

Use and Working of Solar Powered Refrigeration System for rural applications

Syed Muzammil Ahmed¹, Ayesha Samreen Naina²

^{1,2}Asst. Professor, Dept. of EEE, ARKAY College of Engineering and Technology, Nizamabad, (India)

ABSTRACT

Large extent of population in India lives in rural or remote areas where electrical power is inaccessible and isn't imagined within a reasonable time-frame. Since conventional, electrically powered vapour compression refrigeration systems may not be of much use in such territories, for fundamental applications, for example, sustenance and medication safeguarding, elective refrigeration systems are required. Such systems are displayed and examined in this paper. These incorporate photovoltaic (PV) powered vapour compression systems; ceaseless and discontinuous fluid or strong retention systems; and adsorption systems. Run of the mill application illustrations are drawn from late encounters around the world. Specialized and monetary requirements which confine their far reaching application are checked on, and strategies for overcoming them are talked about.

Keywords: Air compressor, solar energy, Refrigeration system, Refrigerants.

I.INTRODUCTION

Refrigeration is a process of attaining and maintaining a temperature at a lower that of the environment, the purpose being to cool some item or space to the required temperatures. Solar based controlled iceboxes can keep perishable products, for example, meat and dairy cool in hot atmospheres, and are utilized to keep genuinely necessary antibodies at their fitting temperature to maintain a strategic distance from deterioration.

Solar based controlled iceboxes are normally utilized as a part of off-the-system areas where utility gave AC control isn't accessible. n created nations, module iceboxes with reinforcement generators store immunizations securely, however in creating nations, where power supplies can be temperamental, elective refrigeration advancements are required".[3] Solar refrigerators were acquainted in the creating scene with cut down on the utilization of lamp fuel or gas-controlled ingestion refrigerated coolers which are the most widely recognized options. They are utilized for both immunization stockpiling and family unit applications in territories without dependable electrical supply since they have poor or no lattice power at all.[2][4] They consume a liter of lamp oil every day in this manner requiring a steady supply of fuel which is expensive and malodorous, and are in charge of the generation of a lot of carbon dioxide.[3] They can likewise be hard to change which can bring about the solidifying of drug. The utilization of Kerosene as a fuel is presently generally demoralized for three reasons: Recurrent cost of fuel, trouble of keeping up exact temperature and danger of causing fires.

Sun based controlled fridges are described by thick protection and the utilization of a DC (not AC) compressor. Customarily sun oriented fueled fridges and antibody coolers utilize a mix of sun powered boards and lead

batteries to store vitality for overcast days and during the evening without daylight to keep their substance cool. These ice chests are costly and require substantial lead-corrosive batteries which have a tendency to fall apart, particularly in hot atmospheres, or are abused for other purposes.[3][4] also, the batteries require maintenance,[5] must be supplanted roughly like clockwork, and must be discarded as dangerous squanders perhaps bringing about lead pollution.[3] These issues and the subsequent higher expenses have been a deterrent for the utilization of sun based fueled fridges in creating regions.

II.WORKING OF SOLAR POWERED REFRIGERATION SYSTEM

A conventional spray gun using a compressor to supply the air, however the spray gun itself involves a lower pressure (LP). A higher volume (HV) of air is used to change over into a fine shower and move the fluid at bring down gaseous tension. The result is a higher extent of fluid accomplishing the target surface with diminished overspray, materials use, and air contamination. Presently a day, the most broadly used refrigeration systems for ventilating in the residential division and structures are vapor pressure refrigeration system. This system fundamentally requires electrical energy to make the supportive refrigeration. This is on account of such system must be driven by technique for a mechanical compressor. Ordinary VCRS system use power for there working time and go through a great deal of power. Because of the increments of air contaminations, the warm vitality apparatuses are diminishes and the vitality charge is vast, the use in little extent wellsprings of vitality for instance, wastage air, sun arranged vitality and additionally geo-warm vitality in a refrigeration system. Such sorts of vitality ought to be used to convey the refrigerate affect in an air pressure refrigeration systems. Further, the benefit of air pressure refrigeration system is low working, establishment and upkeep cost. In any case, the coefficient of execution of an air pressure refrigeration cycle is diminish than the vapor pressure refrigeration cycle. To diminish the request of electrical vitality for refrigeration application, the option refrigeration systems that can be worked by using warm vitality.

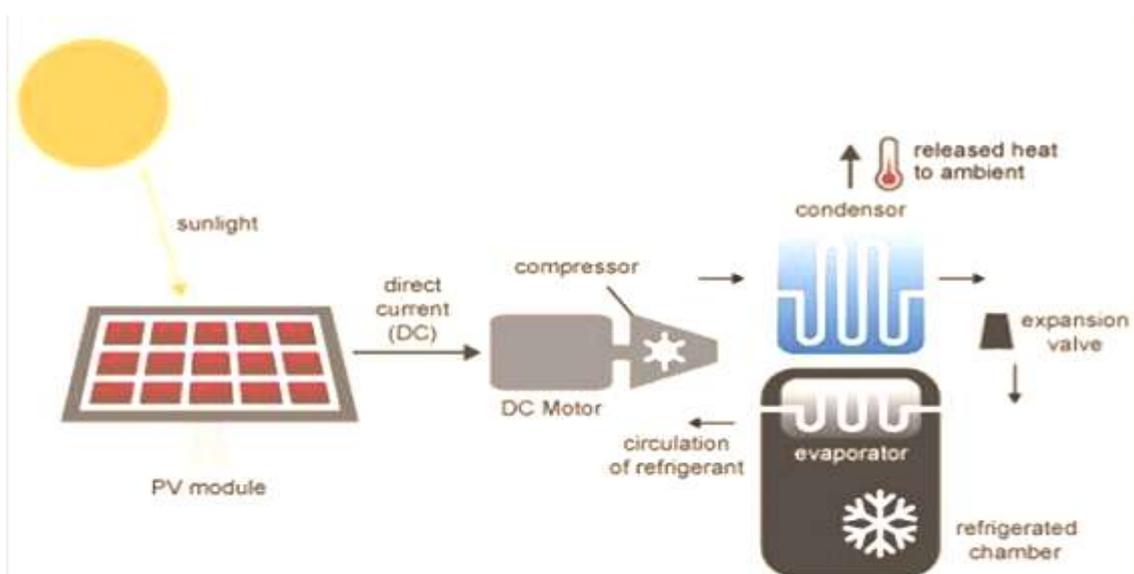


Figure 1: Solar Powered Refrigeration System

The Evaporator is filling up with refrigerant up to the foreordained level. Air compressor is a machine to press the air and to expand its weight. Air compressor sucks the air from encompassing, stuffed it and after conveyed some under the high weight. To run the air compressor, an expansive number of electrical vitality is required relying on the yield weight of air. The nonrenewable assets to make power have turned into a restricted, driving high vitality cost. In that situation, the sustainable sources like sun based power are to a great degree helpful and utilization of this innovation to run air compressor is called as sun oriented power air compressor. The high weight refrigerant experiences the spout of compressor. The essential stream enlivens and extends to the concurrent unique spout to conveyed supersonic stream which makes the low weight and increment the speed. This partial vacuum is made by the supersonic essential stream entrains refrigerant fluid in an evaporator.

The weight of evaporator abatements and refrigerant in an evaporator occurs at the lower temperatures and at a little beat weight. The utilization of air pressure refrigeration system is to control the aerating and cooling system giving cooling in a hazardous situations and Run off the waste air from the compressor to cool nourishment and solution. An air pressure refrigeration system is a piece of ejector refrigeration systems. Ejector is comprised of three fundamental segments, a united unique supersonic spout, blending chamber and diffuser. Be that as it may, I am utilize just a single segment i.e. united different supersonic spout rather than ejector. Heater is supplanted via air compressor. There is a no need of condenser.

Refrigeration using solar energy can be achieved through the following means :

- Vapour Compression Systems (VCS)
- Vapour Absorption Systems (VAS)
- Vapour Jet Systems (VJS)
- Thermo-electric cooling systems
- Adsorption refrigeration systems

III.LITERATURE REVIEW

Aphornratana S et al. [5] have direct a tentatively examination of a stream refrigeration system using the ejector alongside an essential spouts are versatile. There results shows the usage of such sorts of a spout gives more noteworthy supple execution than a totally the geometry of ejector is settled and raises coefficient of execution of systems.

Nahdi E et al. [6] thought probably the presentation of super-sonic ejector with refrigerant R11 other than an incredible breadth in mixing chamber in to territory of throat spout extent and imparted there results permit ideal layout of system. At a moment that the warmth source temperatures are to be known.

Sun DW et al. [7] is tentatively performed in the show characteristics of ejector refrigeration system. In this writing the writer says that when the ejector is performed optional spill out of evaporator in gagging wonder happened. The gagging marvel is a noteworthy part in execution of ejector and the acquired guide execution of systems.

Addy AL et al. [8] propelled a solitary dimensionally system for the region of ejector is consistent outwardly of diffuser and the creator demonstrates that hypothetical results accomplished by using these system in extraordinary retirement alongside tentatively results.

Table 1: This table shows performance parameter of steam jet refrigeration system

Name	Work reported	Outcome
Eames and Aphornratana	Ejector refrigeration system utilizing an ejector with a primary nozzle is movable.	COP increases
Huang and Jiang	Secondary stream from evaporator choking phenomenon occurred.	COP varied between 0.59 to 0.67

In this table utilization of nozzle gives a more flexible operation and operation at accurate condition; however in which the jet refrigeration systems can be work, proved to be identical.

Sankarlal T [9] Built up a simple ejector steam refrigeration systems works on the ammonia as a refrigerant and has examined the factor influencing the working temperatures on performance of system. According the theoretically & experimentally outcomes, great achievement on each other. The boiler temperature & evaporator temperature are increase with the coefficient of performance of system also rises as well as decrement along with the raising temperature of condenser.

Mani A et al. [10] the consequence of an analysis performed over jet system with alkali, and concluded that the entrainment ratio and coefficient of performance raise with raise expanding ratio as well as area proportion in ejector with lower the compressor ratio.

S.B. Riffat et al. [11] has introduced the effect of an examination and experimental examination of a system along with methanol. They acquired trial estimate of performance coefficient of between 0.2 and 0.4 at working conditions achievable utilizing low-grade heat such as waste heat and solar energy.

D.W. Sun et al. [12] understood a hypothetical review constructing the COP of a jet refrigeration system utilizing working liquids, for example, R123, R152a, R113, R134a, R142b, R12 and R11. The result indicates that steam jet systems have low COP values. The system utilizing R152a as a working liquid has better performance.

Roman R [13] Investigation of the jet refrigeration cycle is performance with R134a operating fluid. The COP is increasing together along with the raise of the generating temperature values, the best Coefficient of Performance value being 0.178.

Table 2: Working conditions and performance of Ejector refrigeration system

Working Fluid	Generator Tem[°C]	Condenser Temp[°C]	Evaporator Temp[°C]	COP	Ref
H2O	95-130	5-15	25-45	0.05 - 0.75	18
CH3OH	80-100	-2-14	16-28	0.20 - 0.40	19
R134a	65-90	2-13	26-38	0.03 - 0.16	20
R113	65-80	7-12	28-45	0.16 - 0.24	21
R245fa	90-100	8	29-38	0.27 - 0.68	22
R123	80-105	9-15	32-37	0.22 - 0.50	23
H2O	120-140	5-15	22-36	0.28 - 0.48	24

These table special considerations are given on the performance, working condition & working fluid. The exhibition of jet refrigeration systems efficiently dependant on the working fluids & each and every refrigerant there are suitable working times.

Huang.BJ et al. [14] have developed an awesome execution of solar based controlled steam refrigeration systems using single working liquid refrigerant 141b and displayed single ejector refrigeration systems they got high coefficient of execution of 0.6 tentatively.

Sun. DW et al. [15] the numerical portrayal of climatic well disposed in a sun based vitality systems. The different sub-cycle of a pressure and an ejector using the two distinctive refrigerant i.e. R134a and steam as a refrigerant. The influenced results showed the change in coefficient of execution up to the 60% looking at the ordinary VCRES systems.

Nguyen VM et al. [16] have developed refrigeration systems that system is practically controlled by solar based vitality completely. As opposed to the nourishing pump in systems, to trade the fluid from condenser to generator by using heat gravity. The creator resultant the made cooling systems have inconsequential necessity of support and this system workable for the exceptionally direct rate of separate and also long life period.

Zeren. F et al. [17] considered the financial ability of a sun based controlled fly refrigeration system alongside the refrigerant utilization of this system are R12. They chose the productivity from a systems dependant dominantly on a gainfully of sun powered warming source.

Sun oriented ejector refrigeration system are intriguing systems proper to their expectation, use of a solar based power and blend of the ejector refrigeration system advances. Inconveniences that limit the execution of system containing the sun based level plate gatherer strategy and the intrude on character alongside solar based vitality. In a Solar ejector system, the COP of the ejector cycle lies in the vicinity of 0.1 and 0.55, where as the generator temperature and COP are besides subject to the gatherer used.

Gil B et al. [18] Performance and Development of a propelled steam stream ejector cooling systems for a supportable constructed condition. R600a was picked as working liquid. Trial Coefficient of Performance changed from 0.4 to 0.8 relies upon working conditions. The cooling cycle is being facilitated into a solar based driven.

K. Chunnanond et al. [19] Learned about segments influencing the execution of ejector. Also the effect on one of the geometrical parameter was assessed. In the work, three geometrical segments – the territory extent in the middle of the spout and the steady zone fragment, the spout outlet position and consistent zone section length were seen. The theoretical examination was finished by a CFD model of a steam fly ejector using FLUENT. The results exhibited the nearness of ideal territory extent, holding tight working conditions.

T. Sankarlal et al. [20] a numerical model is delivered for the fly refrigeration systems using one-dimensional stream and a granulating model. The made model is used as a piece of imitating the ejector stream cooling system for R152a and R134a to choose the upgraded execution, refrigerant and ejector geometries for the system. Properties of fluid amid the stream at the sections of ejector were gotten.

P. Chaiwongsa et al. [21] probably audit the like hood of vitality proficiency are enhancing the VCRS where a two-arrange ejector replaces the augmentation valve. A test situate using refrigerant R134a was plot and developed which works in both the ejector mode and in customary mode. In stream refrigeration the essential spout was equipped alongside two throats, having a portable region for essential throat and a totally settle territory for second throat.

Primary choices of different solar based refrigeration systems and their positions

The primary choices are positioned by their detailed execution and the required ventures per kW cooling:

- Solar warm with single-impact retention system gives off an impression of being the best alternative nearly took after by the sun oriented warm with single-impact adsorption system and by the sun based warm with twofold impact ingestion system choices at a similar value level.
- Solar thermo-mechanical or sun oriented photovoltaic choices are fundamentally more costly. Primary alternatives of different sun oriented refrigeration systems and their positions,
- The vapor pressure system and attractive systems are the most appealing choices took after by the thermo-acoustic and Sterling systems.

- Desiccant systems and ejector systems will be more costly than the initial three systems however since these systems require particular hardware their correct position is hard to recognize.

IV.CONCLUSIONS

In this paper, we have studied the status of work completed on solar powered refrigeration system for provincial application with various refrigerants and same air as working refrigerants. During the normal running of the solar refrigerator the power is supplied directly by the solar panel, but when the output power of solar panels is less, the additional power is supplied by the battery. The battery is revived when overabundance measure of energy is created by the sun based boards. Another application where the sun powered vitality can be extremely helpful is the vapor ingestion refrigeration system. In these systems warm from the steam is utilized to warm water blended with lithium bromide or smelling salts that go about as the refrigerant. In these machines, the warmth created by the steam can be supplanted by the warmth delivered by sun powered vitality.

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