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Solar Based Cold Storage

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Abstract: *The history of agriculture in India dates back to the Indus Valley Civilization. India ranks second worldwide in farm outputs. As per 2018, agriculture employed more than 50% of the Indian work force and contributed 17 18% to country's GDP. The total agriculture commodities export was US$3.50 billion in March - June 2020. India exported $38 billion worth of agricultural products in 2013, making it the seventh largest agricultural exporter worldwide and the sixth largest net exporter. Most of its agriculture exports serve developing and least developed nations Indian agricultural/horticultural and processed foods are exported to more than 120 countries, primarily to the Japan, Southeast Asia, SAARC countries, the European Union and the United States Estimates place post-harvest food wastage due to inadequate cold storage at 40% (Desai, October 2011) for fruits and vegetables alone without including dairy produce and food grains. This has a bearing on India"s contribution to the world with regard to international food trade as although the country is self-sufficient, the export volume is comparatively low (Alam, 2006).The Ministry of Food Processing in India identified the cold chain to be a weak link in the food processing sector. There exists much room for improvement in the cold storage and integrated cold chain infrastructure with regard to both capacity and operation. (MoFPI, Government of India, 2010). India is developing and while electrification is considered a top priority by the planning commission, there are still a great number of villages that are still to be electrified. Even the ones that are electrified have unreliable power (Gopal & Suryanarayana, 2011). This a challenge with regard to the energy required for refrigeration of food produce. Hence, there exists a pressing need to develop a smaller capacity refrigeration system which can be operated independent of the electrical grid. This thesis is an investigation into the methods of refrigeration that can be adopted for the purpose of reducing food produce wastage. Specific focus on solar based refrigeration is placed due to the tropical position of the country that ensures adequate delivery of solar energy through the year.*

Keywords: Sunlight, Cold Storage, Renewable Energy, Mobile Storage.

I. INTRODUCTION

The most significant application of refrigeration is in food preservation, weather it is by way of processing or for cold storage. The preservation of food is defined as the preservation of palatability and nutritive value of food preventing the natural spoilage with respect to time. Solar refrigeration is thought as one of the best techniques to address this issue, due to its good match to the variation of solar radiation; namely, the supply of sunshine, and the cooling output of a solar refrigeration system reach maximum levels at the same season. The theory of combined solar thermoelectric refrigerator is proposed and for its optimum operation, the ratio of number of thermocouples required is given by Vella et al.[1]. After that a small prototype of thermoelectric refrigerator powered by solar photovoltaic solar collector was proposed by Sofrata[2]

1.1 Literature survey

Basic solar adsorption system working with different types of adsorbent & adsorbate combination : Abstract: In this the combination like, activated carbon-methanol, activated carbon-ammonia, Zeolite-water, silica gel- water and other unpopular working pairs. The experimental data of adsorption system around the world is compiled with respect to their working pair to have clear comparison between all the adsorbent-adsorbate pair. The selection criteria of adsorbent-adsorbate according to the application and operation is also explained. Combination of basic adsorption system with other systems i.e. hybrid systems are mentioned literature work on different types of adsorbent adsorbate pair which used in

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solar adsorption systems. This includes classification and comparison for the working pairs in order of their use. The comparison is done on the basis of the performance parameters of the pairs. This will help us to discover and invent future pairs of adsorbent-adsorbate for better COP. According to review, Silica gel and chlorides with water gives maximum COP whereas zeolite with water shows poor performance working under similar conditions.

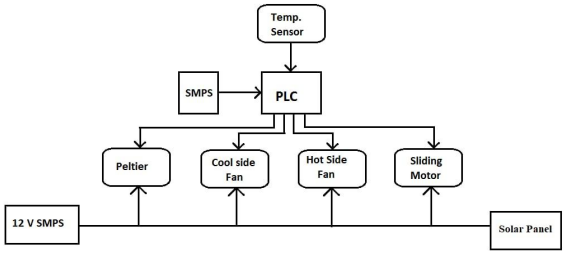
1.2 Requirement

In India seventy perclistic developmenent population depend on Agriculture. Upliftment of those categories can improve the overall status of the State. Comparing the developed States of our country, the economic condition of farmers of our State is miserable. The economic condition of most of the people is poor out of the total farmers about 47 to 48 percent of people cultivate cabbage, beans, onion, sweet potato , Brinjal, pea etc which has a very limited period . Similarly the fruits have also limited life after harvest. Post Harvest cooling rapidly removes field heat, reduces respiratory - activity, reduce internal water, wilting, slow the growth of micro organism and reduces the production of natural ripening agent i.e. ethylene. Post Harvest cooling also provides marketing flexibility by allowing the grower to sell produce at the most appropriate time. Unavailability cooling and storage facilities makes it necessary to market the produce immediately after harvest and may result un distress sale. This can be an advantageous to growers who supply products restaurants and grocery stores or to small growers who wait to assemble truck load for transportation to other place. Post Harvest cooling can be an effective tool to deliver highest qualitative produce to the consumer. Intervention through Post Harvest cooling will help the farmers to store their produces and market them at the opportune time.

1.3 Necessity

The financial condition of the farmers does not permit to establish a cold storage having capacity of 5000 MT which is meant to store 50,000 quintals of the products in the cold storage which require crores of Rupees to establish it. The concept of cold room is to store vegetables, fruits and flowers for shorter duration for which a small and marginal farmer can store products for shorter period and sell it without deterioration of the product. Farmers will also get appropriate value of the product. It will reduce the distress sale. The farmers can establish cold rooms having 10 MT capacity where the storing of surplus quantities may vary from 100 quintals . Since the investment of such cold room is low a farmer can easily establish a cold room to store his surplus products.

II. BLOCK DIAGRAM



In the block diagram a separate SMPS module is shown which is used to run PLC. Next temperature sensor is used which will sense the temperature. Next 12V SMPS module is used to give supply to peltier module, cooling fan ,heating fan and sliding motor. The peltier module will produce cool as well as hot air so here we are going to utilize both the air for different purposes. Cold air will preserve the air for long time and hot air will use for drying the dry fruits and other produce.

III. CONCLUSION

An Investigation into the refrigeration solutions for agriculture in India has been made using deductive reasoning based on evidence and case study to arrive at the best possible approach for holistic development of the cold chain. Heat driven refrigeration cycle were deemed most appropriate for the India scenario due to high solar isolation levels throughout the country.

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