Journal of Engineering and Applied Sciences 3 (2): 211-213, 2008
ISSN: 1816-949X


# Alternative Solution for the Replacement of CFC, Machine Absorption Refrigeration Coupled with a Solar System Application, Ouargla Region (South-Eastern Algeria)

[1]Tahar Guermit, [1]BaChir Bouchkima and [2]Mourad Boumaza
[1]Energy Laboratory, University of Ouargla, Ouargla, Algeria
[2]University of Constantine, Algeria

**Abstract:** The environmental risks of CFCs and HCFC are well known and they warrant particular banning them: they contribute to the destruction of the stratospheric ozone layer. Their Bench, HFC, are not participating in this destruction but on the other hand help the greenhouse effect. One of the alternatives for replacing the CFC and HCFC, is to use other refrigeration systems that do not use these refrigerants pollutant environment among these refrigeration systems, the absorption refrigeration. Hence, the possibility of developing air conditioning systems coupled with a solar system that can guarantee the conditions of comfort with a saving energy. The solar coupled with refrigeration systems, must be optimized depending on the site and its applications so they can provide a conversion efficiency-cost of implantation. In our study, it proposes a program to calculate the solar fraction using the method Phibar-fchart, with the meteorological data of the Ouargla region (south-eastern Algeria). Simulation results show that the optimum angle of inclination of the solar collector is 45° so that the solar fraction peaked, believes solar fraction linearly with the capture solar surface, this result should be involved in any study technical-economic status of solar systems, in order to have an optimum design of the facility.

**Key words:** Replacement of CFC, machine absorption, refrigeration, solar system, HCFC

## INTRODUCTION

The concerns of scientists on the effects of chlorofluorocarbons on the environment have led governments of many countries to take measures to restrict refrigerants pollutants, the adoption of the Vienna Convention for the Protection of the Ozone Layer, In 1985, which was followed by the adoption of the Montreal Protocol on Substances that depletion of the ozone layer, in 1987 was the starting point for global cooperation to protect the stratospheric ozone layer.

**Destruction of the stratospheric ozone layer:** The sunlight break down many of the gases in the stratosphere and containing chlorine and bromine (Fig. 1). The radial chlorine and bromine then trigger a chain reaction which breaks destructive other gases whose stratospheric ozone.

**Refrigerants contribution to global warming:** Although all CFC combined, the concentration of CFCs in the atmosphere is much lower than that of $CO_2$, their relative effectiveness is several thousand times higher than that

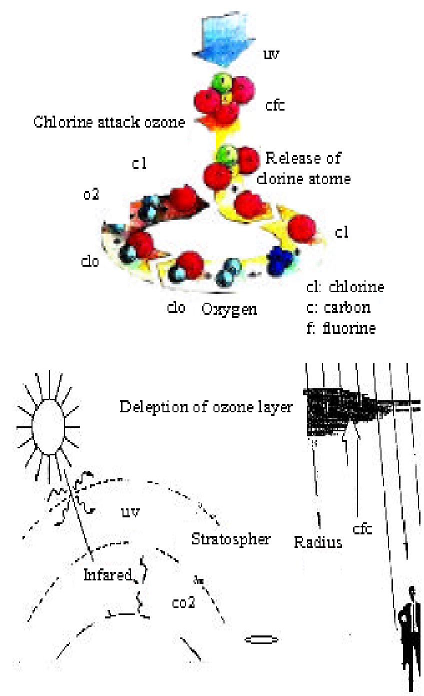


Fig. 1: Destruction of the stratospheric ozone layer

**Corresponding Author:** Tahar Guermit, Energy Laboratory, University of Ouargla, Ouargla, Algeria

of $CO_2$ among other things because of their lifetime high (58 let R11, R12 for 100 years and 250 years for R115 "component of R502).

The alteration of the stratospheric ozone forming on the other hand, an entirely different phenomenon as it relates to energy ultraviolet radiation from the sun.

At the Kyoto summit, an outstanding contribution to the greenhouse effect fluid which is now being called into question, the Kyoto Protocol requires the cessation of these new HFC, any chemical with a high GWP (Global Warming Potential) is considered harmful to the environment (http://www.eieretsher.org).

One of the alternatives for replacing the cfc and hcfc, is to use other refrigeration systems that do not use these refrigerants that are harmful to the environment.

- Among those refrigeration systems, the absorption

## MACHINE ABSORPTION REFRIGERATION

The absorption refrigerating machine is a device on a continuous basis with the input of heat energy and without the use of mechanical energy (where very few).

It is a machine operating through 3 levels of temperature, cold temperatures on evaporation; hot spring on the contribution of energy boiler which is solar energy in our case and the source Intermediate allowing condensation of refrigerant (Make *et al*., 1988).

The absorption machine is rustic asking very little maintenance and the absence of rotating machines powerful because of absorption refrigerating machines safe, quiet the opposite of mechanical compression machine (Fig. 2).

**Description and operation of absorption refrigeration cycle:** A solution (consisting of a refrigerant and an absorbent) is heated in the boiler through external inputs of heat (steam, hot water circulating in a serpentine or too burned by gas combustion, or solar energy).

The heated solution allows steam to escape refrigerant gas which then passed in the condenser (in some cases vapour refrigerant gas is mixed with a little steam absorbent). The solution is then refrigerant in impoverished or enriched absorbent and sank regulator No. 2 and the absorber.

The steam condenses refrigerant in the condenser, passes through the regulator No. 1 flowing evaporator.

The liquid refrigerant evaporates in the evaporator (producing cold) and steam forms and goes to the absorber. Where it meets the solution from boiler, this solution will absorb or dissolve the refrigerant gas and steam to form another solution refrigerant rich or poor absorbent (Fig. 3). This solution then returns to boiler,

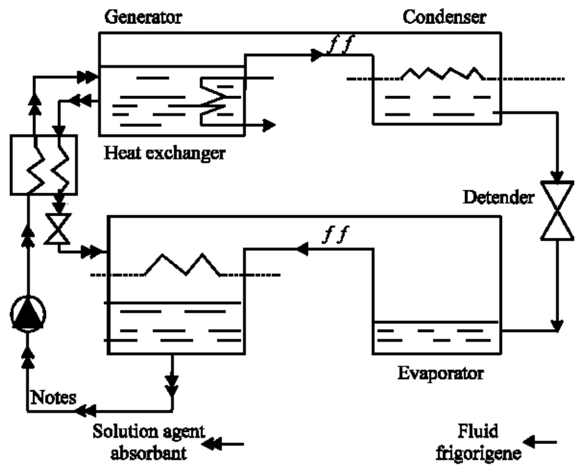


Fig. 2: Absorption machine refrigeration

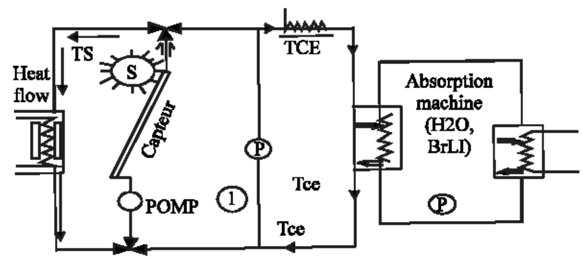


Fig. 3: Coupling solar system-absorption machine refrigeration

there are 2 circuits: the refrigerant circuit and a circuit of a binary solution (i.e., consisting of two officers: refrigerant and absorbent) (Rapin and Jacquard, 1998; Pansrad, 1973).

**Notes:** The possibility of developing air conditioning systems coupled with a solar system that can guarantee the conditions for comfort. The solar coupled with refrigeration systems to be optimized depending on the site and its applications so they can provide a conversion efficiency-cost of implantation (Byh and Jordan, 1960).

## APPLICATION

In our study we have chosen the method Phibar-fchart (Curran, 1977) for the calculation of the fraction Solar with monthly and annual data for the region of Ouargla.

This method is rather simple to use and does not require expensive ways. We propose a program of calculation using the method Phibar-fchart, the development of this calculation program is based on knowledge:

- Weather data provided by the meteorological station of Ouargla and combining the average monthly values ambient temperatures and energy overall daily average over one month received on a horizontal surface.
- Thermo physical data of the sensor corresponding to the sensors plans to water.

The average performance fall within the range of application of energy Among solar (70-110°C).

## RESULTS

According to these curves (Fig. 4 and 5) can be observed that the bank angle equal to 45° is the optimum angle for the 4 quarters therefore we can say for a collection system coupled with a refrigeration system used to cool the corner desired optimum is 45° in the region of Ouargla.

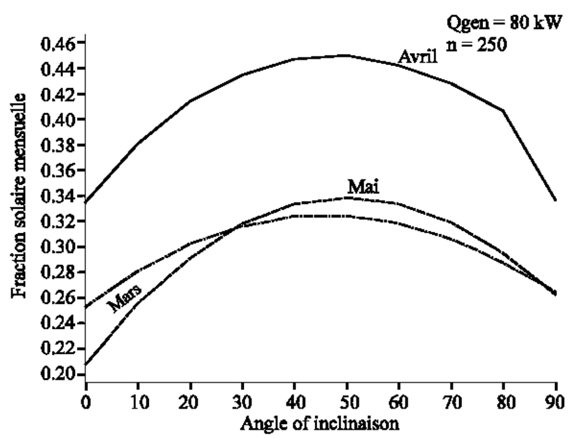


Fig. 4: Influence of the tilt sensor on the solar fraction monthly (March, April, May)

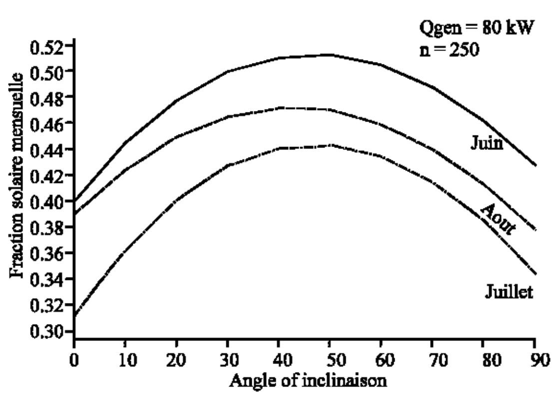


Fig. 5: Influence of the tilt sensor on the solar fraction monthly (June, July, August)

The Ouargla region enjoys an appreciable especially solar radiation months: April, June, July and August.

## CONCLUSION

- Simulation results for the region of Ouargla show that the angle of the solar collector is 45° so that the solar fraction reached its peak.
- A small variable 5° angle sensor relative to the optimum tilt too does not affect the coverage rate of solar energy as giving more freedom of architecture at the moment of conception of 'installation.
- The portion solar believes linearly with the capture solar surface, this result must be associated with any techno-economic study of solar systems.
- In order to have an optimum system design.

## REFERENCES

Byh Liu and Jordan, 1960. The intrrelation characteristic and distribution of direct broadcast and total solar radiation. Solar Energy, 4 (3): 1.

Curran, J.M., 1977. Coefficient of performance space for solar powerd conndtonning system. Solar Energy, 19: 601.

Duffie, J.A. and Wabekman, 1980. Solar thermal engineering of processes.

Make, W. and J.L. HJEckert, 1988. Cauchepin, pohlman. Edition.

Pansrad, M.J., 1973. Current status of the technique of a absrption refrigerating machines (Brommure Lithium). General Review of the Cold, 10: 1065.

Rapin, P. and P. Jacquard. Form cold. 11th Edn. Edition.