

# "Construction of a cold store prototype for the transport of perishable foods over long distances using the vehicle combustion gases and the solar energy to reduce the fossil energy consumption and the environmental impact"

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**Subject:** Engineering Project

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## SUMMARY

With the project will be built a prototype for a vehicle of 1 tonne capacity, with a hybrid cooling system to be reliable for the refrigerated transport and in this way we can replicate the results of the project for other load capacities and products. Our system consists of three energy sources: solar energy, thermal energy of the exhaust gases and an auxiliary system energy. The thermal energy by solar radiation and thermal energy of the exhaust gas in vehicles (temperatures between 440 °C and 490 °C in a truck) are not exploited.

## INTRODUCTION

The use of the free energy involves savings in energy consumption and environmental impact reduction when used to replace the traditional refrigeration equipment by vapor compression (greenhouse refrigerants).

The non-availability continuously of solar energy by radiation and the thermal energy given by exhaust gases make it difficult the use of a unique cooling system that take one of these energy efficiently. On the basis of this we propose a hybrid cooling system that will work with both solar energy and thermal energy of the exhaust gases

which will allow the reduction of energy consumption for the refrigerated transport.

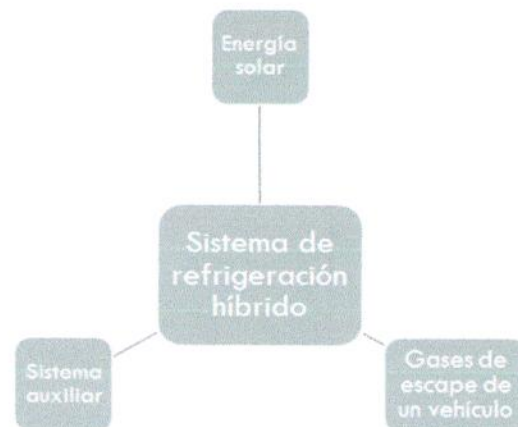


Figure 1 1

## DESCRIPTION OF THE PROBLEM

Companies with a predominance in the peruvian commercial refrigerated transport have as customers: supermarket chains, food industries and large companies; and do not provide economic solutions for small carriers, do not use other sources of energy such as solar and the exhaust gases that are voted into the environment. As a result, this produces high running costs and maintenance in the refrigerated transport, which causes small carriers do not use a cooling system for the transport of food and, therefore, their products spoil quickly

and do not arrive with the expected quality to their destination. Our market opportunity is the sector of small carriers who are very interested in a cooling system of low cost of operation and maintenance. The target population is comprised of: carriers for small and medium-sized popular markets, producers/agricultural associations and agricultural carriers for small and medium industry.

## OBJECTIVES

Main objectives:

- Build a prototype of cold store with a hybrid cooling system that use the combustion gases and solar energy to reduce the energy consumption of fossil fuels, in 20% compared with the traditional system, and the environmental impact, with emissions lower than 10% of the motor vehicle's emissions, for the transport of perishable foods from the north to Lima.

Specific Objectives:

- Designing the prototype of the cold chamber outside to keep the product fresh.
- Designing the prototype of the hybrid cooling system to keep the product fresh.
- Build the prototype of the cold chamber.
- Perform testing in the laboratory of the prototype of the cold chamber.
- Perform field test of the prototype of the cold chamber.
- Management and closure of the project.

## MARCO PERUANA

-Leader in the industry (annual sales >> \$ 16M)

-It has 5 offices and workshops in Peru.

-Specialize in marketing of equipment Thermo King.

-Services: Installation, post-sale.

## AUTOCLIMA S.A.C

-Manufacture of national equipment.

## CORPORACIÓN Z1

Sells and installs Korean equipments Hwasung Thermo (official distributor)

## ZGROUP

-Sells and installs Carrier equipment.

-Has refrigerated containers and generators of marks like Carrier, Mitsubishi and Thermo King.

## POTENTIAL MARKET

The Peruvian companies under this heading are: importers of American, Chinese, and Korean equipments; supermarket chains; food industries and big companies. These do not provide economic solutions and have high costs. So the smaller carriers do not use refrigeration systems, have poor transport logistics, spoiled products and low quality. Therefore our potential market are:

- Small carriers going to popular markets.
- Small producers.
- Small businesses.

## TECHNICAL MEMORY

With the image below we describe the main characteristics of the innovation raised.



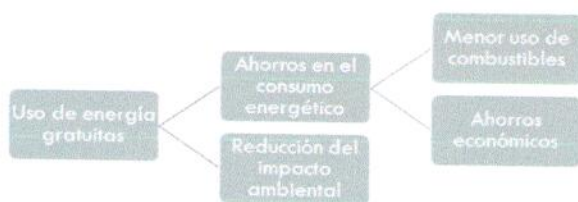


Figure 22

Below is a schematic of the system raised:



Figure 3 3

## CONCLUSIONS

With this project it was hoped to meet the large demand in the refrigerated transport of small and medium-sized companies that are engaged in the transport of the products of the agricultural places to shopping malls and wholesale markets ("Mercado Mayorista de Frutas", "Gran Mercado Mayorista de Lima", etc).

The results of the project will serve as a basic methodology for other designs in vehicles of various capacities (10, 15, 20, 30 tonne), with other products and various climatic conditions.

The project will promote the relationship company - university which will allow the development of researchers and innovation in the country.

## TIMETABLE AND BUDGET

For this project has been carried out the calculation of the budget that is shown in table 1.

Table 1: General Budget of the project.

Name of the Entity	If non-monetary contribution.	If monetary contribution.	Contribution Total S/.	Percentage %
Applicant Entity				
AUTOREL S. R. L.	41,135.00	28,550.27	69,685.27	20.71
Entity(s) associated(s)				
UNIVERSIDAD NACIONAL DE INGENIERÍA	32.300.00	0.00	32.300.00	9.6
RNR				
FINCYT	0.00	234,523.73	234,523.73	69.6S
<b>TOTAL</b>	<b>73.435.00</b>	<b>263.074.00</b>	<b>336.509.00</b>	<b>100</b>

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