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# SOLAR ENERGY INTERNATIONAL PROGRESS

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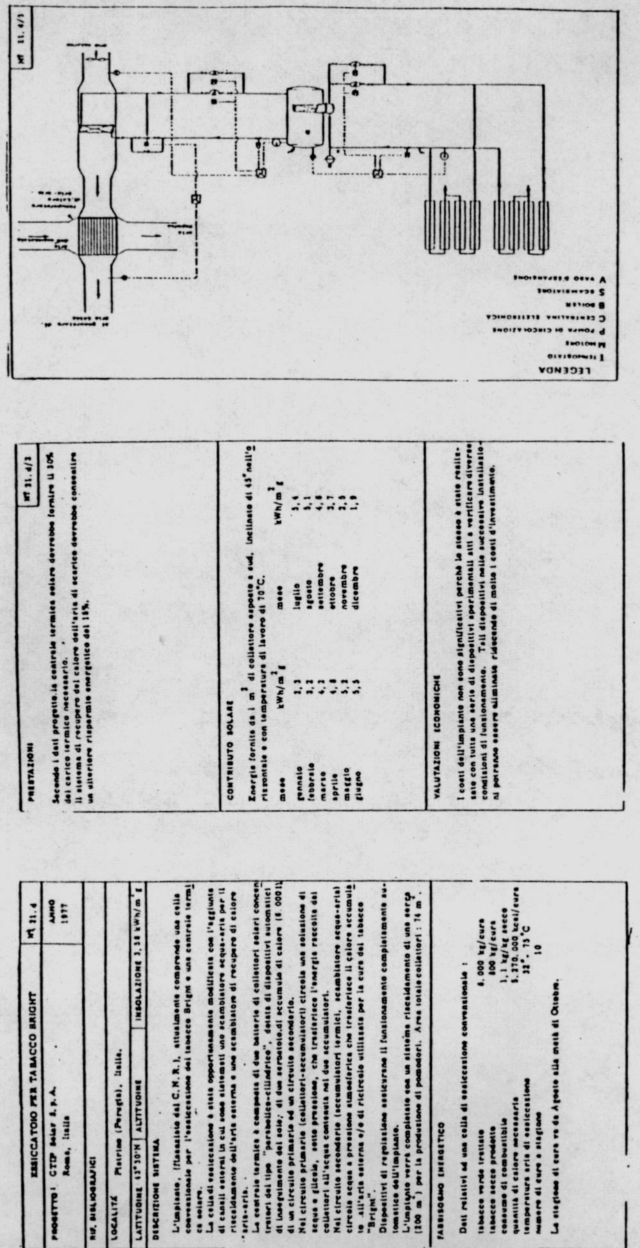

FIGURE 1 TYPICAL FORM USED FOR THE SURVEY





# SOLAR ENERGY UTILIZATION FOR AGRICULTURAL PURPOSES IN EGYPT

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## ABSTRACT

With the increasing foodstuff consumption in Egypt emerges the application of solar energy for agricultural purposes as a highly recommended resolution. Corresponding water sources for desalination are abundant, and installations can be, to great extent, locally supplied. Nutrient-film technique in polyethylene coated greenhouses is very appreciable. Growing vegetables, expensive crops, raising fishes and poultry on own plant wastes can be relatively competitive and even vital.

## INTRODUCTION

Egypt is facing in the near future a challenge which may be the worst in its whole history. The tremendously increasing population is evoking the serious danger of famine, especially for a country which is not capable of industrial competition on the consuming foreign markets in order to integrate its alimentation demands through exchange of its own industrial products against food requirements. The population has exceeded now 38 million and is expected to reach 70 million in the year 2000. The local wheat production is already, and remains, very far behind the consumption, unless triticales are going to be grown. The imports of other cereals, fats and newly sugars are growing continuously. The only rescue out of this affliction can be through the use of the vast deserts, 97% of the total area in Egypt, at locations where soft water can be gained and using it very carefully raising relatively expensive crops, such as vegetables and fruits and small animals. International experiences and practices are now too far to be reliable exhibiting that the use of non-conventional water sources, with differing grades of salinity, in non-rainy regions can only be possible through desalination depending upon the use of the free source of energy, namely solar energy. The needed initial installations may not be that cheap such as conventional farming, but following a proper plan in crop selection and management and an automation system to avoid the recent high salaries of the agrarian labour, should lead to competitive prices of the second products.

PROPOSED LOCATIONS

Certain suppositions must be taken in consideration for the choice of the suitable locations. Water as a matter of fact is the main element for agricultural establishments, yet almost soft water, up to 2000 p.p.m., is too precious to be elaborated for such purposes, then it can be used even for growing several salt-tolerant crops and serve some other objects, without the required expenses of any of the desalination processes. Hence, it is clear for Egypt that raising of desalination establishments can take place anywhere at the long coastal front, over 3000 kilometers, at both Mediterranean and Red Seas or at sites where saline water can be gained from near of deep wells. Such sites are abundantly existing in the northern regions of the Sahara, Sinai, and in the eastern desert. The regularly flowing amount/annum differs between 5000-300,000 tons from such wells, with a salinity ranging between 2000-10,000 p.p.m. Yet, there are some other aspects which must be taken in consideration, namely the kind and size of community that may inhabit the regions where this relatively expensive, till now, crop growing can be executed. Real probabilities are expected to be found at isolated sites, with intensive mining operations, tourism assemblies, considerable seaports, and army units. It is then preferable if soft water is gained secondarily as a waste in a procedure during which also energy is generated and can be possibly stored in order to offer, simultaneously, several services levelling the balance between expenses and income. Speaking about energy, it is sometimes necessary to have additional devices for energy, for moveable parts, and in this case it is advisable to spare the own gained energy and substitute it through other means, such as wind whose velocity is ranging between 5-45 K/h. on the Red Sea Coast. Additively to crop growing, raises the necessity for heat production or cooling systems for processing and storage of excessive agricultural products, respectively. Such locations exist already in Egypt at sites with mass production which is not all thought to be immediately consumed or with non-convenient transportation.

APPROPRIATE SYSTEMS

Specially, in the case of Egypt, an appropriate system must exhibit certain attributes in order to be principally acceptable. Egypt is spoiled through the free excessive supply of Nile water, mild weather, and fertile soil. What may be good enough for parched, and though a rich country on the Persian Gulf does not, compularily,have the same advantages for countries like Egypt. For these countries an appropriate system whether for crop growing, processing of agricultural products or raising animals must be cheap in acquisition, serving numerous purposes, having a simple automation to deal with, and with low running





costs. Luckily, it is already so far that the developments of such equipments has produced several models which are approaching the figured objective. After Hodges and Hodge [1] greenhouse construction should be simple, fairly inexpensive, and rely on using the locally available material as much as possible. Plastic-covered greenhouses proved to be successful in intensive agricultural operations in several arid areas including Abu Dhabi, Kuwait, Iran, Mexico and Arizona. The substructure frame can be constructed of wood, iron, or aluminum. Inflated greenhouses using polyethylene film (12 mil Monsanto film made of light-stabilized plastic sheets with a yield strength of about 1400 psi and with approximately 12-14 months life span in warm arid climate, or any similar films). Newly produced coated membranes can last for more than 15 years. A greenhouse with a closed environment and air-locks seems to be very proper. In this case $CO_2$ enrichment leads to better yields. Hodges and Hodge estimated the costs of producing 2 million pounds of greenhouse harvested, 20 folds yield as conventional farming [2], vegetables per year of a 10 acre unit in Abu Dhabi to be less than 20 cents per pound (compared to $1.50/pound or more for imported vegetables). Under the different examined models of greenhouses, the soil-less construction seems to be the most suitable for Egyptian conditions, by which the available amount of irrigation water is not always high enough. Crop growing by the intensive methods of soil-less culture is becoming, everywhere, quite prevalent in recent agricultural and horticultural operations. These methods provide an immediate source of income, almost like instant returns, while the longer-term projects are underway. Hydroponics, i.e., growing plants in watercultures placed in containers where the nutrietient solution is recirculated, were first used by American research workers in the early part of this century. In the last episode, modified hydroponics were constructed, with the so-called nutrietient-film technique (NFT) and some are called the hydroponic layflats or the hydrocanal system. Some recent designs have been developed to accommodate the need for speedy construction, light weight components, easy portability, and immediate crop production. By all these new models, the nutritient film is flowing past the roots and ensures enough moisture for all roots, grown in plastic tubes. This method has the advantage of providing simplicity of operation, can tolerate fluctuations in the concentration of the nutrient solution and thus one formula of the nutritient solution can be used for all stages of growth of all crops and under all climates in various countries. Thereby, such a model can be highly recommended for large-scale application in Egypt.

PROPOSED CROPS

As for vegetables and small trees, it must be taken in consideration that the choice of the crops has to care for the commercial point of view, and vital necessity at some sites in Egypt. The recommended crops must be those who can be sold for high prices, such as vegetables in the off-season, strawberries, and some exotic spices. Speaking about vital necessity in isolated sites with bad or impossible transportation, vegetables, salad plants, and small trees such as vines can be adopted. In addition to these conventional objects, algae mass-culture for protein production, fish basins supported with own or additive feeds, poultry and sheep fed on wastes of higher plants, can be also raised. Productive high-protein field crops such as soya been can be grown as well to integrate the nutritional supply of the inhabitants in some locations.

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# SOLAR POWERED WATER PUMP FOR THE RURAL THIRD WORLD

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## ABSTRACT

A vapor actuated pump containing no other moving parts than two check valves has been developed. The vapor is to be produced directly in a flat-plate solar collector (about 25 square metres) with plane reflectors along its sides.

The yield is in the order of 5-20 cubic metres per day. The investment cost is relatively low - less than one U.S. dollar per capita - and the cost of the water is in the order of 30-100 dollars per 1000 cubic metres, assuming a 10 year life-time. The pump can only be used for shallow wells (about 0-10 metres depth).

The pump has been developed with special reference to the technological resources of the developing countries, thus being based on the concept of appropriate technology. It is robust, simple, and suitable for manufacture and maintenance by local workshops from readily available materials, requiring no hign standards of accuracy. Its operation is reliable under laboratory conditions and is expected to be so in the field. The production process is labor intensive, thus providing local opportunities for employment.

## INTRODUCTION

A major part of the World's population is still without safe water supply. Many have little or no ready access to any water at all. The lack of water causes victims of debilitating diseases or death. Lack of water also results in economic and social stagnation of entire communities and regions. Often the population - especially women and children - spend a great deal of their time on manual handling of water at the expense of other productive activities or education.

Developing water supply systems is therefore one of the major objectives in raising the Third World's living standard.

It is in the light of this situation that the Laboratory for Energetics at the Technical University of Denmark has developed a prototype water pump. The pump is the so-called thermopump, as patented by Kleen |1|. It was later followed up by Coleman |2| and MacCracken |3|, but since then no further development seems to have taken place. The thermopump appears interesting, however, and in 1975 a project was started in our laboratory with the aim of developing a pump that could become of use to the rural population in the developing countries.