area of TEM
θ=inclined angle

Cooling Capacity:

=m*Cp*dt

We calculate the cooling heat load:

Q= mass of water*Sensible heat of water at 25°C*dt +
mass of water*Latent heat of ice
Gross Cooling load=1/n,
Where,
n=1-isulation losses

Total Heat Supplied Calculations:

- ✓ Total heat supplied required (cooling)=total heat load + heat loss during cooling
- ✓ Total heat supplied required (heating) =total heat load + heat loss during heating

Sample Calculation:

*Cooling Capacity=2000*1.005*10*
=20.1KJ
*Heat Loss=(1.1*20000*10)/2000*
=11 W

Efficiency of TEM:

$$\eta=(2000*1.005*10)/(6.43*1.6*.7092)$$

=27.54%

We calculate the cooling heat load:

*Q= mass of water*Sensible heat of water at 25°C*dt +*
*mass of water*Latent heat of ice*
=708.2 W

Gross Cooling load=1/n,
Where,
n=1-isulation losses
=1-.11
=.89
So We get Gross Cooling Load=112.35 W

RESULT AND ANALSIS:

Cooling Side:
1st Reading at 10:30 A.M.
T(input)=39℃& T(output)=31℃in 1.27 min
2nd Reading at 12:30 P.M.
T(input)=31℃& T(output)=29℃in 2.07 min
3rd Reading at 02:30 P.M.
T(input)=29℃& T(output)=26℃in 2.43 min
Heating Side:
1st Reading at 10:30 A.M.
T(input)=39℃& T(output)=45℃in 1.27 min
2nd Reading at 12:30 P.M.
T(input)=45℃& T(output)=49℃in 2.07 min
3rd Reading at 02:30 P.M.
T(input)=49℃& T(output)=52℃in 2.43 min
So we can say that the Temperature difference is increased so cooling effect is decreased and the system take more time for cooling and heating

CONCLUSIONS

In our project we conclude that the system operated on solar energy it means no need of electricity. So this system implemented to overcome increasing electricity crisis. in our project we try to make prototype of this system and that was tested for cooling andheating purpose.This system is environment friendly. it has long life and also energy saving. this system avoids any unnecessary electrical hazards.

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