



No. 20 June 1991 Nicosia Cyprus

# Review

## THE HIGHER TECHNICAL INSTITUTE



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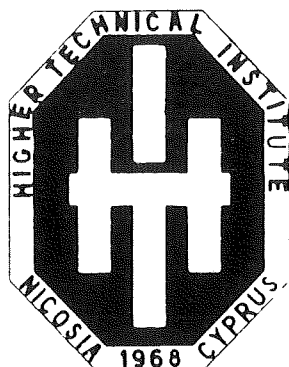
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# Review

No. 20 June 1991 Nicosia Cyprus

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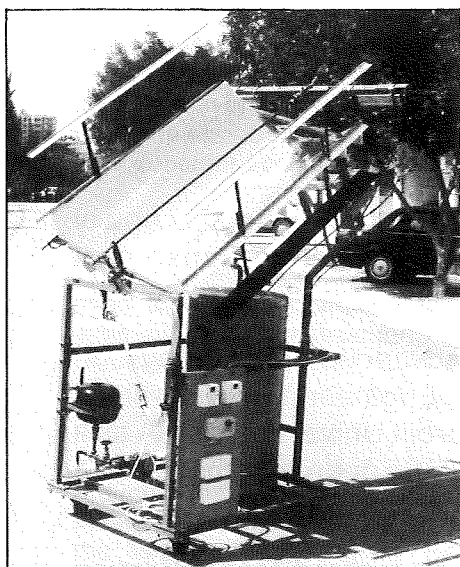
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Model of a parabolic trough collector developed for a research project.

Photo: by S. Kalogirou

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P.I.O. 14/1991 — 500

## HTI DIRECTOR



### PROFILE

Mr Demetrios Lazarides is the newly appointed Director of the Higher Technical Institute. He was promoted from the post of Head of Civil Engineering Department which post he has held since 1970.

Mr Lazarides joined Loughborough College of Advanced Technology in September 1961 for the three-year Diploma course in Civil Engineering. He received his Diploma with Honours in 1964. In 1977 he joined Vanderbilt University in USA as a Fulbright Scholar and after a year of studies he received an MSc degree from the same University.

Mr Lazarides became a member of the Institution of Highways and Transportation (MIHT) in 1968 and a member of the Institution of Civil Engineers (CEng MICE) in 1970.

Mr Lazarides' professional experience started with Edmund Nuttal Ltd (UK) in 1964. He then joined Mott, Hay and Anderson (UK) in 1965 and finally Taylor Woodrow Ltd (UK) in 1969. His professional experience includes both design and construction work for various major engineering projects.

He is the Honorary Secretary and one of the founders of the Cyprus Group of Civil and Mechanical Professional Engineers. In this capacity and in cooperation with the Industrial Training Authority he organises Further Professional Development courses for engineers in Industry.

He is an active member of various technical committees and has participated in many seminars both locally and abroad.

Mr Lazarides is forty-nine years old, married and has four sons.

# An investigation into the performance of a thermosyphon solar water heater

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Senior Lecturer, HTI

## ABSTRACT

This paper is concerned with the investigation of the performance characteristics of a thermosyphon solar water heating system using a computer simulation model.

The instantaneous collector efficiency was determined as a function of flow rate of water and the water temperature difference between the collector inlet and outlet.

The model was also used to predict the monthly and yearly solar contribution of the system for two different load profiles. The results of simulation indicate that the yearly solar contribution of the system for a low consumption profile is about 94% as compared to 63% for a high consumption pattern.

## 1. INTRODUCTION

Thermosyphon solar water heaters are widely used for domestic water heating due to their simplicity in construction, installation and maintenance and their cost effectiveness as compared to conventional methods of water heating.

In Cyprus, for example, it is estimated that there are more than 130,000 units in operation, which means one solar water heater for five people in the island. According to Construction and Housing Statistics for 1987 [1], about 87% of new dwellings built in 1987 have been equipped with solar water heaters as compared to 69% in 1982.

There has been, extensive work on the analysis of the performance of thermosyphon solar water heaters, both experimentally and analytically, by numerous researchers [1-9]. Most of these studies correlated the system performance with the thermosyphonic flow, the temperature difference and the solar insolation, and a good agreement between simulation results and experimental data was reported by a number of researchers [8, 9].

The present study aims to investigate the performance characteristics of a typical Cypriot Thermosyphon Solar Water Heater for the conditions of Nicosia, through simulation, using the model of TRNSYS [10] Simulation Program. Such an investigation will provide a detailed understanding of the phenomena involved in the system operation which will help in further improvements in the system performance.

## 2. SYSTEM DESCRIPTION

A schematic diagram of the system under investigation is shown in Figure 1.

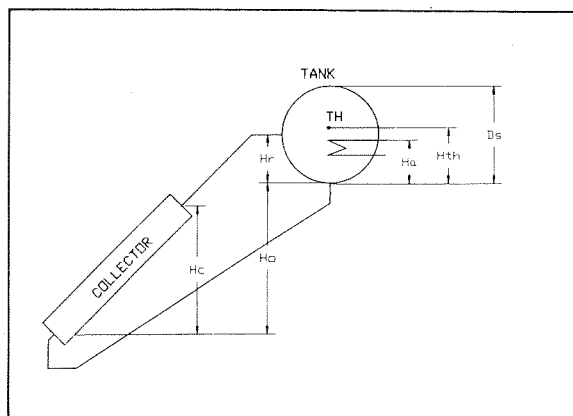


Figure 1 Thermosyphon System Schematic

It consists of two flat plate solar collectors having a total surface area of 3 m<sup>2</sup> tilted at 42 degrees from horizontal, an insulated horizontal storage tank of capacity 180 litres equipped with a 3 kw electric heater and interconnecting piping. The collectors are connected in parallel through the supply headers, both employing ten evenly spaced parallel copper pipes embossed by semi-circular grooves formed in the flat plate absorber.

The above system is supposed to meet the hot water requirements of a family of four.

The system parameters are shown in Table 1.

## 3. SYSTEM MODELLING AND SIMULATION

The performance of a thermosyphon solar water heater depends on the weather; both the energy collected and the load are functions of solar radiation, ambient air temperature, wind velocity and other meteorological variables which may be viewed as a set of time dependent forcing functions acting on the system.

Experimental investigations are essential and useful in determining the performance characteristics of a system but they are not repeatable. The alternative solution is the modelling and simulation of a system which can provide much of the same thermal performance information as the experiments with less time and cost.

$A_c$	3 m <sup>2</sup>
$F_R(\tau\alpha)_n$	0.77
$F_R U_L$	24.4 kJ/h m <sup>2</sup> °C
$G_{test}$	54 kg/h m <sup>2</sup>
$\beta$	42 degrees from horizontal
$N_R$	20
$d_R$	12 mm
$d_h$	26 mm
$L_h$	1900 mm
$d_i, d_o$	20 mm
$H_c$	1000 mm
$H_o$	1150 mm
$H_r$	250 mm
$H_a$	300 mm
$H_{th}$	370 mm
$L_i, L_o$	2000 mm, 520 mm
$(UA)_{pi}, (UA)_{po}$	1.6 KJ/h °C, 0.5 KJ/h °C
$V_s$	180 litres
$D_s$	500 mm
$(UA)_s$	4.65 KJ/h °C
$P_{aux}$	3 Kw

The simulation of a thermosyphon system can provide a mean of analysing the dynamic performance of the system in response to selected meteorological data and load profiles and can be used to generate design methods.

Like most solar energy systems, the thermosyphon solar water heater is modular and the simulation model for the system can be formulated by connecting models of each of the system components. This modular approach is used in TRNSYS [10], where system components are described by individual FORTRAN subroutines which are based on models. The simulation of the system requires hourly weather data which must be representative of the location under investigation and this is the difficulty. For design, "long-term" performance refers to a period equivalent to or representative of the expected life of the system, which may be 10-20 years. Klein et al [11] have constructed the "average year for a number of simulations by selecting for each month of the year, that month of data from the 8-year period which most closely corresponded to the average monthly insolation and ambient temperature.

For the present investigation, monthly average values for the years 1984-1987, of the daily solar radiation and air temperatures, taken from the Cyprus Meteorological Service [12, 13], have been used in the simulation, as shown in Table 2, where:

$T_a$  = ambient air temperature, °C

$I_h$  = monthly average of the daily total radiation incident on a horizontal surface, kJ/m<sup>2</sup>

$v$  = wind velocity, m/s

Month	$T_a$ (°C)	$I_h$ (kJ/m <sup>2</sup> day)	$v$ (m/s)
January	10.3	8,568	3.09
February	10.9	11,948	4.12
March	13.2	15,836	3.61
April	17.1	20,624	4.12
May	21.9	23,267	4.64
June	26.3	25,304	5.15
July	29.0	25,758	5.15
August	28.8	22,835	4.64
September	25.8	18,846	4.12
October	21.5	13,892	3.61
November	16.4	9,896	3.09
December	12.0	8,269	3.09

#### 4. ANALYSIS OF SIMULATION RESULTS

Two different scenarios of daily load profiles have been used: a high load profile corresponding to a consumption of 160 litres of hot water at 50 °C daily as shown in figure 2, and a low load profile corresponding to a daily consumption of 120 litres of hot water at 45 °C.

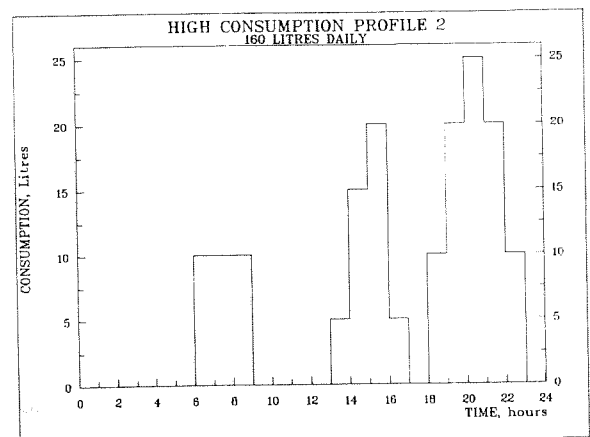


Figure 2 High consumption profile (2)

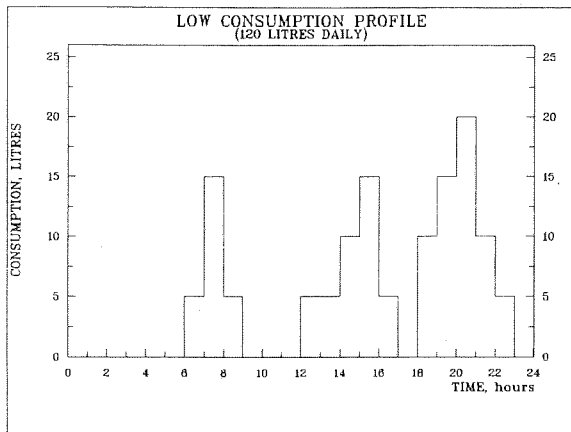


Figure 3 Low consumption profile (3)

Daily simulations have been ran for a number of days and the results of 1st May were used to plot a number of graphs to correlate the various parameters of the system, i.e. the flow rate, the efficiency, the temperatures and the solar fraction with time, and the efficiency with the thermosyphonic flow rate of water.

The system was also simulated to investigate its behaviour without any load. Figure 4 shows the variation of thermosyphonic flow and incident solar radiation with time for a high consumption pattern (profile 2). Water flow rate in the system was found to follow the pattern of variation of the solar insolation as expected. The flow rate increases during the morning hours to reach a maximum of about 86 kg/h at solar noon, corresponding to approximately 28.7 kg/h per m<sup>2</sup> of collector, and then starts to decline in the afternoon hours as the solar radiation does. The same pattern of variation was also observed for the other two cases studied i.e. without load and with the low load profile 3.

The above values seem to be high as compared to experimental data reported by Shitzer et al [14] for a similar system tested in Israel and Pafillias et al [15] for a similar system tested in Greece. However, no concrete conclusions can be made before the system simulated is tested experimentally in Nicosia.

Figures 5,6,7 illustrate the variation of the system efficiency with time for the three different scenarios under investigation, with the graph of flow rate variation superimposed. The system efficiency follows a pattern which is slightly different from that of flow rate. It increases rapidly during the morning hours to reach a maximum of about 60% at around 9.00 a.m. solar time in all three scenarios. There is however a remarkable difference in the afternoon hours where the best efficiency pattern is obtained in the case of high consumption. Thus, at 4.00 p.m. the efficiency of the system without load becomes zero while in the case of load profile 2 (high consumption) the system collects energy at an efficiency of about

25%. This can be attributed to the fact that the temperature of water entering the collector in the system without load is higher than that with load and therefore the collector is operating at high (Ti-Ta) corresponding to low efficiency.

Another interesting piece of information which is provided by the above figures, is that the peak of efficiency does not coincide with that of thermosyphonic flow.

In correlating the efficiency with the thermosyphonic flow, it appears that the pattern of variation is more or less the same in all three cases, with slight differences in the case without load.

From figures 8 and 9, it appears that in the morning hours the efficiency rises slowly as the flow rate increases, and it reaches a maximum of 60% when the flow is 55 kg/h, that is 18.3 kg/h per m<sup>2</sup> of collector. As the flow rate increases further, the efficiency declines very slowly to drop down to 58% at 83 kg/h with high consumption and down to 57% at the same flow without load.

The variation of collector inlet and outlet temperatures and their difference, with time is shown in figures 10 and 11 for the systems with and without water consumption respectively.

The first interesting piece of information in these graphs is that the collector temperatures start rising in the morning hours following the variation pattern of the solar radiation, but they reach their peak values at around 2.00 p.m. in the cases of water consumption (profiles 2 and 3) and at 4.00 p.m. in the system without load and reached 72 deg C at the collector outlet, at 4.00 p.m. In the case of consumption profile 2 the maximum temperature attained at the collector outlet was 69 deg C at 2.00 p.m.

Another interesting piece of information is that the temperature difference between the collector inlet and outlet starts rising in the morning to reach a maximum of about 18 deg C in all cases, at 9 am and drops down in a slow rate afterwards. It is interesting to note that the variation of the temperature difference follows the pattern of the variation efficiency.

In the absence of experimental results, no comparison can be made to validate the simulation results.

The variation of the annual solar contribution for the high and low consumption profiles are shown in figures 12 and 13 respectively. In these figures, *f*, the solar fraction, is defined as the ratio of the useful solar energy supplied to the system and the energy needed to heat the water if no solar is used. As a matter of fact this represents fractional energy savings relative to conventional system. It must be noted here that these results assume the same daily load profile throughout the year. This is not quite true when it comes to summer, where the consumption pattern is somehow different. However, during the same period, the hot water

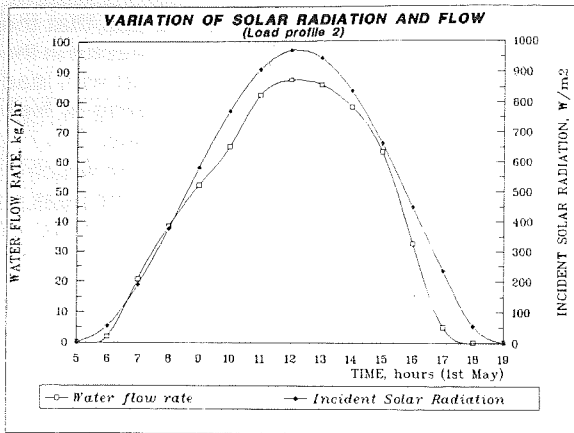


Fig 4

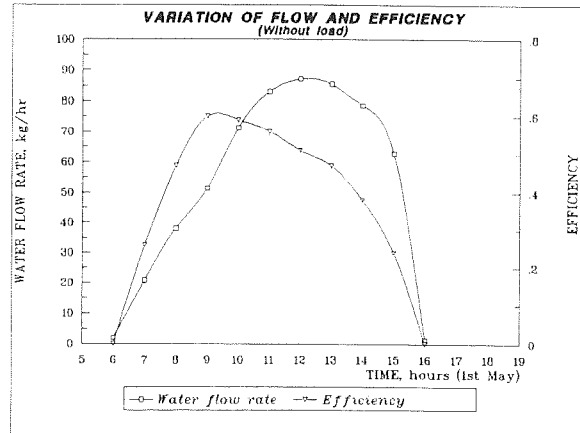


Fig 5

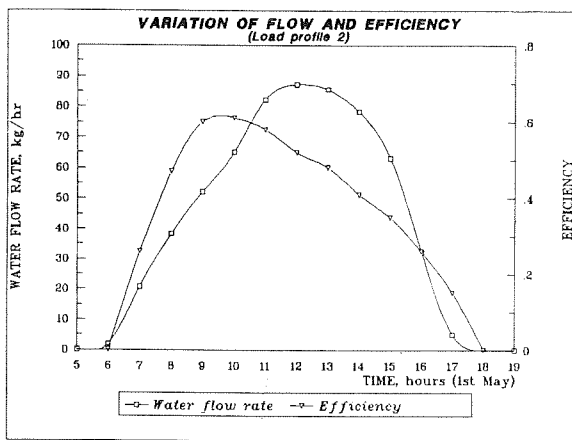


Fig 6

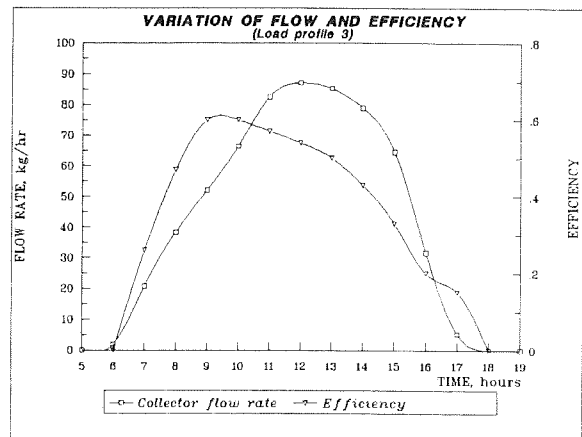


Fig 7

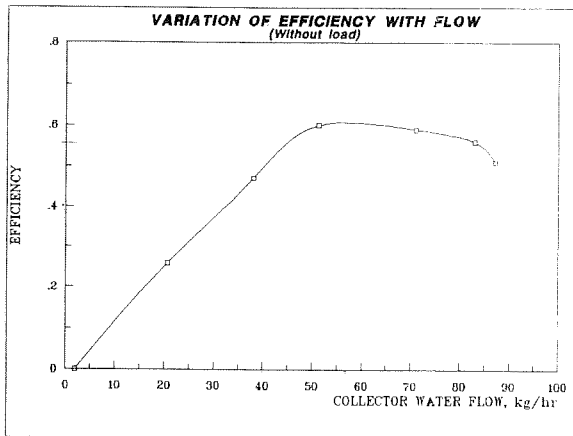


Fig 8

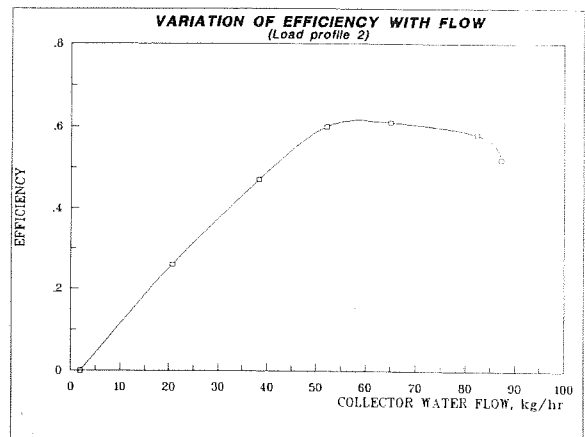


Fig 9

temperature requirements are not as high as in the case of winter. Consequently, from the point of view of thermal energy requirements the difference cannot be much. With the high profile consumption the yearly solar fraction is 66% as compared to as high as 89% with the low profile consumption and lower water temperature.

With reference to figure 13, it must be noted that the useful energy collected during the seven months of the year, namely April to October included, is greater than the load; in these cases

the solar fraction is taken as 1.

The validity of the simulation results cannot be checked unless monitoring of the system under actual operating conditions is carried out.

## 5. CONCLUSIONS

A thermosyphon solar water heating system, representative of systems commonly used in Cyprus, was simulated using TRNSYS Simulation Program. The simulated results lead to the following observations:



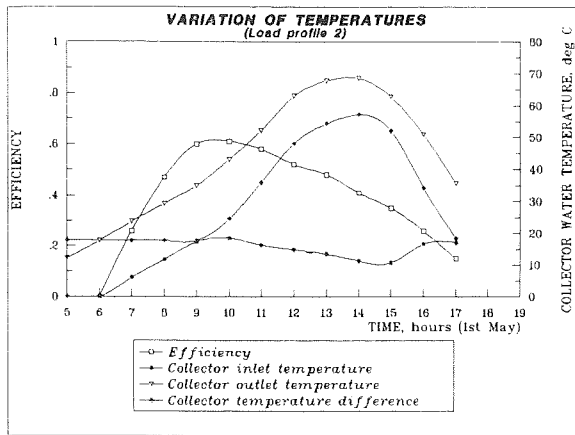


Fig 10

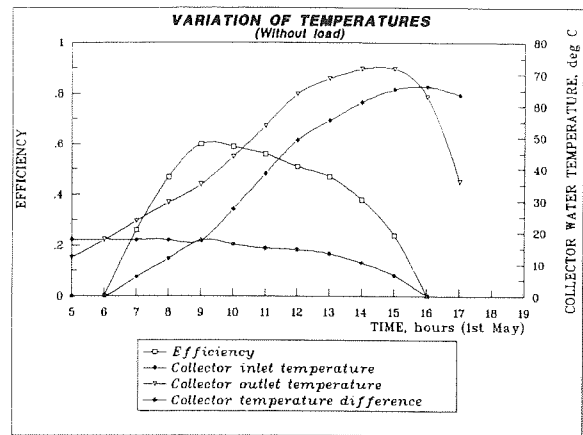


Fig 11

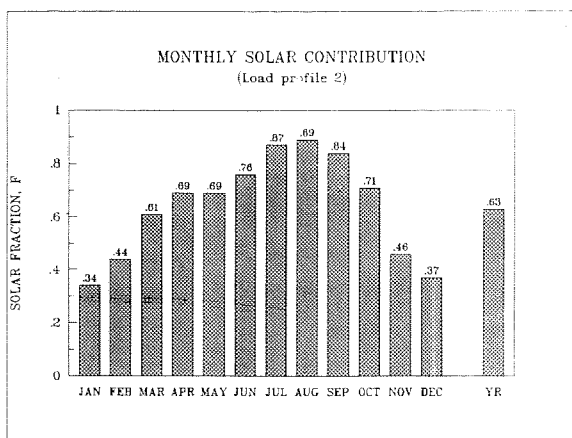


Fig 12

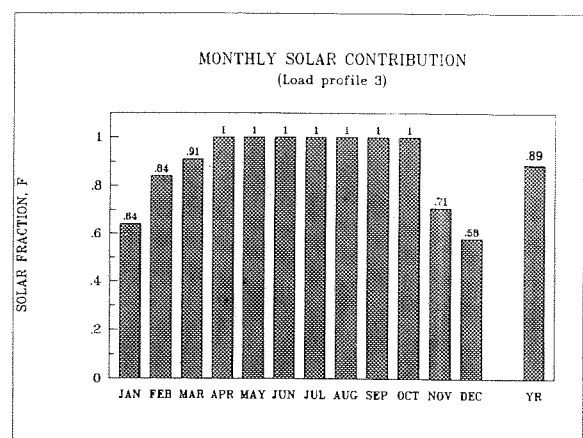


Fig 13

1. Thermosyphonic flow of water in the system generally follows the pattern of variation of the incident solar radiation. The flow rate increases during the morning hours, reaches a maximum of about 86 lt/h and then starts declining in the afternoon hours.

2. The variation of the system efficiency does not follow the pattern of flow rate. It reaches its peak value in the morning hours and it drops down slowly in the afternoon hours. The efficiency pattern is better in the case of high load profile.

3. The efficiency rises as the water flow rate increases, and reaches a maximum value of 60% when the flow rate is 55 kg/h.

4. The yearly solar contribution of the simulated system is as high as 63% assuming a daily water consumption of 160 lt at 50 deg C, throughout the year and 89% when the daily water consumption is assumed to decrease to 120 lt at 45 deg C.

5. The performance of a thermosyphon solar heating system depends on many parameters which have to be exploited through simulation and experimental studies. These studies are necessary to obtain a detailed understanding of the system behaviour and lead to more efficient designs.

## NOMENCLATURE

Ac	Collector area
$\beta$	Collector tilt angle
$c_p$	Specific heat of working fluid
$d_i, d_o$	Diameter of collector inlet & outlet pipes
$d_h$	Diameter of collector headers
$d_R$	Diameter of collector risers
$N_R$	Number of parallel collector risers
$F_{R,U_L}$	Slope of the collector efficiency curve
$F_R(\tau\alpha)_n$	Intercept of the collector efficiency curve
G	Collector flow rate per unit area
$G_{test}$	Collector flow rate per unit area at test conditions
$I_T$	Total radiation incident on the (tilted) collector surface
$I_h$	Monthly average of the daily radiation incident on a horizontal surface
$L_i, L_o$	Length of inlet and outlet piping
$L_h$	Length of collector headers
$\dot{m}$	Thermosyphon flow rate
$\dot{m}_L$	Load flow rate
$Q_{max}$	Auxiliary energy input to tank
$Q_u$	Useful energy collection
f	Fraction of the load that is met by solar (Solar contribution)
$T_a$	Ambient air temperature
$T_{env}$	Environmental temperature for losses from storage

$T_i$	Temperature of the fluid at the collector inlet
$T_o$	Temperature of the fluid at the collector outlet
$T_s$	Thermostat set temperature
$(UA)_s$	Conductance for heat loss from storage tank
$(UA)_c$	Conductance for heat loss from pipes
$H_c$	Vertical distance between outlet and inlet of collectors
$H_a$	Height of auxiliary heating element above bottom of tank
$H_o$	Vertical distance between outlet of tank and inlet to collector
$H_i$	Height of collector return above bottom of tank
$D_s$	Diameter of storage tank
$H_{th}$	Height of auxiliary thermostat above bottom of tank
$P_{aux}$	Auxiliary energy input to tank
$V_s$	Storage tank volume

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*I would rather be good, kind and just even if people think of me to the contrary, than being called good, just and kind when I am bad.*

Saadi

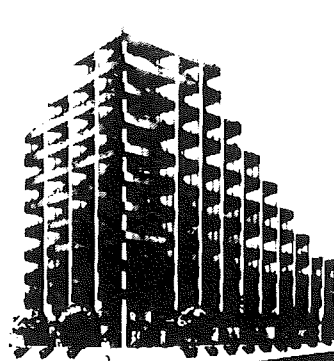


# The Best in Civil Engineering and Building

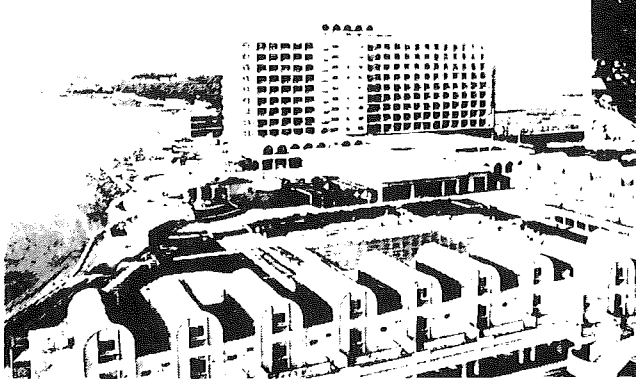
Από το 1950 κτιζουμε και δημιουργουμε τοσο στην Κυπρο όσο και στο εξωτερικο.  
Μια δυναμικη παρουσια, σ' όλα τα επιπεδα.  
Διαθετουμε και τα μεσα και την πειρα. Κερδισαμε την εκτιμηση και την εμπιστοσυνη χαρη στη συνεπεια και την ποιοτητα της δουλειας μας.  
Με έργα... όχι μονο λόγια.



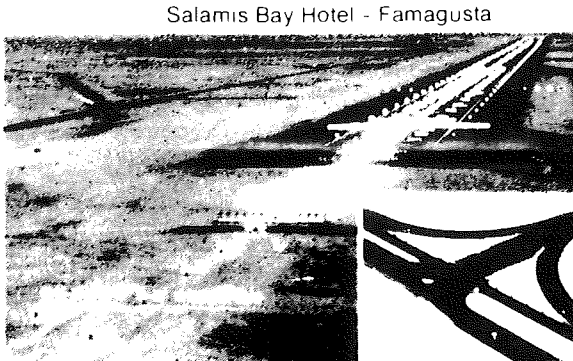
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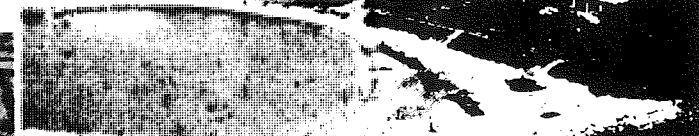
Medcon Tower  
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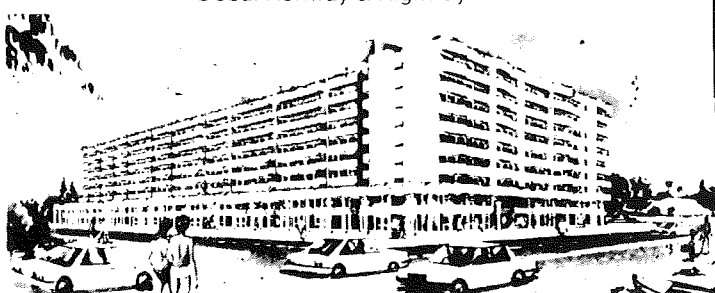
Dubai Runway & Highway



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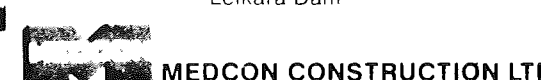


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# Pyrotechnically activated guillotine

Research and development at HTI

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## INTRODUCTION

For many centuries, man has utilised explosives and pyrotechnic powders for doing useful work. During the past decade, explosive/pyrotechnic technology has developed tremendously with an excitingly rapid increase in the fundamental understanding of technological practices. Manufacturers of metal parts have turned their factories into explosion chambers wherein the mighty power of explosive/pyrotechnic substances is harnessed and used to work metal. Such metal working applications<sup>1</sup> are, explosive cutting, welding, forming and powder compaction and the use of gas generation from pyrotechnic powders for propulsion, closing and opening valves and activating cutters/guillotines.

Recent research work undertaken at the HTI, resulted in the development and manufacture of a simple pyrotechnic guillotine for severing wire ropes. Details of the guillotine design are given below.

## GUILLOTINE DESIGN

The pyrotechnic guillotine was designed to utilise caliber 12 shotgun cartridges (see Fig. 1) specially charged with pyrotechnic powder<sup>2</sup> D-10.

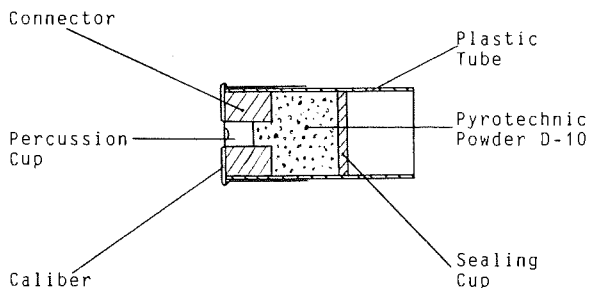


Fig. 1 Specially designed cartridge

By equating the energy released<sup>3</sup> by the D-10 powder to the energy required to shear a section of wire rope about its diameter it was found that cartridge loadings ranging from 0.3 grams to 1.2 grams are capable of severing various wire ropes with diameters up to 18 mm.

The accuracy of the cartridge loading was  $\pm 0.001$  grams.

The pyrotechnic guillotine consists of the following metal parts:

1. Main Body
2. Locking Cap
3. V-Shaped Cutter

4. Firing Pin
  5. Firing Pin Retainer Seal
  6. Spring Assembly
  7. Firing "Turn Handle"
  8. Firing Mechanism Housing
- which are shown in Fig. 2.

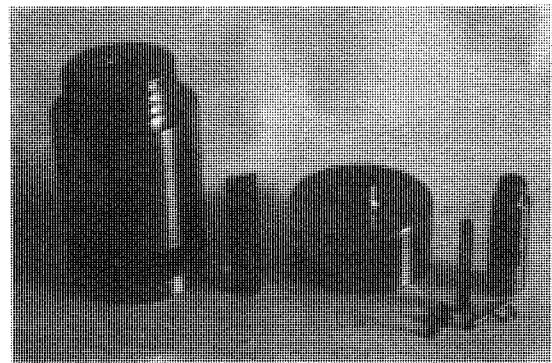


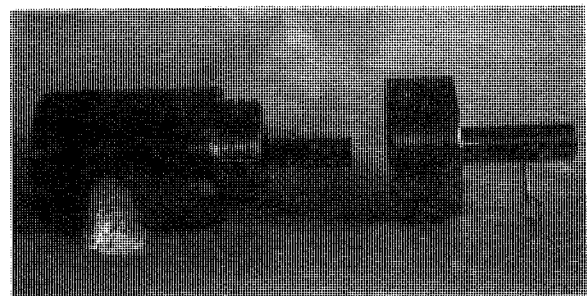
Fig. 2 Components of the Pyrotechnic Guillotine

All these components, with the exception of the spring, were manufactured at the HTI's Mechanical Engineering Workshops.

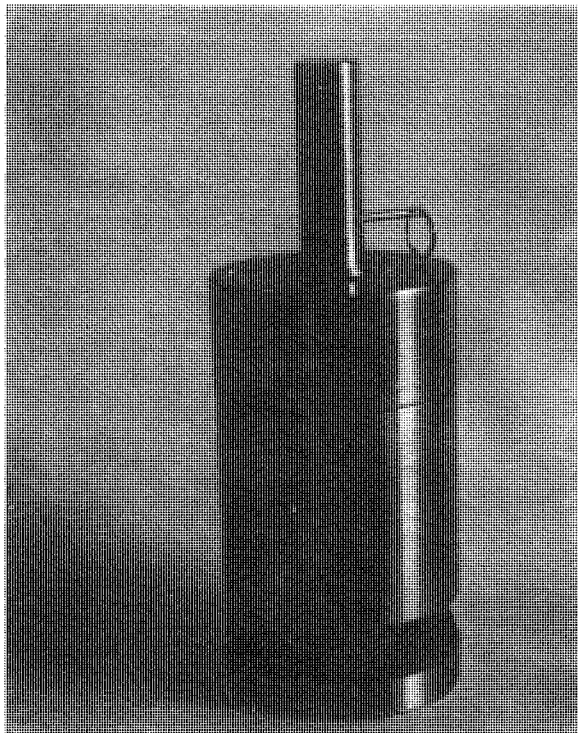
The V-shaped cutter was designed with a "V" angle of  $80^\circ$  which was found to present minimum friction during the cutting action. The cutter was manufactured from K460 steel and was subsequently heat treated<sup>4</sup> to increase its hardness by as much as 100%. In order to remove the build in stresses, the cutter was tempered at a temperature of  $100^\circ\text{C}$  for an hour and it was then left to cool down in the furnace over a night.

## TESTING OF THE PYROTECHNIC GUILLOTINE

The guillotine was assembled as shown in Fig. 3 (a) & (b) with the wire rope placed in the slot at the lower end of the main body.



(a)



(b)

Fig. 3 Assembling the pyrotechnic guillotine

Various tests were carried out using a range of cartridge loadings against various diameters of wire ropes and solid steel rods (for details see Table 1).

TEST NO:	CARTRIDGE LOADING (g)	CABLE DIAMETER (mm)	DEPTH OF CUT	REMARKS
1	0.4	4mm	COMPLETE SEVERANCE	WIRE ROPE
2	0.6	6mm	"	"
3	0.6	6mm	"	"
4	0.8	11mm	"	"
5	0.8	13mm	"	"
6	0.8	13mm	"	"
7	0.8	8mm	"	SOLID CABLE

Table 1

Fig. 4 (a) & (b) shows typical results from the severance of 11 mm and 13 mm diameter wire ropes using 0.8 gram cartridges. Similar results are shown in Fig. 5 where a solid steel rod was completely severed using again a 0.8 gram cartridge.

It was found that higher cartridge loadings were required for cutting solid steel rods than wire ropes of the same diameter. This is due to the higher friction effects and work hardening exhibited by steel rods during the cutting action.

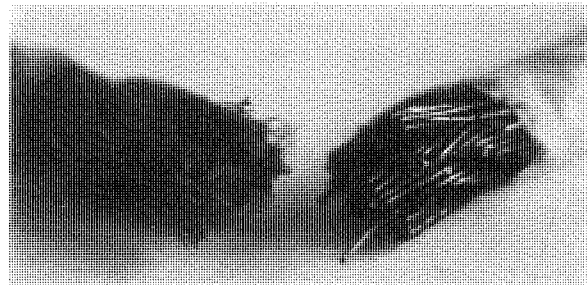


Fig. 4(a) 11 mm diameter wire rope severed with an 8 gram cartridge

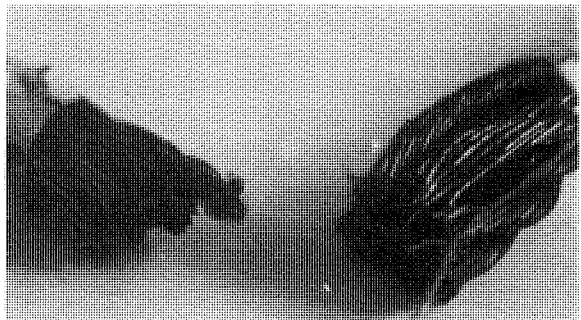


Fig. 4(b) 13 mm diameter wire rope severed with an 8 gram cartridge

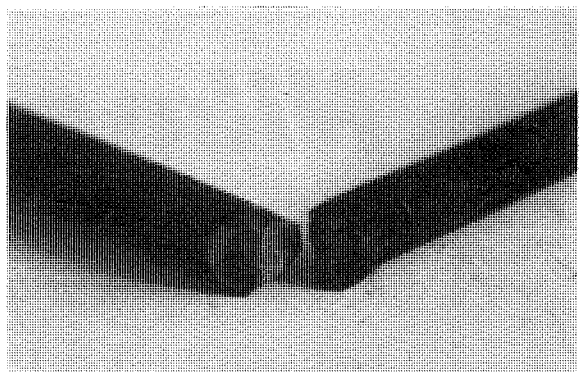


Fig. 5. 10 mm diameter steel rod severed with an 8 gram cartridge

## CONCLUSIONS

The pyrotechnic guillotine can be manufactured quite easily with off-the-shelf materials and readily available tools.

The cutting power of this pyrotechnic tool was tested over a range of cartridge loadings and it was found that it can successfully sever wire ropes upto 18mm in diameter. The cutter of the guillotine may be modified (increase cutting edge) to sever upto 25 mm wire ropes with just over 1 gram of pyrotechnic powder (1.2 grams).

The most attractive features of this tool result from the fact that it is perfectly safe, and the noise generated is far less than that given out by a shotgun. One can literally stand right next to it during firing without any risk to personal safety.

Furthermore, the pyrotechnic guillotine has the following advantages over conventional cutting techniques:

- (a) Simple to operate
- (b) It does not require external power source
- (c) It can operate both on land and subsea
- (d) It can be operated remotely
- (f) It can be used in harsh environments
- (g) It can be emplaced, loaded and fired by using a remotely operated vehicle (ROV).

The practical applications of the pyrotechnic guillotine are infinite. Some of these are given below:

It can be used subsea for cutting cables and wire ropes at depths exceeding those possible by divers, in nuclear plants where cutting or welding operations are carried out remotely. The pyrotechnic guillotine may be emplaced by a remotely controlled vehicle or a robot and can be

activated manually, electrically or by acoustic initiation based on frequency matching.

Also, due to its construction it can be easily modified and used for welding dissimilar metals or for perforating with high speed water jets for various other applications.

Finally it can be concluded that the pyrotechnic guillotine (designed and manufactured at the HTI) is a unique tool with unlimited potential and it is believed that its contribution to industry will be invaluable.

#### REFERENCES

1. L.G. Lazari, PhD Thesis, U.M.I.S.T., 1986.
2. G & L Calibers Ltd, Psimolophou, Nicosia.
3. J.S. Pinehart and J. Pearson, "Explosive Working of Metals", Pergamon Press, 1963.
4. G Bohler, "Special Steel Manual", A-8605 Kapfenberg, Mariazeller, Strasse 25.

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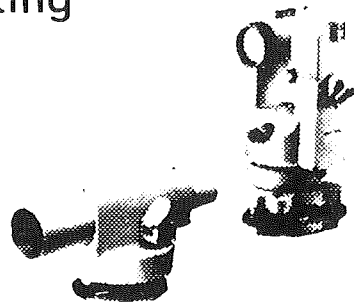
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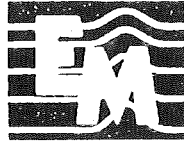
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# Bioclimatic design and energy conservation in buildings

## ABSTRACT

This introduction presents the bioclimatic design approach in buildings and outlines the prospects for its adoption in Cyprus.

Bioclimatic design is a climatically interactive building design, which integrates the scope to use the location and the regulatory systems inherent in Architecture, through the choice of orientation, form, fabric and use of natural resources of energy to achieve indoor comfort conditions. This is often succeeded at no extra construction or maintenance cost.

## BENEFITS AND SIGNIFICANCE FOR CYPRUS

The benefits for Cyprus from the conservation of energy in buildings are enormous. As a result of the displaced fuel by the free energy systems, is the benefit of financial savings in running costs, reduction of the growth rate of national energy consumption and ultimately reduction of the dependence on the world's finite fossil fuel extending its availability. Moreover the reduction of pollution from the production and consumption of fuel, results to healthier environment as bonus.

Cyprus relies entirely on expensive imported fuel supplies.

The effort of the Government of Cyprus to minimize its deficits while at the same time encouraging industrial development and tourism, the islands' major profit-making commodity, demands serious consideration in the use of imported resources.

Rapid urbanization and the inefficient use of building services technology has had catastrophic consequences on the islands' ecology, culture and tradition.

The trend towards greater standards of comfort in recent years has led to the increasing adoption of air conditioning systems.

The influence of the post war movement for "International", mass production Architecture, has further resulted in climatically rejecting buildings in Cyprus. Buildings which no longer act as climatic moderators to soften the unpleasant climatic extremes, an architectural task the traditional wisdom handled skillfully. On the contrary, adoption of international styles aggravate adverse climatic conditions.

The buildings have become enclosures for our artificial environment and often their shells act as an additional obstacle to the efficient use of their mechanical installations.

The search for identity and styles in Cypriot

*By Despina Kyprianou Serghides  
AA Dipl., RIBA II, AA Grad. Dipl.  
Energy and Environmental Studies*

Architecture, the increasing international awareness in energy and environmental issues spurred on by the energy crisis in 1970s, and stirred up recently with the Gulfwar, focus once more on the challenge of Architecture.

Further more the successful implementation of energy conservation policies in other countries especially the adoption of climatic design measures is a possible model for our island.

## BIOCLIMATIC DESIGN APPROACH FOR CYPRUS

Further to these interrelated factors which increase the complexity of the Architecture in Cyprus is the question of the climate itself. The climatic conditions of a location are very rarely combined in nature to give satisfactory indoor thermal environment. The temperate Mediterranean weather pattern of Cyprus, usually lacking in extremes, would appear to present no special problem for bioclimatic design. Yet in Cyprus, buildings must be designed and constructed to cope with the possibility both of uncomfortably hot summers and surprisingly cold winters.

This design challenge is highlighted and all the more complex when the designer uses the architectural design itself to utilize natural renewable energy resources particularly solar energy-rather than the use of auxiliary energy, for the provision of indoor comfort.

In order to assess the energy demands for heating and cooling in Cypriot buildings and evaluate the free energy systems available to contribute to these requirements, the comfort criteria and the local climatic conditions must be carefully considered and analysed.

Cyprus, although a relatively small island necessitates attentive bioclimatic analysis; the sea that surrounds it, its morphology, its varied elevation, and its prevailing winds define different topoclimatic zones.

However the lengthy procedure involved do not permit a detailed and extensive bioclimatic analysis for Cyprus to be made during this introduction.

Based however, on the apparent and general demand of the Cypriot climate of cooling in the summer and heating in the winter, some aspects of building design are outlined which incorporate very basic principles of bioclimatic design strategies which are appropriate for the island.

Basically throughout the design process, the aim



should be to maximize heat gains in winter, minimize them in summer, encourage heat losses in the summer and limit them in winter.

## BIOClimATIC DESIGN ASPECTS

### A. Siting the Building

#### a. Solar Access in Winter

The sun path diagram (Fig. 1) in relation to the  
 i. Site Plan (Fig. 2)  
 ii. Height of neighbouring buildings (Fig. 3)  
 iii. Vegetation (Fig. 4, 5)  
 iv. Land masses (Fig. 4)  
 determine the spacing distance of the buildings in order to ensure winter sun.

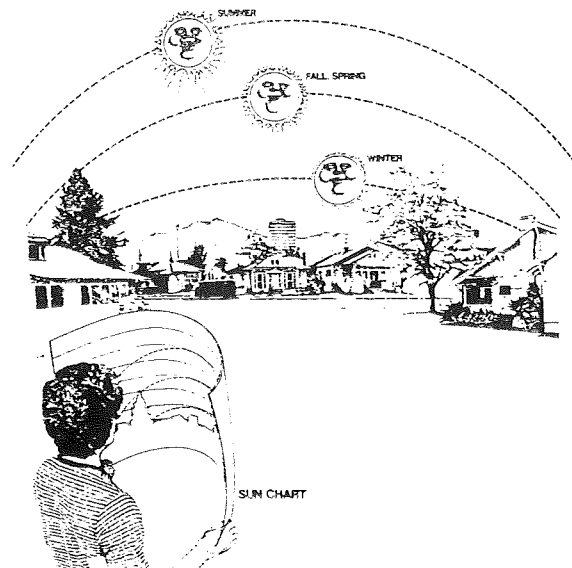


Fig. 2 Using the sun chart to visualize solar obstruction

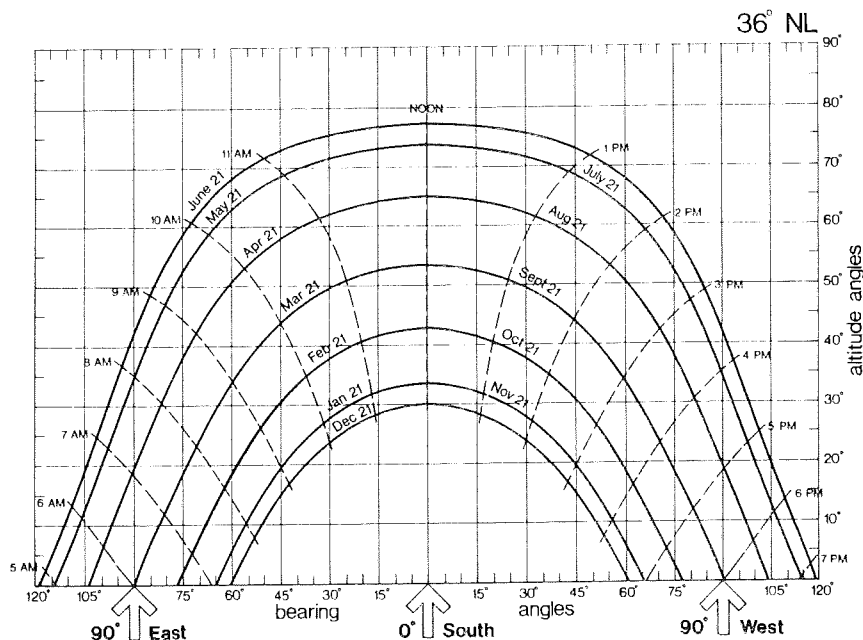


Fig. 1 Sun path diagram

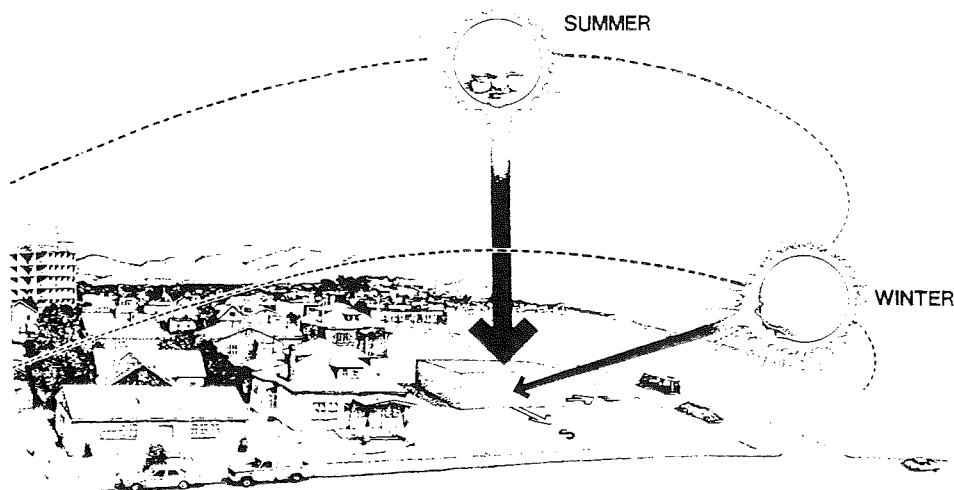


Fig. 3 Existing built conditions Future extensions and development

**b. Summer shading**

For summer shading one could use  
 i. Neighbouring land forms (Fig. 4)  
 ii. Vegetation (Fig. 5)  
 iii. Building Structures

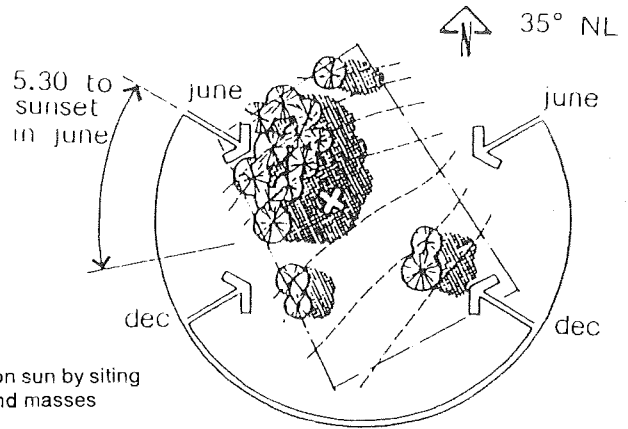
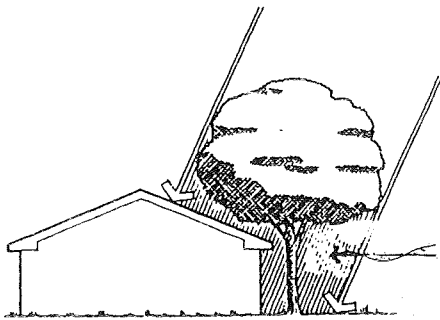
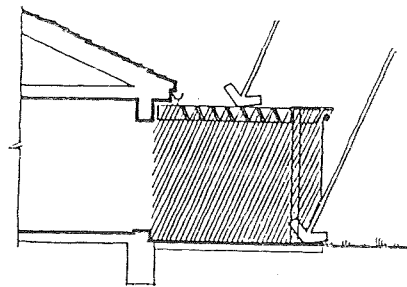


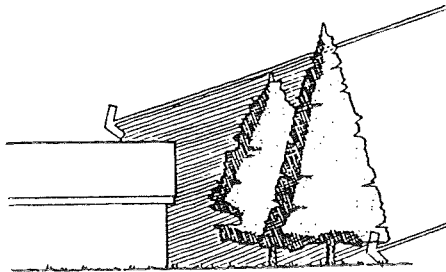
Fig. 4 Reduction of solar gain from afternoon sun by siting building east of existing trees and land masses



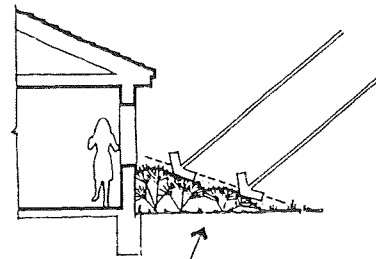
Tall trees on South Shade walls and Roof



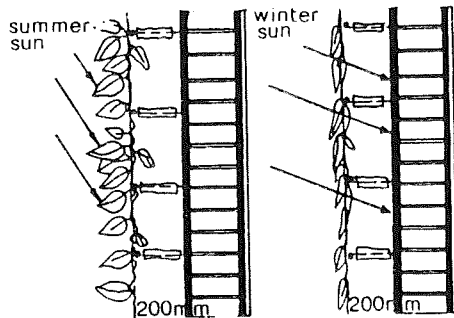
Pergolas or trellises and climbing vegetation to shade walls and fences and reduce reflected gain



Dense trees shrubs hedges, walls on West to intercept afternoon sun



Irregular shrubbery surface intercepts sun for reduction reflectivity



Climbers for shading & Insulation

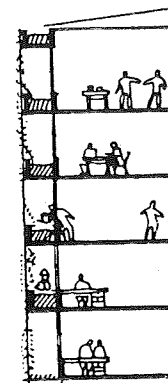
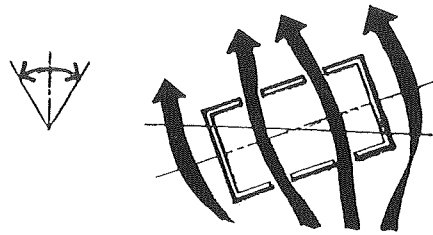


Fig. 5 Vegetation and Shading

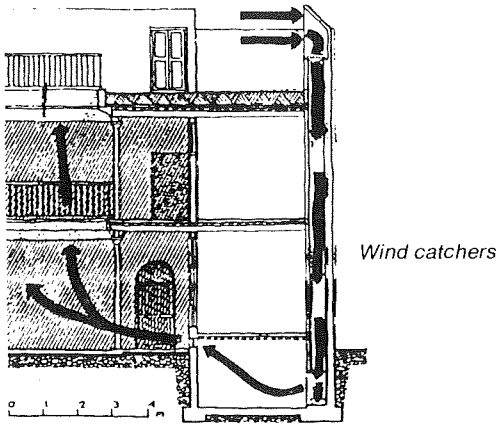
**c. Summer Breezes**

The use of

- i. Land forms (Fig. 4)
  - ii. Building structures (Fig. 6)
  - iii. Vegetation (Fig. 8)
  - iv. Wind catchers (Fig. 7)
- could increase exposure to summer breezes.



Long facade to face into the direction of prevailing breezes  
Building as an air flow dam



Wind catchers

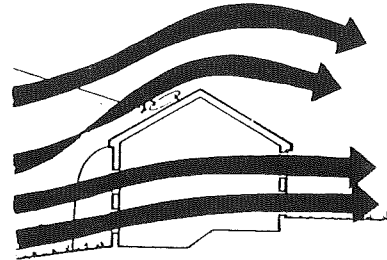
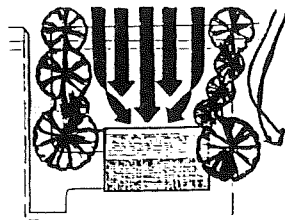
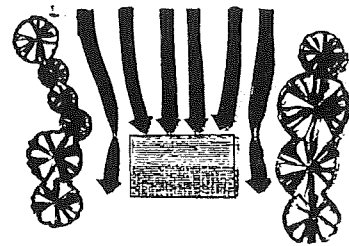


Fig. 6 Higher facades mean greater pressure and air movement  
Windward roof plane experiences suction  
Stacking rooms vertically facilitates good ventilation

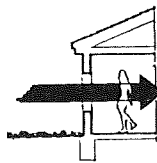
Fig. 7 Inlets enough into the streamline flow zone Uni-directional oriented to favourable breezes Multi-directional utilize winds from any direction



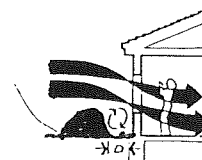
Trees to guide wind into the building



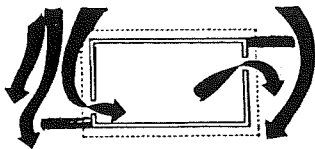
Rear venting  
Funnel at front  
Narrow corridors for air jets



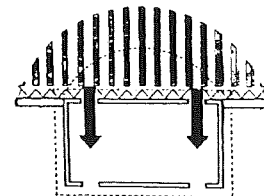
Unwanted wind pressure



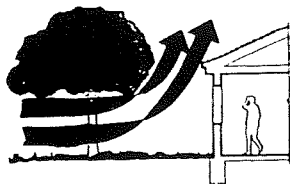
Relieved by Hedge and shrub  
Fostering downward deflection of air stream



Hedges or walls to the side of the window increases air pressure through the building



Ceiling wash flow



Influence of tree canopy outside the window is to lift or warp the air stream upwards

Air stream misses the house

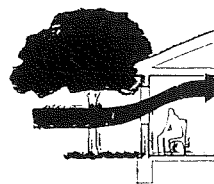


Fig. 8 Summer breezes & vegetation

**d. Summer Temperature Reduction**

The temperatures in and around buildings can be tempered or aggravated by the nature of the surrounding surfaces (Fig. 9 and Fig. 10)

Temperatures shown here were recorded in a hot-dry climate when the air temperature was 42 degrees Celcius. (Fig. 9)

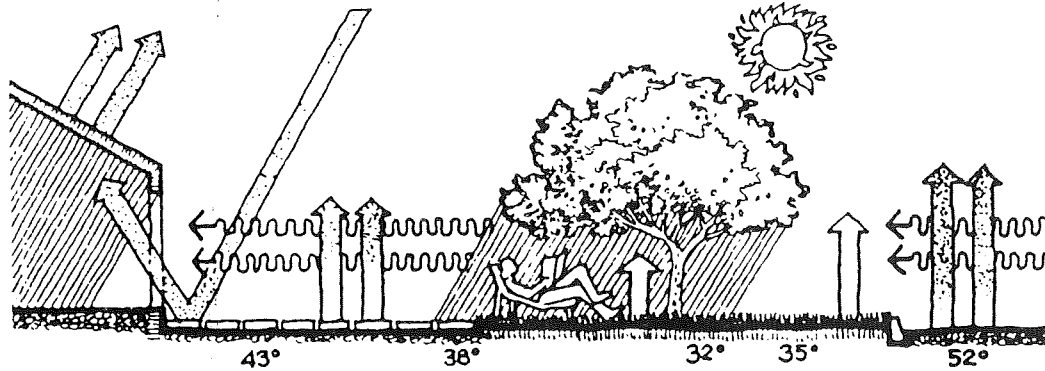


Fig. 9. Summer temperature reduction

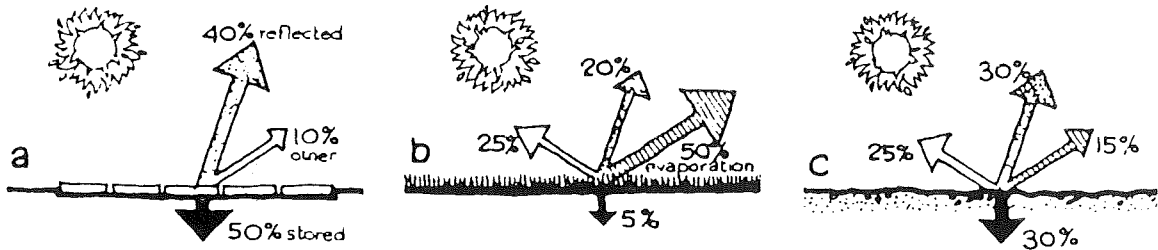


Fig. 10 Absorption of heat by different surface materials; (a) paving, (b) grass, (c) bare ground.

**B. Orientation and Shape of the Building**

Elongated building shape maximizes heat gains in winter and minimizes heat gains in the summer. (Fig. 11)

In winter the South side receives three times more solar radiation than the East and West sides.

In the summer the situation is reversed; North side receives little radiation. (Fig. 12)

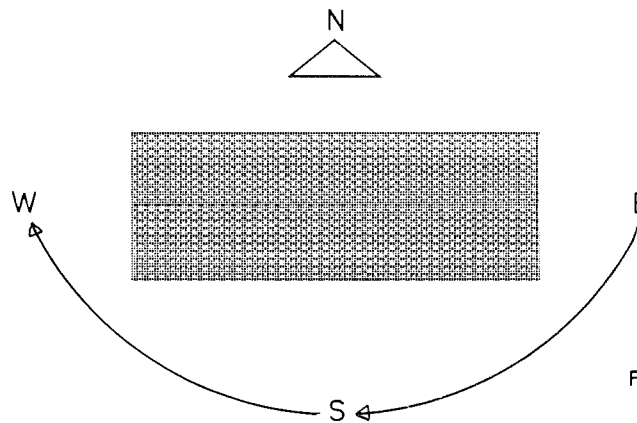


Fig. 11 Orientation and shape

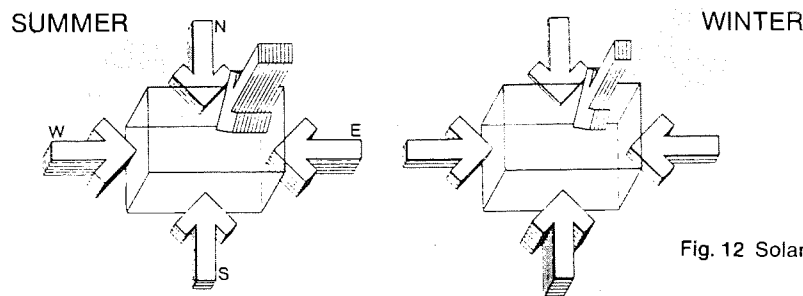


Fig. 12 Solar radiation

### C. Building Layout

Generally the rooms according to their sunlight requirement, and the sequence of the activities housed in them, should follow the Sun-Path, located South-East, South, South-West. Placing spaces with minimal heating and lighting requirements, along the North face as buffer.

Internally heat gains generated in certain spaces (by people and equipment) should be either utilized to supply heat, or isolated according to the demands of the spaces.

Long thin buildings with rooms stacked high, offer good cross ventilation opportunities. (Fig. 14)

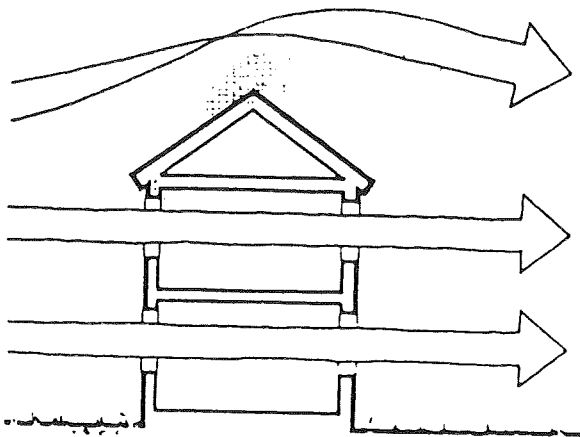


Fig. 14 Long thin buildings

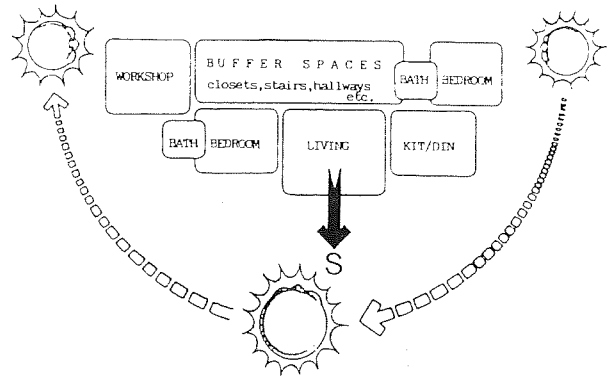


Fig. 13 Building layout to follow sun path.

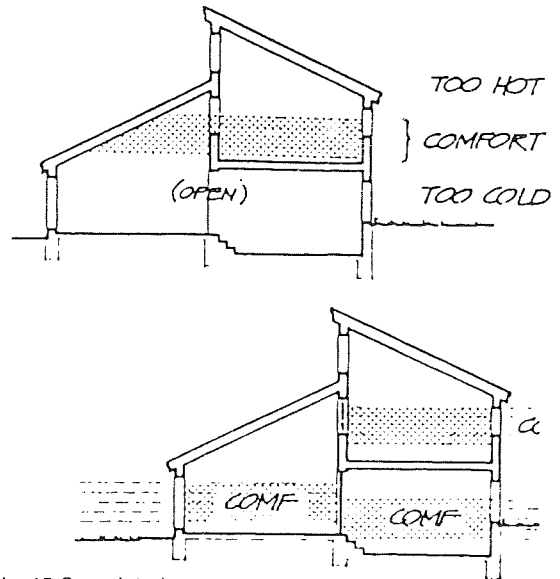


Fig. 15 Open Interior

Although an open interior is useful for natural ventilation during the heating season, it is a liability during winter. It must be ensured that all

openings can be closed to control stratification and to maintain separate zones. (Fig. 15, 16).

*If the entry is large and supports other activities, provide a way to passively heat the space in winter*

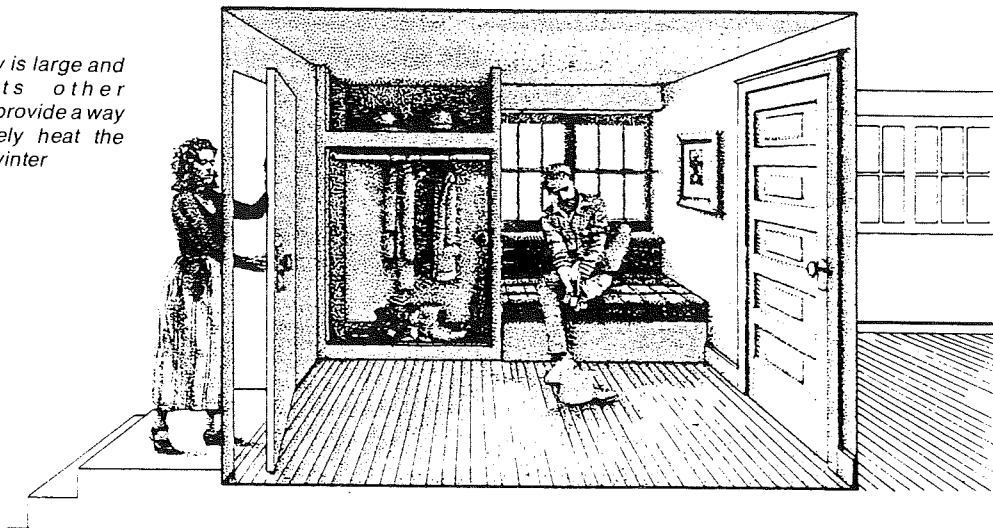


Fig. 16 Protected entrance

### D. Courtyards

The thermal advantages of courtyards are enormous. The wisdom of the traditional Cypriot architecture is reflected in the courtyard as a valuable village structure. (Fig. 17)



Fig. 17 Traditional Cypriot Courtyard

The courtyards can be used as cold air 'sinks' in the summer and wind protected exterior spaces in winter. (Fig. 18)

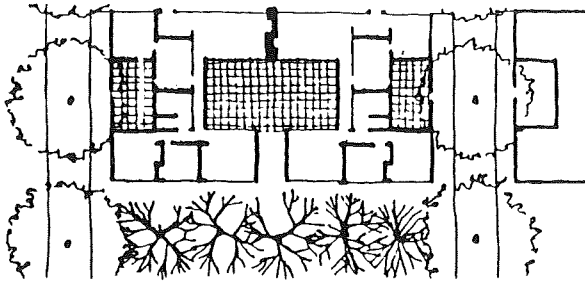


Fig. 18 Courtyards as exterior/spaces in winter

Shading can be provided with the introduction of trees and vegetation. (Fig. 19)

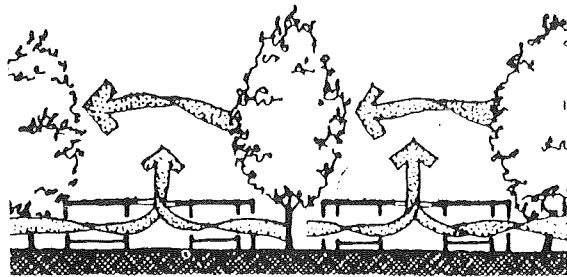


Fig. 19 Provision of shading in Courtyards.

Spray-pipes on courtyard wall is an excellent and inexpensive way of providing evaporative cooling in a courtyard. Moreover, spray cools air as well as wall surface, thereby reducing both ambient and mean temperatures. (Fig. 20)

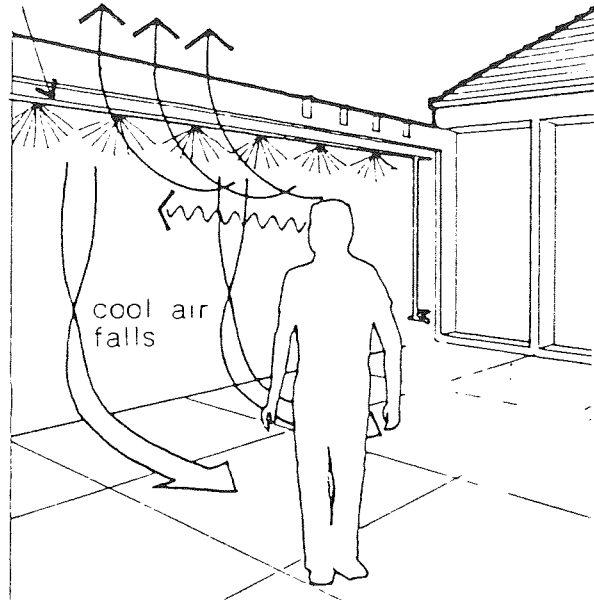


Fig. 20 Evaporative shading in Courtyards.

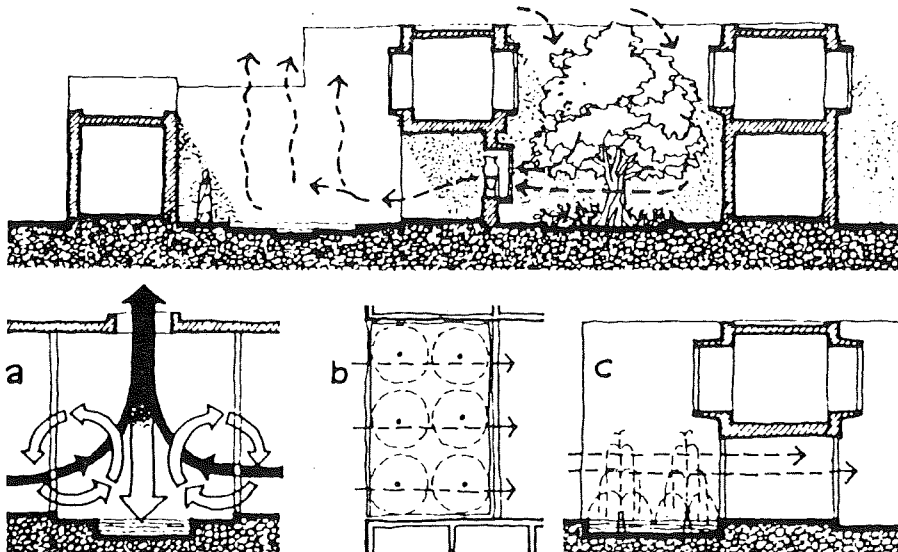


Fig. 21 Evaporative Cooling in Courtyards.

TOP: In the two-courtyard house, the air from the shaded courtyard flows over evaporative coolers to larger warm courtyard. The coolest space lies between the courtyards.

BOTTOM: Air passing over water sprays is cooled and cleaned before entering the building.

### E. Building component design

For the windows, floors, walls, roofs and balconies one must carefully consider:

- Insulation: Levels of insulation, location, and order of assembly to prevent heating in the summer and heat losses in the winter.
- Thermal mass: To act as heat and cold storage. For Cyprus where diurnal temperature differences are large, thermal mass is ideal.
- Heat reflective materials: For surfaces exposed to the summer sun.
- Absorbing materials: For surface exposed to the winter sun.

#### a. Windows

The openings whether glazed or not, openable or not, play a significant role in the thermal

performance of a building, due to their great effect on the heat transfer of the building fabric. Through the openings the heat transfer may occur in any or in all of the three modes of:

- Conduction
- Convection
- Radiation

Therefore, their contribution to heat gains and losses is considerable and their design is significant for the thermal performance of the building.

The best orientation of the major glass area of a building is one which receives maximum solar radiation in winter and minimum in the summer. (Fig. 22)

Use windows for ventilation according to the desired pattern of air flow (Fig. 23) and shade when necessary (Fig. 24, Fig. 25).

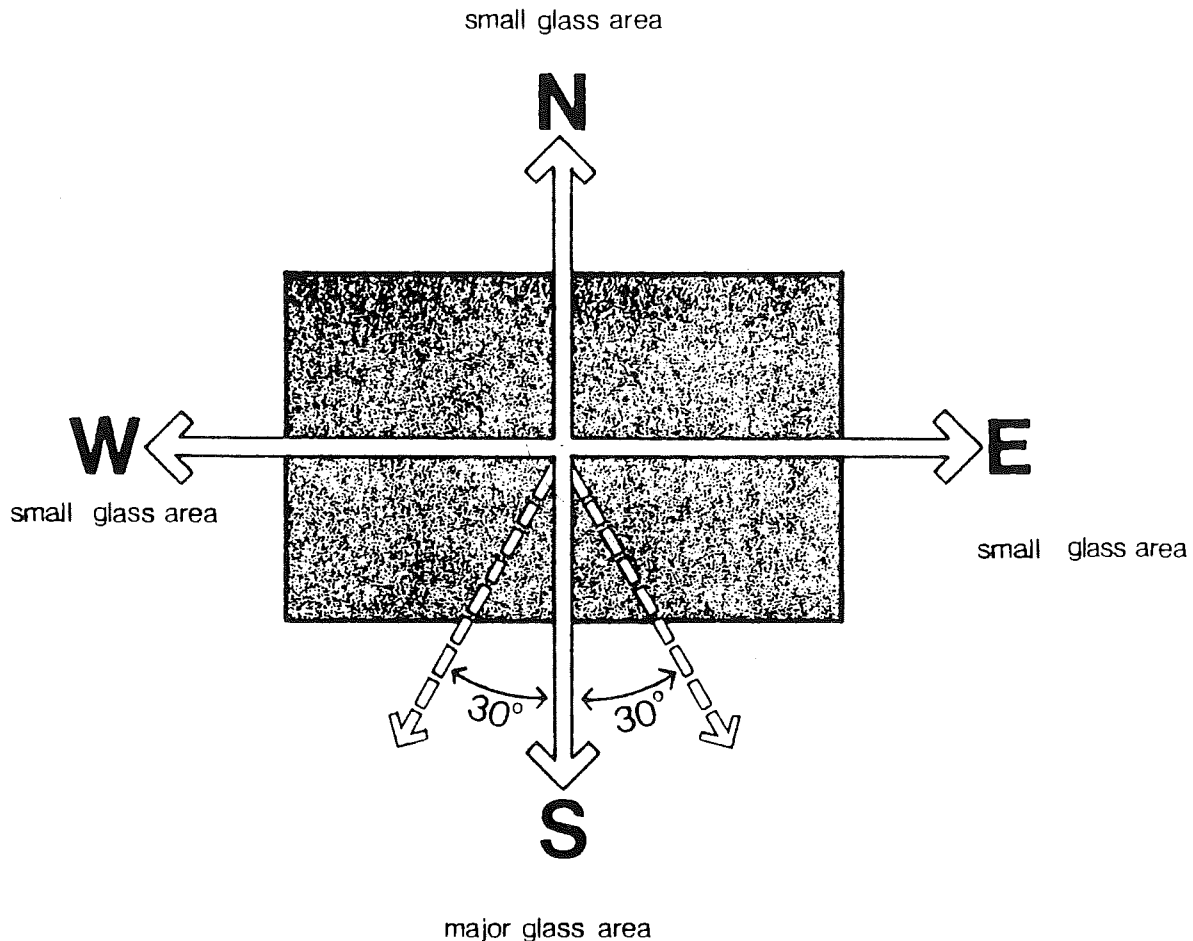


Fig. 22 . Orientation of windows.

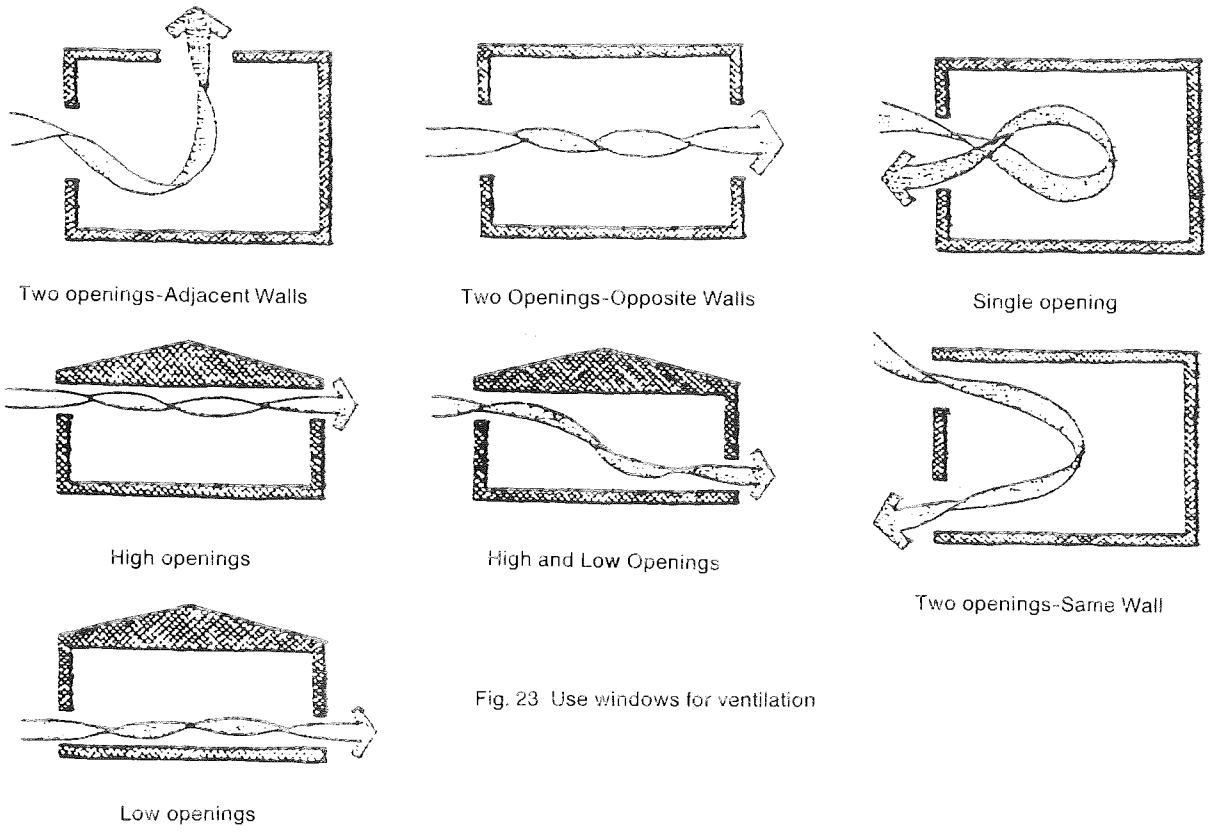
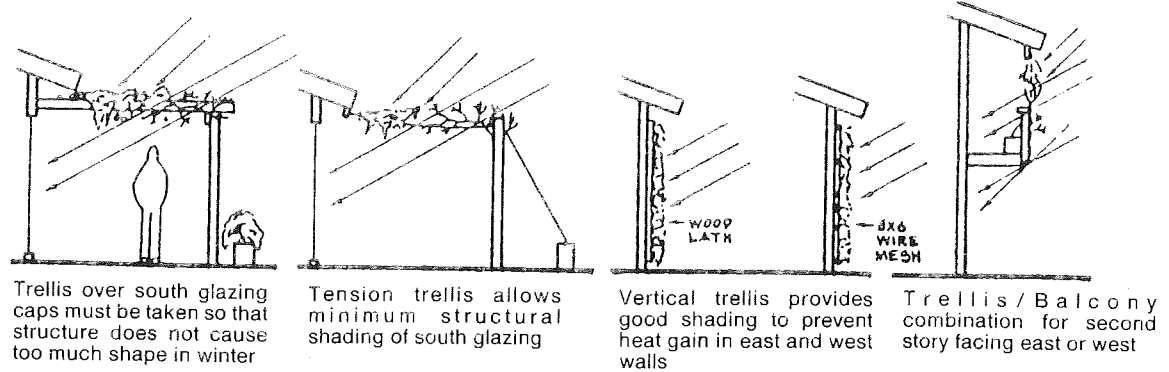


Fig. 23 Use windows for ventilation



Trellis over south glazing caps must be taken so that structure does not cause too much shade in winter

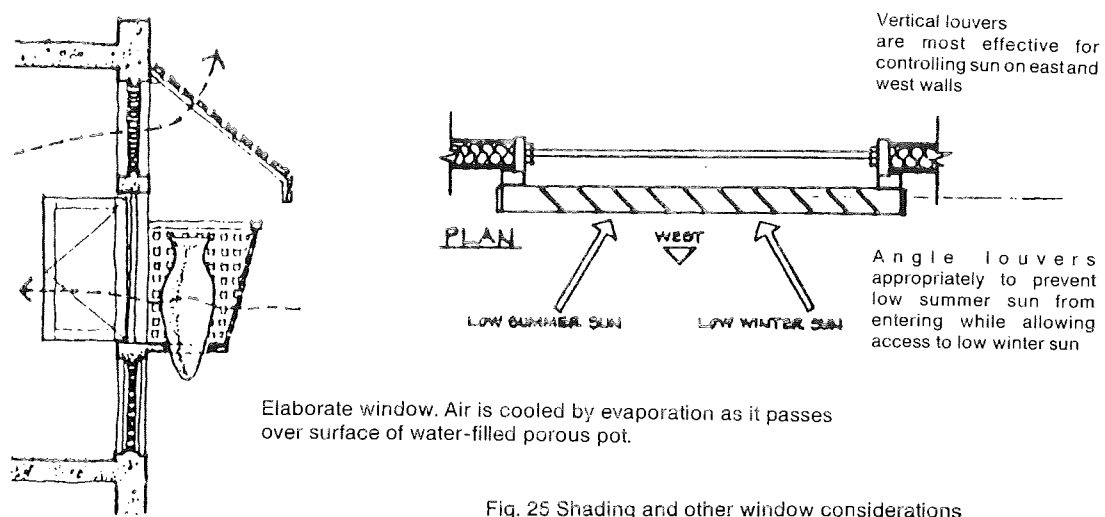
Tension trellis allows minimum structural shading of south glazing

Vertical trellis provides good shading to prevent heat gain in east and west walls

Trellis/Balcony combination for second story facing east or west

Fig. 24 Window shading

Besides being a very attractive method of sun control, deciduous plants on pergolas or trelliss will automatically adjust to cool springs or hot autumns provided that the plant material is carefully chosen.



Elaborate window. Air is cooled by evaporation as it passes over surface of water-filled porous pot.

Vertical louvers are most effective for controlling sun on east and west walls

Angle louvers appropriately to prevent low summer sun from entering while allowing access to low winter sun

Fig. 25 Shading and other window considerations



**b. Roofs**

Roofs are the most vulnerable envelope component to solar gains. Improved design can be achieved:

(a) with application of thermal insulation and introduction of mass.

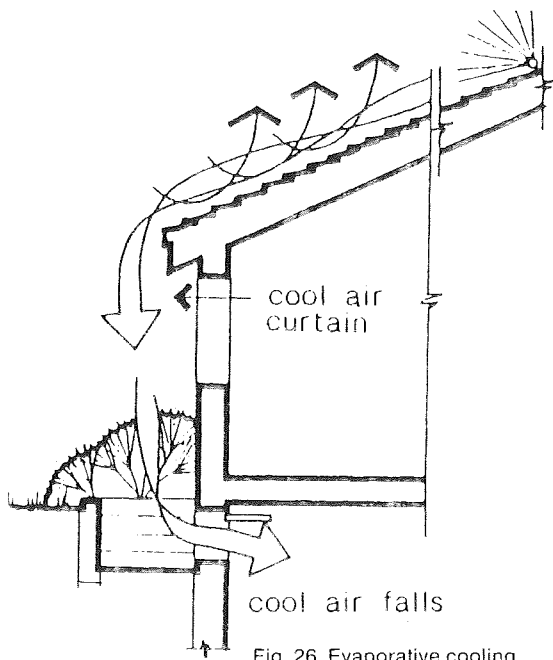


Fig. 26. Evaporative cooling

(b) by using roofs as reflective surfaces and for evaporative cooling. (Fig. 26)

Spraying roof keeps surface temperature constant, and prevents rapid expansion and contraction that ages roofs quickly. Roof spray has advantage of being operable only when needed.

perforated pipe, hose, or lawn sprinkler can be used for spray source.

(c) By using roof ponds to act as combined system: (Fig. 27)

- solar collectors in winter

- heat dissipators in the summer to achieve cooling.

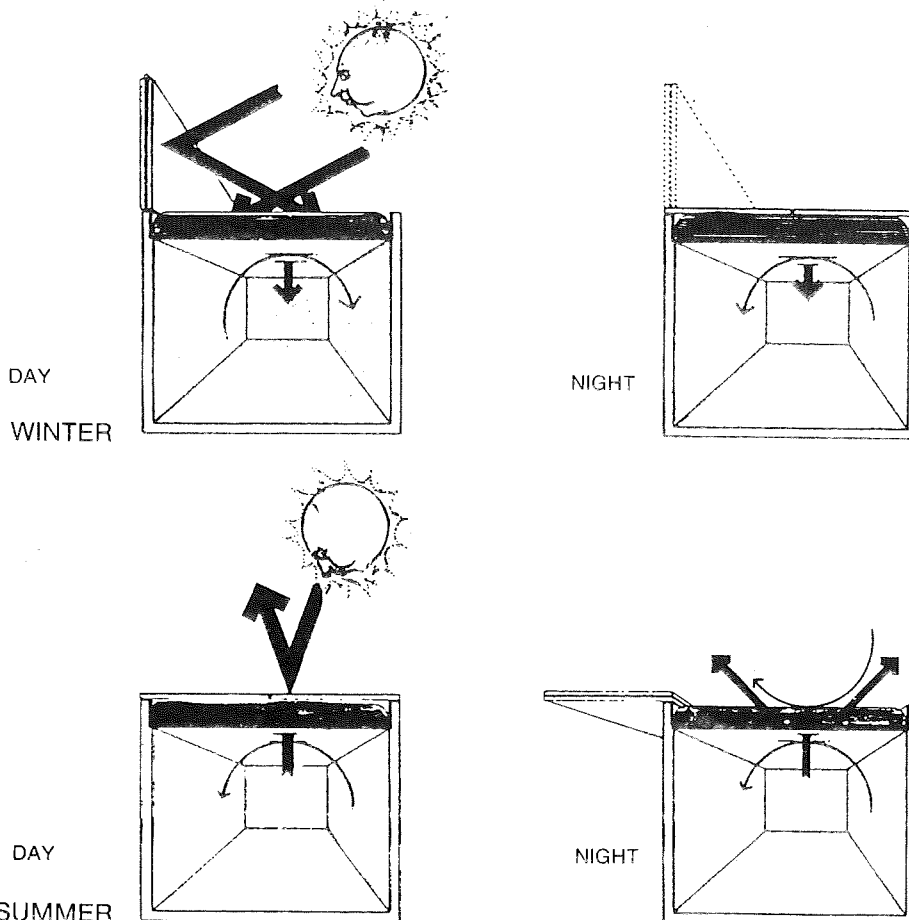
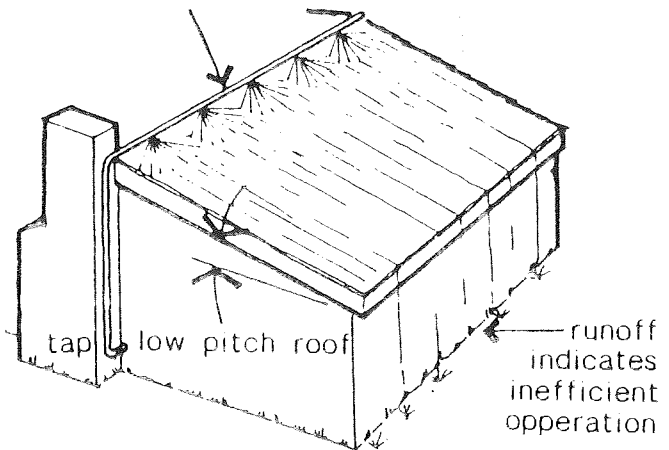


Fig 27 Roof ponds - mild climates

### c. Balconies

Balconies, when well designed, are offered as pleasant sitting areas for the sunny winter days and the cool summer nights.

Balconies can be designed to admit the winter

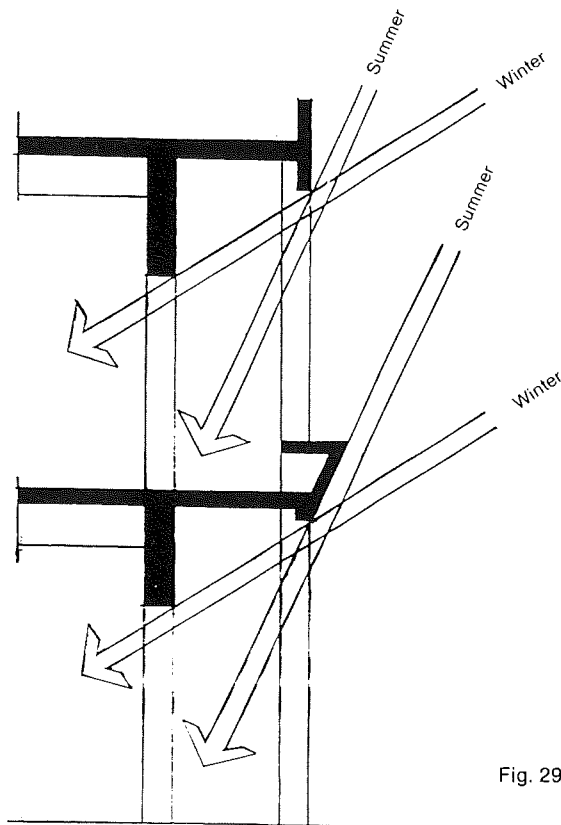


Fig. 29 Use Balconies to provide shading in Summer  
Allow Sun in Winter

sun, but prevent it entering the glazed facade in the summer. (Fig. 29)

Construction provision of the balconies must ensure discontinuity of their extended, exposed structure to the air, which is liable to act as a thermal bridge to the internal slab. (Fig. 28)

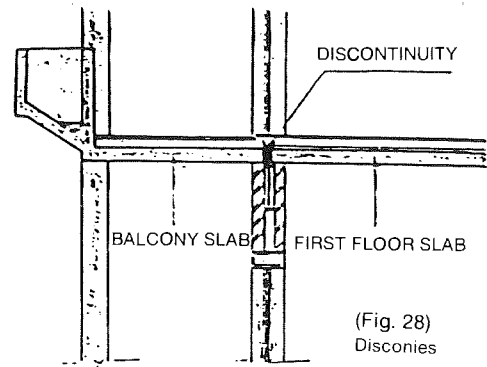


Fig. 28 Discontinuity between internal and external slab

### Epilogue

The above design concepts are only basic considerations of bioclimatic design approach. However, detailed bioclimatic analysis, optimization of the regulatory building systems in order to achieve its fine tuning and become successful climatic moderator, evaluation of the building performance, and ultimately analysis of cost-effectiveness, necessitate detailed and at the same time robust, dynamic and interactive design approach.

This is now-a-days possible with the use of computer analogues a well established practice, but at the same time on continuous development.

No doubt the potential of bioclimatic design is dependent on a multi-disciplinary design approach.

However, the thought that buildings could be permanent energy savers demands building designers to consider carefully the practical options available to them.

Nobody has all the answers and Bioclimatic Architecture is not necessarily good Architecture but vice versa good architecture has always been bioclimatic.

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## ΤΟ ΜΕΤΑ-ΠΤΥΧΙΑΚΟ



Απόφοιτοι Σχολών Τριτοβάθμιας Εκπαίδευσης:

### **ΔΙΝΟΥΜΕ ΤΡΑΠΕΖΙΚΗ ΑΞΙΑ ΣΤΟ ΠΤΥΧΙΟ ΣΑΣ**

Τώρα που έχετε θεμελιώσει με το πτυχίο σας τη βάση για μια πετυχημένη σταδιοδρομία, η Τράπεζα Κύπρου σας προσφέρει και οικονομική συμπαράσταση με το νέο ειδικό σχέδιο για πτυχιούχους. Το **Μεταπτυχιακό** είναι ένα πρωτοποριακό σχέδιο της Τράπεζας Κύπρου που σας παρέχει ένα «πακέτο» οικονομικών διευκολύνσεων πριν ακόμα εργοποιηθείτε με δυνατότητα επέκτασής τους και μετά την εργοδότηση.

Για περισσότερες πληροφορίες αποταθείτε σε οποιοδήποτε κατάστημα της Τράπεζας Κύπρου.



**ΤΡΑΠΕΖΑ ΚΥΠΡΟΥ**

# Use of parabolic trough collectors for hot water production in Cyprus

## A FEASIBILITY STUDY

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Lab Assistant, HTI

### INTRODUCTION

This report is part of the work currently being carried out as a part of a research programme at the Higher Technical Institute, for the development and evaluation of a Parabolic Trough Collector (PTC) for use in Cyprus.

The PTC model developed is 1m<sup>2</sup> aperture area and its physical characteristics are shown in Fig 1 [1]. It can be proved that for larger sizes the same performance can be obtained if the ratio of the aperture to length and the concentration ratio (and therefore the receiver diameter) are kept constant. The mode of tracking selected is the polar one, i.e. the collector aperture is tilted at 35° (local latitude) and tracks the sun in an east-west direction. The tracking mechanism developed is a solar powered heliotropic fluid -mechanical system in which the pressure differential in irradiated sensors, charged with refrigerant R12, is used to produce the power required to align the collector with the sun.

ITEM	VALUE
Collector Aperture	0.8 m
Rim Angle	90°
Receiver Diameter	12mm
Concentration Ratio	21.2
Focal Point	0.2m
Rim Radius	0.4m

Fig.1 PTC physical characteristics

Concentrating collectors are used effectively in medium temperature applications (around 150°C) to produce low temperature steam. In this report an attempt is made to investigate whether it is feasible to use such collectors for hot water production, by utilising their high efficiency, in two types of installations; a domestic and a hotel. In this investigation a number of systems and economic parameters are used to evaluate the economic viability of such collectors (as applied on the above systems) and compare these systems to similar ones using flat plate collectors applied to two real life situations.

### ANALYSIS

For the feasibility study the F-Chart program developed by the University of Wisconsin [2] is used. The program runs through the values of mean monthly solar radiation and mean monthly air temperature, and outputs the amount of solar

radiation falling on the collector surface, the amount of building heating load, the domestic hot water load, the auxiliary load required and the F -number which is the solar heat as a fraction of the total heat required by the system.

The weather data used in the program shown in Fig- 2 are obtained from a reference year developed as part of the same programme. With respect to the water mains temperature the mean value of the mean ambient temperature is used from the reference year from 6.00 to 21.00 hours (possible working hours). The ground reflectance value is taken from Ref. [3] for 35° incidence angle and for a concrete surface.

MONTH	SOLAR KJ/M <sup>2</sup>	TEMP. °C	DEG DAY C-DAYS	MAINS °C	REFLEC	HUMID KG/KG
JAN	8654	9.5	275	10.7	.25	.0059
FEB	11765	10.5	221	11.9	.25	.0061
MAR	15912	13.2	167	14.8	.25	.0067
APR	20016	16.5	80	18.4	.25	.0075
MAY	22262	21.4	13	23.6	.25	.0095
JUN	25564	25.5	1	27.9	.25	.0114
JUL	25895	28.1	0	30.5	.25	.0132
AUG	23047	27.4	0	29.7	.25	.0129
SEP	18781	24.9	1	27.0	.25	.0123
OCT	14407	20.7	18	22.7	.25	.0102
NOV	9842	14.5	127	16.1	.25	.0078
DEC	7956	11.1	228	12.3	.25	.0068

Note: Degree-day base temperature= 18.3 °C

Fig.2 Weather data

The developed model cost together with the predicted cost for larger collector area, in Cyprus Pounds (C.P.), are shown in Fig. 3. The hot water storage cylinder cost is not included in the costing shown in Fig. 3 due to the fact that a cylinder is employed in the system as a standard, irrespective of whether solar collectors are used. The extra item required for the case of the hotel solar system is a second heat exchanger which will be included later.

The program requires three types of data:

1. Solar collector data
2. System data
3. Economic parameters

Type of installation	Collector Area (m <sup>2</sup> )	Cost (C. Pounds)	Cost per Unit Area
Domestic	1	375	375.0
	2	431	215.5
	3	488	162.7
	4	548	137.0
Hotel	80	6986	87.3
	100	8686	86.9
	120	10396	96.6
	140	12116	86.5
	160	13816	86.4
	180	15526	86.3
	200	17246	86.2
220	18956	86.2	

Fig.3 Concentrating collector cost

The solar collector data for the concentrating and flat plate collectors used in the program are shown in Fig.4. The incidence angle modifier for the concentrating collector is the ratio of the optical efficiency (for beam radiation at a particular incidence angle) to the optical efficiency for radiation falling at normal incidence at 10° intervals.

The relevant data for the two types of systems considered are shown in Fig. 5. The city number (346) shown in Fig.5 corresponds to weather data for the city of Nicosia Cyprus (see Fig. 2). No building UA value is used which means that the solar systems are used for domestic hot water production only. The hot water cylinder size used is obtained by using a maximum requirement of 36 l of hot water per person, per day. The analysis is done for two types of fuels, electricity for the domestic installation and oil for the hotel installation. The efficiency of fuel usage is 100% (immersion heater) and 70% (boiler efficiency) respectively.

The final requirements of the program is the economic parameters. These are shown in Fig.6. The cost per unit area, for the case of the domestic installation, is taken from Fig.3 in which the area independent cost is included and therefore is set equal to zero in economic parameters. For the case of the hotel installation the cost of the extra heat exchanger must be considered. This is given as the area independent cost. The life of the system is considered to be 15 years in the domestic and 20 years in the hotel installations.

#### A. Domestic Installation

The existing flat plate collectors installed in Cyprus are 4m<sup>2</sup> in area and are connected to a 150 l hot water storage cylinder. For this reason the storage size is kept to 150 l and the system is analysed for 1, 2, 3 and 4m<sup>2</sup> concentrating collectors which are in turn compared to the flat plate ones. The results are shown in Fig.7 from which it can be understood that the optimum selection using concentrating collectors is

slightly better than the installation employing flat plate collectors.

PARABOLIC TROUGH COLLECTOR			
Number of collector panels	1		
Collector panel aperture area	3	M2	
FR•UL (test slope)	.35	W/M2-C	
FR•TAU•ALPHA (test intercept)	.661		
Concentration ratio	21.2		
Axis slope	35	DEG	
Axis azimuth (South=0)	0	DEG	
Inc angle modifier			
1	.929	.83	0 0 0 0 0 0 0 0 0
Collector flowrate/area	.012	KG/S-M2	
Collector fluid specific heat	4.19	KJ/KG-C	
Modify test values (1=Y, 2=N)	2		
Test collector flowrate	.012	KG/S-M2	
Test fluid specific heat	4.19	KJ/KG-C	
FLAT PLATE COLLECTOR			
Number of collector panels	2		
Collector panel area	2	M2	
FR•UL (test slope)	6.78	W/W2-C	
FR•TAU•ALPHA (test intercept)	.77		
Collector slope	45	DEG	
Collector azimuth (South=0)	0	DEG	
Incidence angle mod TYPE (8-10)	8		
Number of glazings	1		
Inc angle modifier constant	0		
Inc angle modifier value(s)			
1	.999	.998	.995 .981 .953.882
.7	.35	0	
Collector flowrate/area	.015	KG/S-M2	
Collector fluid specific heat	4.19	KJ/KG-C	
Modify test values (1=Y, 2=N)	2		
Test collector flowrate/area	.015	KG/S-M2	
Test fluid specific heat	4.19	KJ/KG-C	

Fig. 4 Solar collectors data

The life cycle savings, shown in Fig. 7, are calculated by subtracting the present worth of the owning and operating costs from the present worth of the fuel savings, both calculated for the period of the economic analysis (15 years). This level of savings represents the economic advantage of the system over a fuel only system. Not only the life cycle savings and cost are better in the concentrating collectors case but the pay-back period is also smaller, 7.2 years compared to 8.3 years for the flat plate one. The pay-back period is obtained by changing the period of economic analysis, in economic parameters (see Fig.6), until the life cycle savings is equal to zero.

The monthly solar contribution for the 4m<sup>2</sup> flat plate and the 3m<sup>2</sup> concentrating collectors is shown in Fig's 8 and 9. In all months the concentrating collectors perform better than the flat plate ones. The flat plate collectors provide 100% load coverage for seven months whereas with concentrating collectors for eight months.

DOMESTIC INSTALLATION						
City call number	346					
Water storage volume	150	LITERS				
Building UA (0 for DHW only)	0	W/C				
Fuel (1=EL, 2=NG, 3=OIL, 4=OTHER)	1					
Efficiency of fuel usage	100	%				
Domestic hot water (1=Y, 2=N)	1					
Daily hot water usage		LITERS				
120 120 120 100 100	80 80					
80 100 100 120						
Water set temperature	60	C				
Environment temperature		C				
9.5 10.5 13.2 16.5 21.4	25.5					
28.1 27.4 24.9 20.7 14.5	11.1					
DHW storage tank size	15000	LITERS				
UA of aux storage tank	0	W/C				
Pipe heat loss (1=Y, 2=N)	2					
Inlet pipe UA	0	W/C				
Outlet pipe UA	0	W/C				
Relative load HX size	1					
Collector-storage HX (1=Y, 2=N)	2					
Tank side flowrate/area	.012	KG/S-M2				
Heat exchanger effectiveness	1					
HOTEL INSTALLATION						
City call number	346					
Water storage volume	15000	LITERS				
Building UA (0 fro DHW only)	0	W/C				
Fuel (1=EL, 2=NG, 3=OIL, 4=OTHER)	3					
Efficiency of fuel usage	70	%				
Domestic hot water (1=Y, 2=N)	1					
Daily hot water usage		LITERS				
12000 12000 12000 10000 10000						
10000 8000 8000 8000 10000 10000						
12000						
Water set temperature	60	C				
Environment temperature		C				
9.5 10.5 13.2 16.5 21.4 25.5						
28.1 27.4 24.9 20.7 14.5 11.1						
DHW storage tank size	15000	LITERS				
UA of aux storage tank	0	W/C				
Pipe heat loss (1=Y, 2=N)	2					
Inlet pipe UA	2.5	W/C				
Outlet pipe UA	2.5	W/C				
Relative load HX size	1					
Collector-storage HX (1=Y, 2=N)	1					
Tank side flowrate/area	.04	KG/S-M2				
Heat exchanger effectiveness	.08					

Fig. 5 Systems data

**B. Hotel Installation**

Most of the luxury hotels in Cyprus are employing flat plate collectors for the heating of the service hot water. A real installation is used which is analysed, optimised and compared with concentrating collectors. The analysis of the existing installation is shown in Fig. 10.

DOMESTIC INSTALLATION		
Econ analysis detail (0 TO 4)	1	
Cost per unit area	162.7	C.P./M2
Area independent cost	0	C.P.
Price of electricity	.053	C.P./KW-HR
Annual % increase in elec	5	%
Price of natural gas	.18	C.P./M3
Annual % increase in nat. gas	5	%
Price of fuel oil	.1	C.P./LITER
Annual % increase in fuel oil	5	%
Period of economic analysis	15	YEARS
% down payment	100	%
Annual market discount rate	8	%
% extra insur & main in year 1	2	%
ANNUAL % INCREASE IN I & M	3	%
Eff fed+state income tax rate	0	%
Annual % increase in prop tax	0	%
% resale value	10	%
Commercial system? 1=Y, 2=N	2	
Comm. depreciation schedule		%
25 38 37 0 0 0 0 0 0 0		
HOTEL INSTALLATION		
Econ analysis detail (0 TO 4)	1	
Cost per unit area	86.63	C.P./M2
Area independent cost	3250	C.P.
Price of electricity	.053	C.P./KW-HR
Annual % increase in elec	5	%
Price of natural gas	.18	C.P./M3
Annual % increase in nat. gas	5	%
Price of fuel oil	.1	C.P./LITER
Annual % increase in fuel oil	5	%
Period of economic analysis	20	YEARS
% down payment	100	%
Annual market discount rate	8	%
% extra insur & main in year 1	2	%
ANNUAL % INCREASE IN I & M	3	%
Eff fed+state income tax rate	0	%
True % property tax rate	0	%
Annual % increase in prop tax	0	%
% resale value	10	%
Commercial system? 1=Y, 2=N	1	
Comm. depreciation schedule	1	%
10 20 15 15 15 15 10 0 0 0		

Fig. 6 Economic parameters

Collector Type	Collector area (m <sup>2</sup> )	Yearly F Value	Initial Investment (C. Pounds)	Life Cycle Savings (C. Pounds)	Pay-Back Period (Years)
Flat Plate	4	0.82	522	315	8.3
Concentrating	1	0.55	375	142	7.2
	2	0.79	431	336	
	3	0.91	488	394	
	4	0.97	548	385	

Fig. 7 Domestic installation analysis

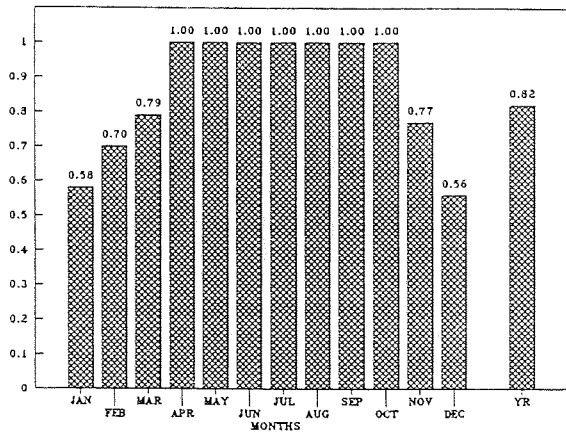


Fig. 8 Flat Plate Collectors domestic installation (4m<sup>2</sup>)

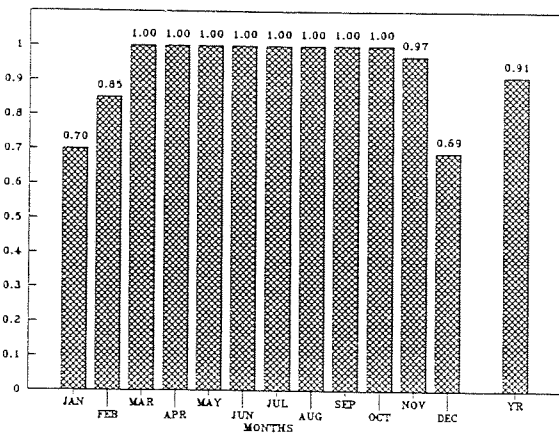


Fig. 9 Parabolic trough collectors domestic installation (3m<sup>2</sup>)

Type	Collector area (m <sup>2</sup> )	Yearly F Value	Initial Investment (C. Pounds)	Life Cycle Savings (C. Pounds)	Pay-Back Period (Years)
Existing	220	0.64	21,435	-660	20.9
Optimised	110	0.44	12,468	2,197	16.0

Fig. 10 Flat plate collector analysis - Hotel installation

A common practice in the design of such systems is to utilise all the hotel's roof available area. It can be seen from Fig 10 that by using the existing installation, 660 C.P. are lost, whereas with the optimised solution half the collector area is required (110m<sup>2</sup>), and 2,197 C.P. are saved.

The analysis for the concentrating collectors for this case is done graphically as shown in Fig. 11. In this case 4m<sup>2</sup> collectors are considered which with an inclination of 35° (local latitude) which give an overall height of 2.5m. The optimum solution is for a collector area of 120m<sup>2</sup> where the yearly F-value is 0.61 and the life cycle savings is 5,177 C.P.

The monthly contribution of the two optimised cases, using flat plate and concentrating collectors, is shown in Fig's 12 and 13. Again in all months the concentrating collectors give higher performance than the flat plate ones and they provide 100% load coverage for the whole of the four summer months.

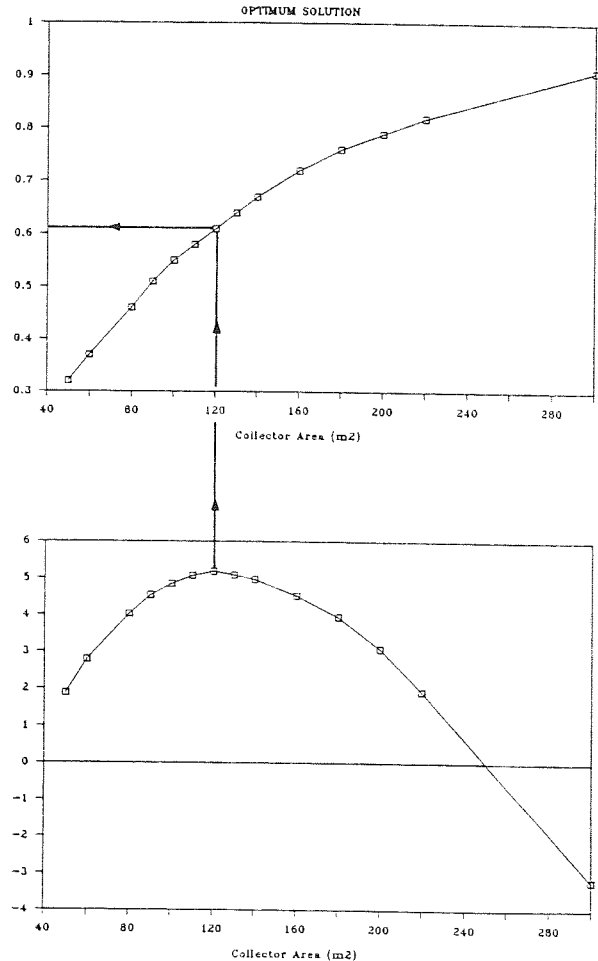


Fig. 11 Concentrating collector selection

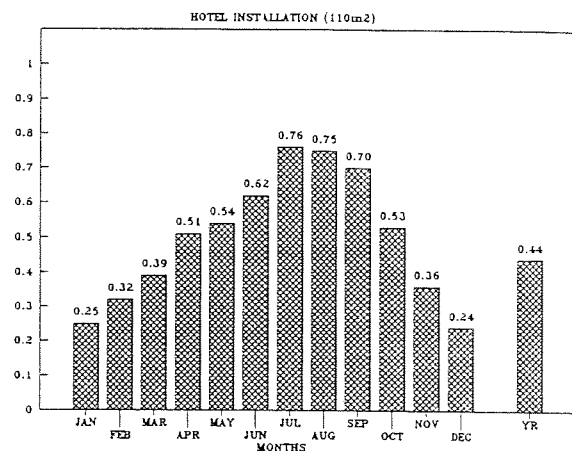


Fig. 12 Flat plate collectors

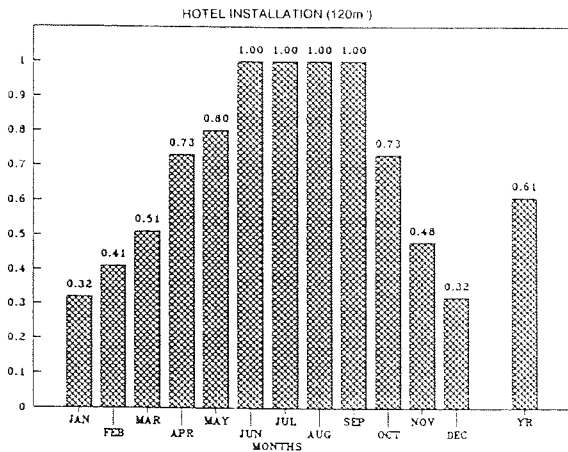


Fig.13 Parabolic trough collectors

## CONCLUSIONS

It can be realised from the two cases investigated above that the concentrating collectors present some economic advantages (resulting from their use) against the flat plate ones. On the other hand their biggest disadvantage is that they require some form of maintenance which is taken into account in the costing (see Fig.6). This constitutes these types of collectors inadequate for domestic installations because it would be difficult to convince customers to buy such collectors and worry for their maintenance whereas in the case of flat plate collectors they almost forget their existence.

For the case of the hotel installation the situation is much better because the savings are bigger,

(5,783 C.P. for the existing installation and 2,980 C.P. for the optimised one), and hotels usually employ permanent maintenance teams. For this reason it is believed that it would not present a serious problem to the maintenance team for cleaning the parabolic surface once a month or so (once a month is the most frequent form of maintenance required [4]). It is interesting to note that, the collector efficiency and cost combination, (gives for the optimum cases) bigger area for the concentrating collectors than for the flat plate ones, of course with much bigger savings. This indicates that no hard rules exist and each case should be optimised on its own merits.

An improved tracking mechanism which would turn two collector panels at the same time will reduce the cost to such a degree that will make the concentrating collectors even more cost effective. A theoretical costing of such a system gives, for the hotel installation, life cycle savings of about 7,300 C.P.

Considering the above findings, it is believed that concentrating collectors should be used for large scale water production instead of the flat plate ones.

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**He who conquers his mind conquers the world.**

G. NAMAOK

**True love is the real purpose of man. No one finds God without love**

M. S. SINGH

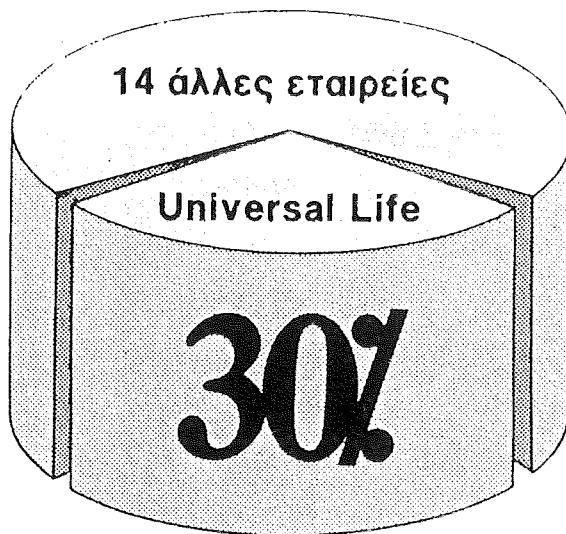




Universal Life

Ξέρετε γιατί η Universal Life  
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στις προτιμήσεις του κοινού;

Σιγουριά  
και στα  
Κέρδη!



**Επειδή**

- τα σχέδια της έχουν την καλύτερη απόδοση και πληρώνουν περισσότερα
- προσφέρει συνέπεια και σταθερότητα
- είναι ο μεγαλύτερος ασφαλιστικός οργανισμός στην Κύπρο

Για περισσότερες πληροφορίες  
γιά τα ασφαλιστικά προγράμματα μας στείλετε το  
κουπόνι στην πιο κάτω διεύθυνση:

ΚΕΝΤΡΙΚΑ ΓΡΑΦΕΙΑ

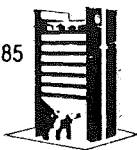
Universal Tower

Λεωφ. Διγενή Ακρίτα 85

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Τηλ: 02-461222

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Όνομα \_\_\_\_\_

Διεύθυνση \_\_\_\_\_

Τηλ \_\_\_\_\_

# Narrow Band Measurements and Calibration

by Polyvios Eleftheriou, Ph. D.  
Lecturer, HTI

## 1. INTRODUCTION

In the recent years a lot of progress has been achieved in the area of data acquisition. This was mainly due to the fast growth, and advances in the computer industry which provided the necessary hardware to perform the fast manipulations necessary for fast data gathering and control.

The development of signal analysis and signal processing helped a lot of sciences with data logging, fast data acquisition, and data processing. One of those sciences was Acoustics. Before the arrival of the fast processing routines, people could not even think about acoustic intensity measurements or radiation patterns. Now, this is considered a common practice to solve field problems.

The advances in measurements though, resulted in rather difficult problems with the handling of large number of data points and their actual physical interpretation. Calibration procedures used in the past are difficult to be applied now, and special skills are required not only to handle the computers, but also the necessary measuring equipment.

## 2. USE OF FFT DEVICES

The use of the FFT devices and particularly the ones with zoom capabilities offered to the acoustics researcher a new tool which could be used in a wide range of measurements. Instead of using third-Octave analysis one can use resolutions such as one thousandth of a Hz, numbers which were impossible to achieve few years ago.

With the arrival of the FFT analyzers a special calibration had to be developed in order to get reliable and repeatable data. In the past the calibration of the acoustical measuring instruments was based on a calibrator which was capable of producing repeatable wide band sound pressure of certain level. This kind of calibrator was satisfactory only because the measuring capabilities could not distinguish the frequency variation of the calibrator.

A question arose about the possibility of using such a calibrator and still being able to calibrate FFT analyzers. The answer to this question requires the examination of the spectrum of such a calibrator, its stability, and its repeatability. This study used a number of calibrators which produce wide band noise, and one which produces a "tone".

The results of the above examination and

subsequent development were applied in an in-duct measurement of sound pressure level produced by a vane axial fan. Narrow band were the requirement for those measurements (1 Hz resolution), and so the calibration procedure as well the interpretation of the data had to be very precise.

## 3. CALIBRATION PROCEDURE AND ACTUAL MEASUREMENTS

The averaged spectrums of two typical calibrators are shown in Figures 3.1 and 3.2. Figure 3.1. shows the typical noise output of a pistonphone and Figure 3.2 shows the typical noise output of a tone generator. Obviously a different resolution will result in a slightly different sample of data. It is worth to note however, that in real life there is no "pure tone". In other words nature does not have any quantities which behave like "delta functions".

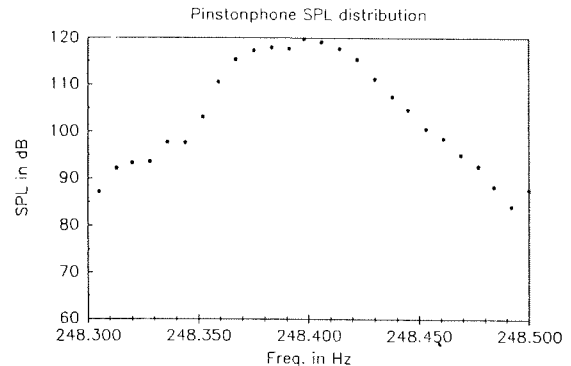


Figure 3.1 Pistonphone output

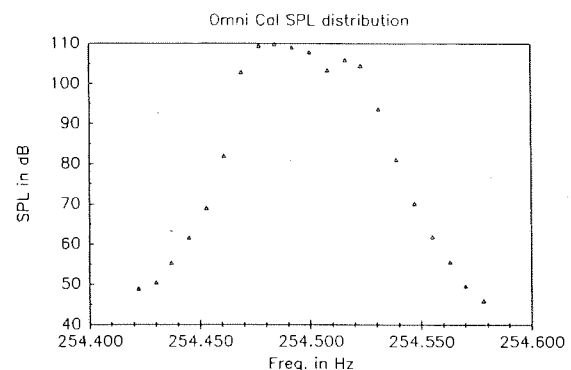


Figure 3.2 Tone generator output

Tonal Repeatability Test  
 0-2560 Hz, 2560 lines, 2.733" & 2470 SCFM  
 Foam Impeller, Inlet Data, 8/10/89

Hz	Max Tone	DF	Sideband				St.Dev
417	85.82	1	87.73	87.73	87.77	87.79	0.03
	85.41	2	87.85	87.87	87.91	87.91	0.03
	85.47	3	87.96	87.96	88.02	88.02	0.03
	85.57	4	88.07	88.06	88.12	88.12	0.03
		6	88.24	88.25	88.33	88.27	0.03
		8	88.41	88.42	88.49	88.43	0.03
		10	88.59	88.55	88.65	88.59	0.04
		15	88.99	88.93	89.00	88.96	0.03
		20	89.38	89.34	89.39	89.33	0.03
834/3	89.28	1	91.47	90.87	91.56	90.91	0.31
	88.09	2	91.64	91.10	91.77	91.12	0.30
	88.61	3	91.78	91.28	91.89	91.29	0.28
	88.06	4	91.90	91.45	92.01	91.43	0.26
		6	92.14	91.74	92.29	91.69	0.26
		8	92.41	92.00	92.53	91.96	0.25
		10	92.61	92.25	92.77	92.21	0.24
		15	93.12	92.81	93.27	92.78	0.21
		20	93.52	93.22	93.64	93.21	0.19
1668/7	86.62	1	89.54	89.25	89.66	89.18	0.20
	87.15	2	89.71	89.41	89.80	89.35	0.19
	87.68	3	89.84	89.54	89.91	89.52	0.17
	87.17	4	89.96	89.65	90.02	89.66	0.17
		6	90.17	89.92	90.22	89.89	0.15
		8	90.41	90.16	90.45	90.14	0.14
		10	90.62	90.38	90.65	90.36	0.13
		15	91.11	90.87	91.12	90.81	0.14
		20	91.50	91.33	91.53	91.28	0.13
2501/0	77.94	1	80.63	80.17	80.14	79.98	0.24
		2	80.95	80.55	80.54	80.42	0.20
	77.47	3	81.22	80.26	80.82	80.73	0.34
	77.21	4	81.45	81.12	81.07	80.99	0.18
		6	81.94	81.63	81.58	81.43	0.19
		8	82.37	82.12	81.99	81.87	0.19
		10	82.74	82.52	82.42	82.32	0.16
		15	83.59	83.38	83.29	83.22	0.14
		20	84.20	84.10	84.01	83.93	0.10

Table 3.1 Tonal repeatability test

Based on reality and the behaviour of true systems what does one use to calibrate a high resolution measuring device, since there is no pure tone available? The answer to this question is rather a philosophical one. Since there is no pure tone available one does not have to calibrate using a pure tone. In other words since the energy appears as a distributed function in time one has to sum that energy and use the sum as the "total energy output" of the calibrator (use the neighborhood of the tone and not just the peak tone amplitude).

A follow-up question to the above is about the neighbourhood size which is needed to obtain most of the energy. The answer to this question is that by knowing the amplitude distribution in the frequency domain one can decide about the range needed to include most of the energy. In practice an FFT device can be calibrated using a wide band calibrator as long as all the calibrator acoustic energy is considered.

In actual measurements of turbomachinery noise the above fact can easily be understood as the energy distribution around a tone due to the speed fluctuation of the machine. Figure 3.3 shows a typical example of sound pressure level measurements of a vane axial fan. Repeated measurements of the sound pressure level of the same fan operating on the same operating point suggested a consistent broad band noise level, but highly uncertain tonal amplitudes (within 3 dB). This amplitude variation though, cannot be observed with wide band measurements. This phenomenon is similar to the "Heisenberg Uncertainty Principle" suggested for the atomic structure. Applied to the tonal noise in turbomachines the uncertainty may be expressed as follows "one may not know the exact amplitude and location of a tone at the same time".

With narrow band analysis, applied to turbomachines, one may locate the averaged tone quite precisely, but its amplitude will fluctuate due to the speed variation of the machine. On the other hand, the wide band analysis will result in a more repeatable amplitude level, but the location of the tone in the frequency domain becomes impossible.

A solution to the above problem is the use of a special summing cursor which can be provided with the FFT analyzer. This special cursor can be positioned and sum over a frequency range, resulting so in the total energy contained in that range. In other words one may use the narrow band analysis provided by the analyzer and then use the summing cursor to obtain the tonal energy. Such procedure was followed to obtain the data of Table 3.1. The table outlines some of the tonal maximum levels, the tonal levels using the summing cursor of the analyzer, and the standard deviations of the results using the

summing cursor. As it can be seen the standard deviations the summed tones are within 0.2 dB, a value which is by far less than the 2-3 dB tonal repeatability obtained using the maximum tone deviation.

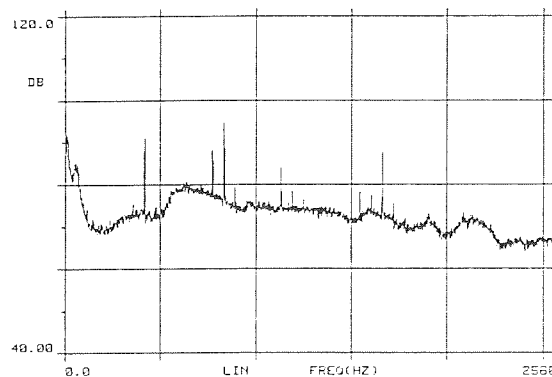


Figure 3.3 Noise spectrum of a typical vane axial fan

#### 4. CONCLUSIONS

The calibration requirements for today's fast data acquisition systems are different than the ones used few years ago. Those requirements will likely be changed again with the advances of technology. The conclusions resulted from the study of the calibrators of today's market are:

- a. Modern FFT -high resolution devices can still use the old calibrators for calibration purposes, as long as all the acoustic energy is included in the calibration,
- b. When tonal noise levels are required the summing of the levels in the neighborhood should be considered as the tonal magnitude, and not just the peak level of the tone, and
- c. For the case of turbomachinery high resolution analysis can be used to observe the acoustic properties of the machine and locate the tones, but the level of the tones should be read as a sum of amplitudes in the neighbourhood of each of the tones.

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# Kirlian photography - A review. Room for further research

by *A. K. Kaplanis MSc, CEng MIEE MBES F.I HospE  
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G. Florides, Diploma HTI, Senior Instructor HTI*

## ABSTRACT

Many claims have been reported as to the uses of Kirlian Photography for producing patterns of the "aura" of hands and toes of human subjects which apparently, give diagnostic information of subjects in health or disease if correctly interpreted by experienced doctors/medical practitioners or clinicians.

Other reports speak of images of "phantom" leaves when part of these leaves from plants and trees have been cut away.

The authors have recently decided to carry out relevant investigation regarding the possibility of repeatability of such claims.

## INTRODUCTION

Kirlian Photography is the name given to a special type of photography using, mostly, high voltages and high frequencies, (although low voltage/low frequency pictures are said to have been taken by some researchers).

It is so named after its inventors Semyon Kirlian and his wife Valentina who produced such high frequency high voltage photographs and patented their device in the Soviet Union in 1949.

Although the first person to produce images from electricity, (called electrographic photographs), was J. Narkevitch Iodko, also a Russian, one hundred years ago in 1891, and although several other names have been used to describe such images, (i.e., Electro Imaging Photography or High Frequency Photography or High Voltage Photography), the name Kirlian Photography has prevailed.

Many researchers believe that Kirlian Photography produces images or special patterns, which convey information about the structure and conditions of organic as well as inorganic material.

The proposed research aims in verifying, if possible, whether such patterns convey useful information especially in organic material in health and disease.

## VARIOUS CLAIMS MADE BY OTHER RESEARCH WORKERS

The International Society of Biophysical Medicine in their booklet "Scientific basis on Basic Acupuncture Course" and in the case of Kirlian Photography, mentions amongst other things the following:

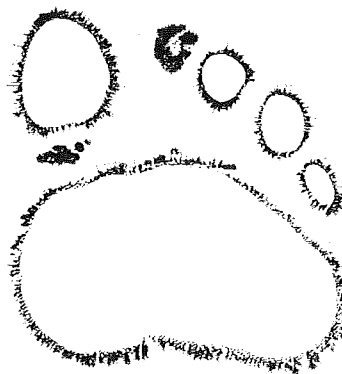
"Kirlian photography can be used to identify disfunctions...

For the technique to be reliable an accurate pulse generator is needed ... good timing is essential ... The failure of a number of workers to interpret these photographs satisfactorily has led some people to say that the system is unreliable.

However, having taken thousands of photographs, the Society has found that this technique consistently shows reliable results... When a major symptom is present, the meridian on which it lies shows altered characteristics." The following photographs show some examples



*Darkening of the fifth toe indicates a severe degenerative condition on the Bladder meridian. In this case, the sinus point Bladder 2 was affected.*



*Darkening of the second toe indicates a severe degenerative condition. The patient was suffering from trigeminal neuralgia. The Stomach meridian crosses the face. Every trigeminal neuralgia picture showed this image.*

Dr Chr. Pishiaras, carrying out research on Bio Energy Phenomena using Kirlian Photography, amongst other things, in a lecture given to members and friends of the Cyprus Association of Medical Physics and Bio Medical Engineering on 30 April 1991 in Nicosia, has shown very interesting Kirlian Photographs of people under two conditions namely in pre and post meditation conditions.

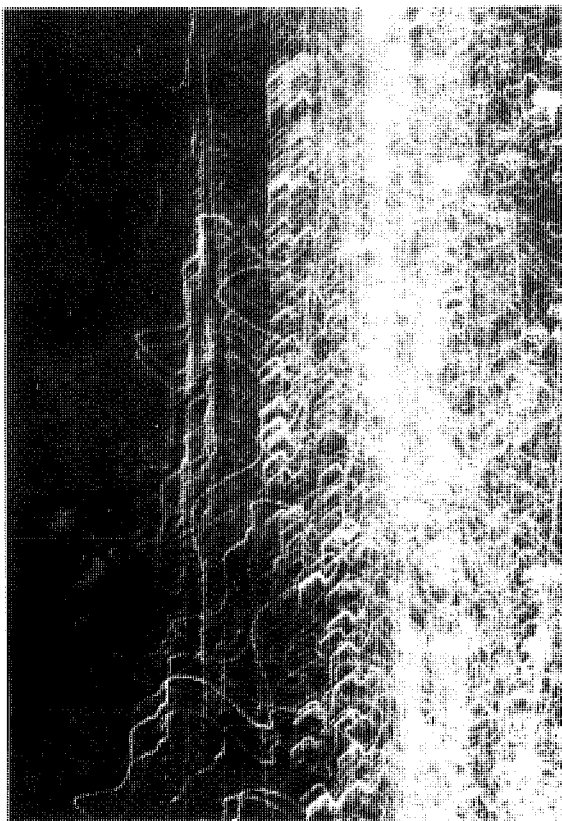
Dr Pishiaras has shown that under deep meditation there seem to be "exchanges in the vegetative nervous system. These exchanges were found using Kirlian Photography where the colours of the 'aura' were different than in the pre meditation conditions.

Kirlian photography is now used as a method of diagnosis of psychic disorders especially in neurosis.

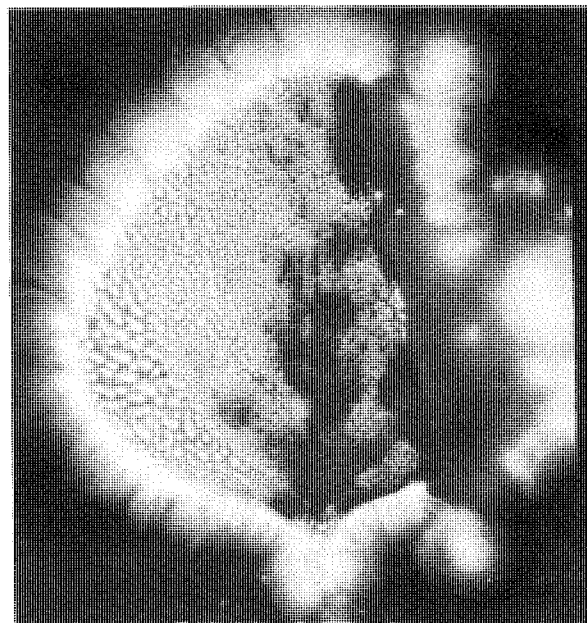
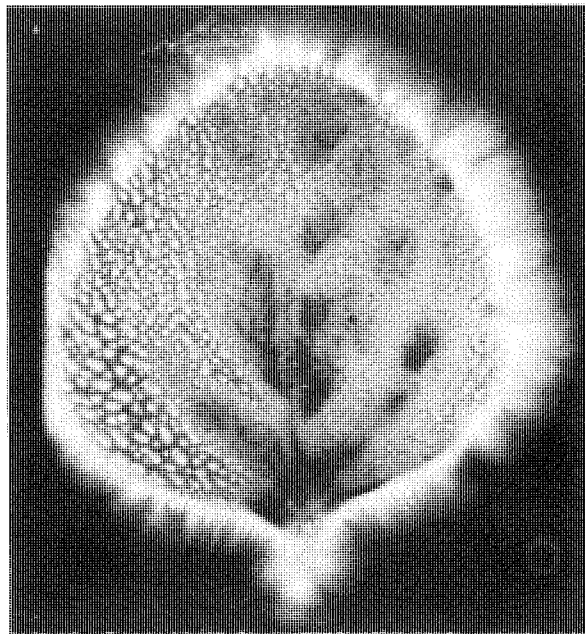
These bioenergy phenomena are very important for the investigation of several paranormal phenomena such as the phenomena of healing, the phenomena of altered state of consciousness, hypnosis meditation etc.

Comparison with the Hammilton's Scale with the colours of the 'aura' of the patients is made..."

The picture of the biofield of a person in deep meditation, as photographed using Kirlian photography is shown below .



Other photographs by other research workers show a leaf with its characteristic aura. Notice the "phantom" part of the leaf when a small section is cut away.



#### PROPOSED RESEARCH WORK

The authors decided to carry out investigation and relevant research as follows:

- Phase 1. Purchase relevant Books and Articles in Kirlian Photography and contact if possible other research workers on the matter.
- Phase 2. Purchase one Kirlian Photography unit to begin with and study its electrical characteristics with emphasis on the safety aspects to the patient and operator.

At a later stage to purchase a second Kirlian Photography Unit of different characteristics and study whether both units will give identical and repeatable patterns of photographs of the same subjects to be examined / investigated.

- Phase 3. Take Kirlian Photography pictures of inorganic and organic matter starting first with leaves of plants and other material before proceeding into the patterns of the human "auras" in health and disease.
- Phase 4. Exchange ideas and information regarding such patterns with other research workers in this field both in Cyprus and abroad.
- Phase 5. (a) Take Kirlian Photographic patterns of Apparently Healthy Individuals on a voluntary basis -at least 200 cases.
- (b) Take Kirlian Photographic 'aura' patterns of patients in Dr. Katsonis clinic in pre and post treatment conditions for not more than 3 abnormalities/diseases.
- Phase 6. Make a scientific epidemiological study / Medical Statistical Analysis.
- The duration of this research is expected to extend over three years or more.

#### WORK COVERED TO DATE:-

- Phase 1. (a) A computer search, (MEDLINE), was made at the Cyprus Institute of Neurology and Genetics, for data on Kirlian Photography, but no relevant data were available with this programme.
- (b) Through correspondence with Several Research Centres various articles have been received.
- More articles and books on Kirlian Photography with relevance to Medicine and Biology have been ordered. Delivery is expected in a few weeks.
- (c) Pictures of patterns of the aura of patients with abnormalities/ ailments/ diseases have been requested from various research centres and are awaiting their reply.
- Phase 2. (a) A Kirlian Photography Unit, from Electro Imaging Company Ltd, Model PAF 101 S. No 123459 has

been purchased by Dr. G. Katsonis out of his own money in view of the very limited research fund (£200) from the HTI Research Fund.

- (b) Harrys Kyriakides, Printer, has kindly allowed us the use of a limited number of film for the project together with one of their darkroom for the development of Kirlian Photography pictures.

Having studied the relevant articles so acquired some of the important points of relevance have been noted and are the following:-

- (I) There are many types of Kirlian Photography Units of different KV and frequency ranges. In some K.P. units the KV is as high as 200 thousand volts! (200 kiloVolts).
- (II) Different K.P. Units give different patterns of pictures of the same subject matter under investigation.
- (III) The subject matter under investigation must be effectively earthed.
- (IV) Taking of Kirlian Photography is 'safe' since there is "more than adequate" insulation (dielectric) between the high voltage plate and the "earthed" subject matter under examination.
- (V) Kirlian Photography is NOT RECOMMENDED for persons with:-
- (a) Heart Problems  
(b) Pacemakers
- Also it is not recommended for pregnant women.
- (VI) The type of film to be used is an important factor in the quality of the pictures to be taken.
- (VII) The power level (KV setting as well as amperage) is also important in the quality of the picture.
- (VIII) The time setting of the exposure is yet another factor to be considered.
- (IX) Dr Giosiaki Omouras' recommendations in taking such pictures have also been noted.

Having noted the above and other points many questions come to mind which had to be answered, before using the equipment. These were:

- (I) What is the KV and amperage output for each 'Power Setting' of the Electro Imaging Kirlian Photography Unit in hand, since there is no manual available for the said equipment?
- (II) What is the frequency range for various time settings?



(III) Does the Kirlian Photography unit produce any X-ray Radiation which could be harmful to the operator and/or the person under "examination" (even if the manufacturers may consider it "safe") in view of the large kilovolts involved?

(IV) Who decides of whether the person under examination has any Heart Problem? That is what if the person under examination does not know if he/she has any heart problem?

Questions (I) (II) and (III) above were easy to determine.

With regards to (I), the KV output, the manufacturers informed us that this ranged from 12KV at power level 1 to 25 KV at power level 10 the scale being almost linear.

The fundamental frequency is 12KHZ.

In order to determine whether the unit produced any X-Ray radiation the Philips Radiation

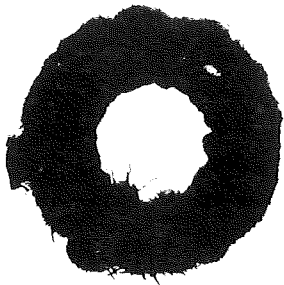
Monitor as well as the Victoreen 666 type were used.

It was found that at the maximum power level setting the Philips X-Ray Radiation monitor showed a reading of 0.05 mR/h which is very small indeed to affect any hazard.

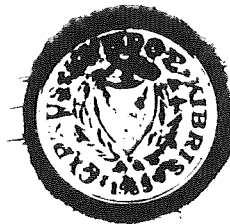
The Victoreen 666 type of X-Ray Radiation monitor has given no reading. Regarding the fourth point, obviously the Medical Doctor will decide as to who will be examined, using Kirlian Photography, in case of heart problem.

#### TESTING OF THE KIRLIAN PHOTOGRAPHY UNIT AND RESULTS OBTAINED

Having ascertained that there is no risk to the operator and to healthy volunteers the Electrolmaging (Kirlian Photography) unit was used to obtain pictures or patterns of the "auras", on inorganic matter, then on leaves of plants and finally on healthy volunteers. Some of the pictures are shown below indicating the power level and time setting in each case.



*Pattern of a metallic ring. Power level 2, time 2*



*Pattern of a coin. Power level 2, time 2*



*Green leaf (left). Dried leaf (right). Power level 3, time 2.*



*Handprint of Mr X whilst undergoing no medication. Power 8, time 2.*



Handprint of Mr X undergoing medical treatment (taking 150 mg of Anaframil). Power 9 time 2.

Note: No handprints were observed of the same person, at Power level 8, time setting 2 sec. Whilst under the said treatment.

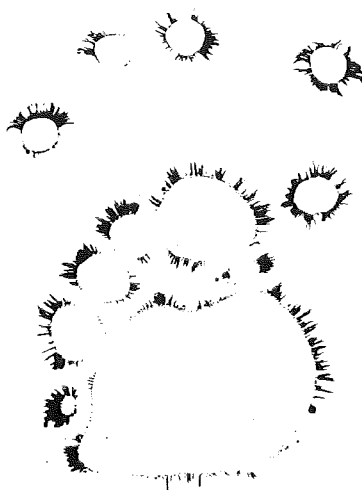
#### SOME OBSERVATIONS REGARDING THE ABOVE IMAGES

1. It seems that all material, whether organic or inorganic, show an 'aura'.

Inorganic (metallic) objects and other material which contain water such as recently cut leaves, give a brighter aura or "glow".

Objects made of bad conductors (insulating material) do not seem to glow as much.

2. Using the said Kirlian Photography Unit mentioned it was found that the more the power level the more the 'glow' of the aura.
3. In taking pictures of the hands of people it was observed that one could not take similar patterns of the same person within a few minutes of taking the first picture under the same conditions of pressure, ambient temperature, humidity etc.



#### A CASE STUDY

The following case study involved one of the authors who narrates the following true story:

As long back as 1987 the first contributor to this article whilst in a Scholarship for a postgraduate degree in Medical Electronics and Medical Physics, propelled by enthusiasm on various Alternative Medicine Techniques using Electronics, and having been encouraged by an equally enthusiastic student of Medical Electronics, (Dr. Tony Matthews), visited, after an invitation, the International Society of Biophysical Medicine in Liverpool in order to observe various demonstrations on new methods and techniques on Alternative Medicine / Complimentary Medicine, for which we were told Prince Charles has shown a keen interest.

Various Techniques were demonstrated and explained such as BioImpedance and Biopotential measurements for determining the degree / possibility of abnormalities as well as techniques used to alleviate various human abnormalities / disorders and diseases.

Techniques such as Auricular search for determining the meridian or acupuncture points, Laser Acupuncture, Electro Acupuncture, Electrostimulation for Withdrawal of drug addiction etc were demonstrated and in fact we were allowed to speak to patients undergoing treatment.

Another method for the diagnosis of ailments / disorders / abnormalities mentioned was that of Kirlian Photography.

In fact both Dr. T. Matthews and myself (A.K. Kaplanis) have accepted to have our "Kirlian Photography Patterns" taken.

The impedance between hands and also between feet for each were first measured and noted. Then the Kirlian photo of the hands and toes were taken and developed.

The Kirlian Photograph of the fingers and toes of myself is shown below.



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After the Kirlian photograph of myself has been developed a medical doctor has examined it who then diagnosed "... A small problem with the Urinary Bladder".

Three years later in July 1990 at the "Here is Health / Alternative and Complimentary Medicine" Exhibition at Olympia Kensington, London, which was also attended by Dr. G. Katsonis, and at the stand of "ENZYME RESEARCH (UK) LTD", a Computerised Biofeedback Diagnostic Apparatus has also given the diagnosis of "... small problem with the urinary bladder" in my case.

[Note: Indeed both doctors / practitioners using completely different and completely independent electronic diagnostic techniques 3 years apart have given the CORRECT diagnosis in my case as diagnosed also by Orthodox Medical doctors in Cyprus and for which the writer, A. Kaplanis, underwent a small intra urethral operation to alleviate the problem on the 21st March 1991.

It was these events that prompted the co-author of this article to proceed into carrying out research on the matter using Kirlian Photography as a diagnostic tool for doctors.

Having found some ground of interest by Dr George Katsonis, M.D., practicing Homeopathy and Mr. George Florides, Senior Instructor at the HTI a keen enthusiast on the matter, it was decided to work as a team to carry out research on the question of Kirlian Photography Images for the purpose of establishing any possible

correlation between various diseases/ailments / abnormalities in pre and post treatment conditions.

## CONCLUSIONS

The team cannot claim to have carried out any serious research on the matter of Kirlian Photography as a possible diagnostic tool in this short period since commencing the investigation a few months ago. Several years of investigation, consultation with more research workers and thousands of Kirlian Photographic Images must be taken before any epidemiological study and medical statistical analysis can be made for establishing of a possible correlation if any between such images and specific diseases/ailments etc.

As for the understanding of the processes involved, this seems to be a far away objective as yet.

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6. Kirlian Photography - an appraisal by Hoosain Ebrahim and Robin Williams.

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*Bear malice for no one ; give help to the needy.  
Be strict with yourself and lenient to others.*

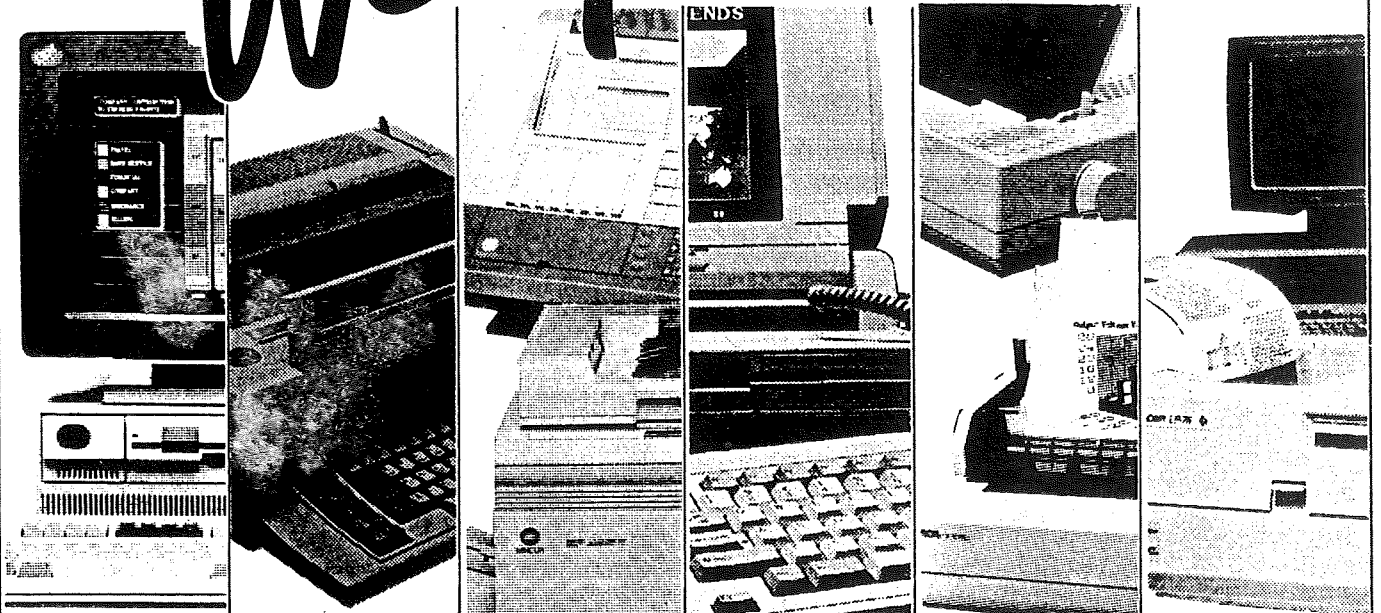
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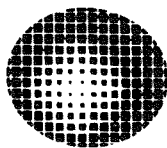


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# Total Quality Management (T.Q.M.)

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 I. Eng, GMIMechE, GMIProd E. MASQC  
 Lab. Assistant, HTI

The interest in quality is growing all over the world. Customers and users are becoming more and more demanding. They are no longer willing to accept inferior quality. Citizens are insisting that the public sector improve the quality at its services. The public sector is just like any other "company" with paying customers.

During the last years several definitions have been established. In the next few lines some of those definitions have been selected.

"QUALITY IS TO PROVIDE THE RIGHT PRODUCT OR SERVICE AT THE RIGHT TIME WITH A MINIMUM COST TO SATISFY CUSTOMERS NEEDS", or QUALITY IS CUSTOMERS SATISFACTION [1].

TOTAL QUALITY can be summed up as "THE COMPANY CULTURE THAT LETS YOU PROVIDE QUALITY GOODS AND SERVICES" at lowest cost.

"TOTAL QUALITY MANAGEMENT" is a genetic form for the modern approach to quality and is to achieve Total Quality by harnessing everyone's commitment.

Total Quality is one of many cultures which may be exhibited by a business enterprise. Without specific instructions, this culture determines the way in which staff carry out their work. Most company cultures have arisen over many years. Changes for the worse can be achieved overnight changes for the better can take years.

If we try to answer what is Total Quality the answer is illustrated in Figure 1.[2].

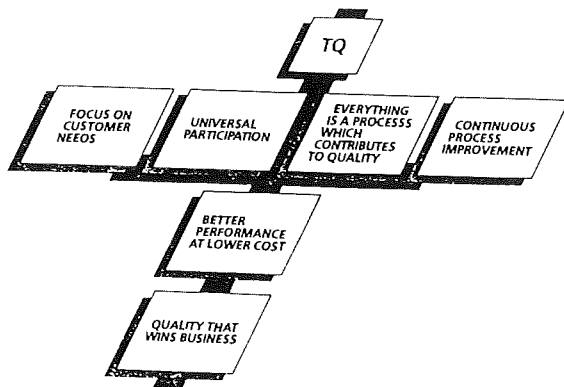


Fig. 1

Total quality is about people. Their attitudes, their organisation, their use of company resources. Everyone is involved.

The focus is on customers, communication and the business process. This focus will bring rewards. The most successful business today depends absolutely on total quality.

The Japanese companies first espoused quality after World War II when the American statistician Dr W. E. Deming began educating them. They accepted that exporting shabby goods was not an effective form of development. After rebuilding most of their industry to improve quality, Japanese companies found that their advantage was beginning to show in international markets. The United States woke up to the erosion of its following the "Quality" route when Japan was already well into a "Total Quality" culture. The Pacific Basin countries, such as Singapore, Korea and Hong Kong were more forward than Europe in following Japan's example. Today, a whole new wave of developing countries - Mexico, Indonesia and Egypt among them - have studied the Japanese ways and are adopting them to take their industries into world markets. Please refer to Figure 2.[4].

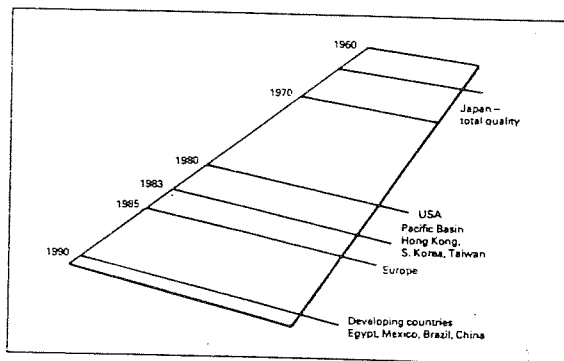


Fig. 2 Total quality time line (source: PA Consulting Group, 1986).

The basic supporting elements required to ensure a Total Quality Approach in order of implementation are:

- (i) The creation of a simple effective controllable organisation structure, with natural cellular groupings of people and facilities round flow charts and with relevant measures of performance for each team in each group, reflecting the overall business targets.
- (ii) The application of all relevant techniques to help support continuous improvement and the control of quality performance (e.g. SPC, FMEA, QFD, Poke-Yoke, Tachuchi Experiment, ZD, DPA etc.)
- (iii) A first-rate and well managed communications system in every part of the

organisation. It should be possible to periodically measure the performance of the communication system.

(iv) Effective supplier development schemes reflecting points 1-3 above, in each supplying company and regularly reviewed against targets.

The most important keys to total quality can be easily illustrated in the following Figure 3.[2]:

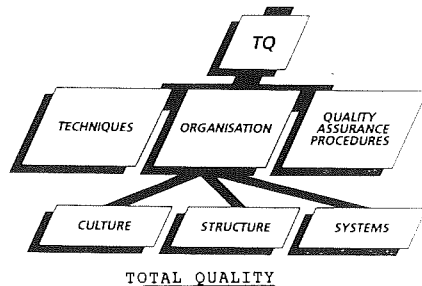


Fig. 3

There are three factors that dictate how an organisation functions and how that organisation is perceived. CULTURE, STRUCTURE, SYSTEM. Success comes from the right balance between these three factors which should be supportive from Total Quality Organisations.

### CULTURE

The Total Quality Culture is one in which everyone in an organisation constantly considers the quality of their work and how it is reflected in the products, services or information that their company handles.

More than anything else, what distinguishes a Total Quality Company from an ordinary one is the way its people think and act. The value that people place on quality at performance in every activity and what they do to improve the quality at their work are key factors in the Total Quality Organisation. It is vital that the Organisation culture supports the Total Quality Concept. [2].

The term "Total Quality of Performance" relates not just to the technical quality of products but rather to the quality of performance of every function in an organisation. This is in recognition of the fact that the quality and cost of a product depends upon its design, the lead times and reliability of processes operated by many contributory departments (both manufacturing and administrative), the choice of materials and the effectiveness of supporting structures.

### STRUCTURE

The restructuring of manufacturing into cellular units makes necessary an examination of organisational structures, many of which are still based on highly specialised and fragmented functions, which are difficult to integrate and to create a common purpose which leads to over specialised job titles. It must be recognised that what was appropriate yesterday may not be the best today, let alone tomorrow. We must move towards the creation of:

#### THE NATURAL PROCESS GROUP ORGANISATION THROUGH THE 'SINGLE OFFICE CONCEPT'

This involves the identification of the major cross functional PROCESSES of a business and grouping them together for management purposes, either physically or by reporting line to a cross functional manager or team leader [2].

### SYSTEMS

Procedures format or informat which match organisational 'Ownerships', some of which may be supported by information technology.

The suppliers organisation wants to install and maintain in quality system that strengthens its own competitiveness and achieves the needed product quality in a cost-effective way.

In addition, in the contractual situation, the purchaser is interested in certain elements of the supplier's quality system which effect the supplier's ability to produce consistently the product or service to its requirements, and the associated risks.

The diagram below Fig. 4, illustrates the use of the Quality System.[4].

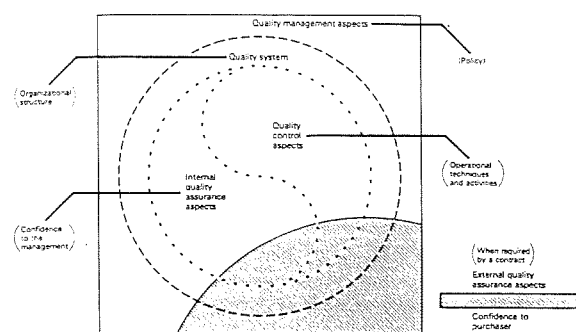


Fig. 4 Quality systems

### Quality system principles Quality loop

The quality system typically applies to, and interacts with all activities pertinent to the quality of a product or service. It involves all phases from initial identification to final satisfaction of requirements and customer expectations. These phases and activities may include the following: (Fig. 5[4]).

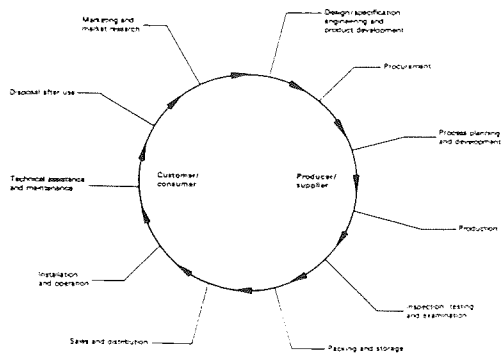


Fig. 5 Quality loop

**Quality tools and techniques**

One way of representing the skills needed by Total Quality Organisations is in the form of building blocks from awareness to continuous improvement. Some of these are applicable to any organisation, some of them are specific to particular areas of the business. It is important that the right tools and techniques should be applied in the right place.

With the basic training completed in problem-solving, team working and occasionally communication skills, most staff are ready to become actively involved in a task force of improvement group. It is at this stage that the appropriate training for that group may be called for. There are general skills tools which few organisations have adopted, yet which can yield tremendous benefits in a very short period of time, and which are easily learnt and applied by all levels of staff in a company.

These skill tools or Quality tools are used to:

- | measure  | using  |
|--|--|
| <ul style="list-style-type: none"> <li>• Achievement of plant</li> <li>• Stock turnover rates</li> <li>• Product quality</li> <li>• Lead times</li> <li>• Sales arrears</li> </ul> | <ul style="list-style-type: none"> <li>• Process control</li> <li>• Audit processes</li> <li>• Paka yoke</li> <li>• Zero defect policy</li> <li>• Kahban and Just-in-Time</li> <li>• Module schedulign and control</li> </ul>  |
| <ul style="list-style-type: none"> <li>• Competitor performance</li> <li>• Value-added per employee</li> </ul>   | <ul style="list-style-type: none"> <li>• Departmental purpose analysis</li> <li>• Continuous improvement mechanism</li> <li>• Competitor analysis</li> <li>• Taguch Techniques</li> <li>• Quality Function Deployment</li> <li>• FMEA</li> <li>• Capability studies</li> </ul> |

Total Quality is a reality. This is the time to improve the performance and competitiveness of your enterprise. This will be achieved by introducing modern concepts of Total Quality Management with appropriate statistical methods. Those concepts must be led by management. As it is already mentioned changes for the worse can be achieved overnight, changes for the better can take years.

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*The Kingdom of God on earth is the love of all people, of all nations.*

*Tolstoi*

*The more I learn the more I discover my ignorance.*

*Kartesios*



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PERGAMON



# The changing patterns of the Greek-Cypriot Family

by *Chrystalla Antoniou Ms*  
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## INTRODUCTION

It is by now a commonplace that times tend to change faster than attitudes. In only a few generations, a mighty transformation has turned a rural society into an urban and industrial one. This revolution has a direct effect on family structure and a consequent change in the relations between its members. Thus, the old equilibrium of the social roles of men and women has been disturbed without as yet being replaced. Gender roles need redefining and this must take into consideration a whole variety of factors - including personalities and circumstances<sup>1</sup>. A "gender role" is a role assigned on the basis of the biological sex, which defines specific personality traits and behavioural responses as appropriate to a person of that sex; i.e. social influences amplify the biological division and gender roles are represented in the psychological construction of masculinity and femininity. The definition of masculinity and femininity varies between different societies and also historically within each society. Modern industrial society has created opportunities for the equality of male and female but has retained and even heightened the differentiation between masculinity and femininity<sup>2</sup>. If the ideology of femininity constrains women, so, presumably, does the ideology of masculinity constrain men. While men may be psychologically limited by their masculinity, women are socially and economically oppressed by their femininity.

Below, I shall try to show the change of the gender roles in Cypriot society, through the changing process of the family structure after 1960. First, I will briefly describe the basic family patterns. Secondly, I will outline the factors which were responsible for bringing about change in Cypriot society. Thirdly, I will elaborate on the change of the structure of the Greek-Cypriot family. The political events of 1963-64 and 1974 which have kept the Turkish minority separated, do not allow me to make a similar study for the Turkish Cypriot family.

## 1. FAMILY PATTERNS

Sociologists classify family patterns into different types, which have as a base either the relation of the family to the relevant existing social system or the relations between its members. In relation to

the social system family types can be classified into four broad groups:

- i) the traditional
- ii) the transitional
- iii) the contemporary, and
- iv) the ideal contemporary family

Mousourou in her research study on 'Women in Occupation and Family' mentions the following definitions of the above mentioned family types, as given by Vitnyi<sup>3</sup>:

- i) The traditional pattern was in force before the appearance of the capitalist system and aimed at the preservation and transmission of traditions. The family functioned as an integrated economic unit (production and consumer unit); the role of each individual member was defined by the prevailing traditions.
- ii) The transitional family stops functioning as an integrated economic unit; its structure is in a stage of transition from traditional to contemporary.
- iii) The contemporary pattern characterises big industrial societies; there is less dependence on pre-defined roles.
- iv) The ideal contemporary family is "personality centred"; each member functions according to his individual characteristics, instead of bearing a specific role.

According to the second parameter - its members' relations, the family pattern, which has been more often used and investigated by sociologists is the nuclear and extended type.

- A nuclear family consists of the two spouses living in the same household together with their unmarried children.

- An extended family is when relatives cohabit with the nuclear family. (i.e. parents, brothers, sisters e.t.c.).

## 2. FACTORS CONTRIBUTING TO CHANGES IN THE STRUCTURE OF GREEK-CYPRIOT FAMILY

The political and economic events which took place in the Republic of Cyprus after 1960 brought about rapid social and cultural changes. The Cypriot economy, after the World War II, was already in a process of transformation from agricultural to one based on commerce and light industry. The subsequent relative rise in the living standard of people and the inflow of rural workers to the towns, contributed to a change of the society model, from rural to urban. Moreover,

two major political events were responsible for bringing about change in Cypriot Society: i.e. the declaration of the island as an independent republic in 1960 and its invasion by Turkey in 1974.

### 2.1 CYPRUS-AN INDEPENDENT REPUBLIC

The newly formed Republic and the subsequent economic growth brought about a lot of innovations to Cypriot society. The leading role played by agriculture in the economy was overtaken by light industry; moreover, the employment opportunities which were offered in a variety of sectors, brought about the full employment of the population and a high participation by women in various sectors of the developing economy. These resulted in an inflow of rural workers to the towns and a considerable increase in the standard of living. Furthermore, the creation of professional posts in the newly established Republic, led to the appreciation of education, the improvement of its standard and the high attendance of students of both sexes in all its levels. These innovations contributed to a change in the traditional values and attitudes of Cypriot people.

### 2.2 THE TURKISH INVASION

The Turkish invasion of 1974 had very marked effects upon Cypriot society. Its consequences have affected the Cypriot family in various ways. The rapid displacement of 200,000 Greek-Cypriots from the north of the island to the south, have brought about changes in the demography, economy and social life of Cyprus.

The majority of the Greek-Cypriots from the northern rural areas were settled in the refugee camps, which were built in the towns of the free southern part of the island. This resulted in the change of the structure of the economy, which experienced a rapid reorganisation soon after the war. The role of agriculture was diminished, since most farmers lost their lands, and light industry became the main sector of the economy. The factories (mostly clothing and footwear), which were built near the refugee camps, depended on female labour. Moreover, tourism, which was the most rapidly growing sector throughout the 1980's, offered employment opportunities to male and female force. Thus, female employment changed from unpaid family worker in agriculture to paid employee in manufacturing and services. These changes in the economy and in demography affected peoples' attitudes and ideologies. In addition, the fact that many people were left without any property and the availability of financial schemes, which were offered to people in buying dwellings, led to the elimination of the institution of the dowry.

The financial independence of women combined with the fact that many of them were turned into heads and supporters of their families (since they lost their husbands or their protectors), led to a

change in the traditional image of the female stereotype. Furthermore, the involvement of Cypriot people with foreign tourists, the development of the mass communication media and the increasing numbers of students studying abroad, contributed to the diffusion of western ideas about sex stereotypes, marriage, family relations and the position of women in the family and society. These changes were instrumental in the redefinition of sex roles and the re-evaluation of the personal qualifications of the people.

### 3. CHANGES IN THE STRUCTURE OF THE GREEK-CYPRIOT FAMILY

I came to the conclusion that the effects of the Turkish invasion accelerated the changing process of the Cypriot family and society. In order to show these changes I have used existing research studies referring to the Cypriot family before and after the Turkish invasion. I defined the Cypriot family pattern before 1974 as Traditional and the one after 1974 as Transitional. Although the Cypriot economy has been in a stage of transitional change after World War II, I believe that the use of 1974 as the turning point is justified, considering that times change faster than peoples' attitudes and taking into account the findings of the existing research studies, which I used.

#### 3.1 FEATURES OF THE TRADITIONAL GREEK-CYPRIOT FAMILY

I drew information from the following research studies in order to show relationships existing in the Cypriot Family before 1974:

1. B.J Surridge, *A survey of Rural life in Cyprus, Nicosia, 1930*. [This survey was printed in the Colonial Government Printing Office and was conducted by B.J. Surridge who was commissioner of Larnaca. It was based on reports of investigators who visited villages throughout Cyprus during 1927 and 1928 and it was amplified by statistical and other information from the records of the colonial Government].
2. Brian K Taylor, *A Report on Three Community Studies in Cyprus*, by the government of Cyprus' Department of Social Welfare Services and Swansea University College's Department of Social Administrations, Nicosia, 1970 (unpublished). [In the second and third part of this report 34 rural and 60 urban adolescents between the ages of 14 and 18 were interviewed. Interviews were also conducted with 38 village and 56 urban mothers. In the rural study the village of Agros was used; it is a village in the mountains of Troodos, in Nicosia District. In the urban study Pallouriotissa, a Nicosia suburb was used].
3. Jack Balswick, *The Greek Cypriot Family in a Changing Society*, Department of Social Welfare Services, Nicosia, 1972-73 (unpublished). [In this research brief studies around the institution of the family were presented in seven articles. The studies were based on statistical information available, on information in published or unpublished governmental reports and on an exchange of ideas with senior scientists in the Cyprus Welfare Department].
4. Kyriakos C. Markides, Eleni S. Nikita, and Elengo N Rangou, *Lysi, Social Change in a Cypriot Village*, Social Research Centre, Nicosia, 1978. [This study was conducted in 1973 and 1974 in Lysi; a village in Famagusta District. As explained by the researchers this village was selected for its centrality in the Mesaoria

region which is the largest plain in Cyprus and because of its economic and urban development. Lysi is in the northern part of Cyprus which has been under the occupation of the Turkish troops since 1974].

5. Michael Attalides, *Social Change and Urbanisation in Cyprus*, Social Research Centre, Nicosia, 1981. [The main sources of information used for this study were: The Nicosia Migrant Survey conducted in 1971 and various government and other publications. The study was completed in 1973, and covered the Nicosia area and suburbs, and ten villages within a radius of about ten miles from Nicosia].

Greek-Cypriot Society has traditionally held to a nuclear family household system. In the research about the village of Lysi, the rural family was characterised as: "nuclear, patriarchal, religious traditional and endogamous with separated roles for the two sexes"<sup>4</sup>. These characteristics could be attributed to the urban family as well, since in Cyprus, as Attalides stated<sup>5</sup>: "there is no distinguishing differentiation between urban and rural". In his study of Nicosia, he observed a high degree of cultural uniformity amongst middle and lower level urban dwellers with rural dwellers. The term patriarchal implies that all the power lay in the hands of the father. He dominated the family's property and social life. In Christine Delphy's words:<sup>6</sup> "Patriarchy is the system of subordination of women to men".

Religion and endogamy had a great influence on the social life of Cyprus and contributed to the maintenance of the traditional family model. Endogamy [i.e. when people get married to people from the same place] helped the survival of traditions and the maintenance of a close society system with defined gender roles. The roles played by both the man and the woman in the Cypriot family were not fundamentally different to their counterparts in other Mediterranean societies. The man was the public representative of the family and the woman's role was in the house. The socialisation of boys was different from that of girls from a very early age. The girls were brought up to be tender and to care about others, while the boys were taught to be tough and competitive.

... Balswick, writing in 1973, states the following about sex roles:<sup>7</sup>

A sex role distinction exists in Greek-Cypriot society. The male sex role, as compared to the female sex role, carries with it prescriptions which encourage inexpressiveness. While the girl is taught to act "feminine" and to desire "feminine" objects, the boy is taught how to be a male and to act manly. In learning to be a man, the boy comes to value expressions of masculinity and devalue expressions of femininity. Masculinity is expressed largely through physical courage, toughness, competitiveness, aggressiveness and defending one's honour, while femininity is, in contrast, expressed largely through gentleness, expressiveness, responsiveness, tenderness and modesty.-

Sex role socialisation influenced the relations of the members of the Cypriot family. In the family the father lacked the intimate relationship that the

mother had with the children. The mother often played the role of the intermediary between father and children.

... As stated in the research about the village of Lysi:<sup>8</sup>

The father never dresses or feeds the children... In matters of discipline however the father is often regarded as a kind of a supreme court... The relationship of mother-son is very sentimental. That of mother-daughter is intimate and affectionate... The father-son relationship is characterised by a distant respect of father's authority... The relationship of father-daughter is even more distant than that of father-son. In the relationship we also notice an additional element of shame and avoidance.

In the report of Brian K Taylor there is some interesting information on parents-children communication. According to the mothers' answers, 58% of the village parents and 50% of the urban parents disagreed with their children. From the adolescents' answers however, the disagreement appeared to be much bigger. In the village of Agros, 94% of the boys and 70% of the girls disagreed with their parents as against 81% and 88%, respectively in Pallouriotissa. The main reasons of parents-children disagreement was the adolescents' leisure aspirations and activities. The boys' activities differed from that of the girls, especially in the villages. In the urban areas the adolescents mostly used to go to the cafes and the cinema; they also attended mixed parties. In the villages the boys used to go to the coffee-shops, while the girls either visited their relatives or went for walks with friends. Surridge described the cafes as the centre of village life and the only place of relaxation for men<sup>9</sup>. It is worth noting that till now, in some remoted villages these are the only leisure activities offered to boys and girls.

Below, I describe the changes in the structure of the Greek-Cypriot family and society after 1974.

### 3.2 FEATURES OF THE TRANSITIONAL GREEK-CYPRIOT FAMILY

I derived information from the following three research studies.

1. Lia Mylona, Costas Paschalis, Eleni Kalava, Niki Patsalidou, Athos Erotokritou, *The Cypriot Woman*, Nicosia, (1982), 1986. [ This study covered all Cypriot women over 15 years of age residing in the free areas of Cyprus. About a thousand women were interviewed in order to investigate the attitude of Cypriot women towards certain fundamental aspects of life such as: marriage, the role of the married woman in the family, equal rights, politics, relations with opposite sex, sex, religion, problems, pleasures and aspirations. The collection of the data took place during 1978].
2. *The structure of the Cypriot family and the position of the adolescent in the family*, by the National Committee of the International Child Committee of Cyprus, Nicosia, 1982. [The aim of this research was to investigate the structure of the Cypriot family and the position of the adolescent in the family. It covered all the Cypriot households in the free areas of Cyprus and a thousand households were interviewed].
3. *Child upbringing in Cyprus*, by the Department of Social Welfare Services, Ministry of Labour and Social

Insurance, Nicosia, 1989. [The purpose of the survey was to find out the practices and attitudes of parents, and in particular those of mothers, in the process of raising children of 12 years of age. The survey covered the Nicosia area [urban and rural] and three hundred families were interviewed].

The Cypriot Family after 1974, maintained its nuclear character, but experienced significant changes as far as its other characteristics were concerned, that is: Patriarchal, religious, traditional, endogamous and with defined roles for the two sexes.

Kalava in her work about "the position and role of the Cypriot woman in the family today", in *The Cypriot Woman*, mentioned that the traditional family pattern had been replaced by the democratic pattern which entailed dialogue and cooperation<sup>10</sup>. In the research, *The structure of the Cypriot Family*, the Cypriot family was characterised as nuclear and democratic with a high degree of protection of children against natural and moral dangers<sup>11</sup>.

The traditional form of religiousness of the Cypriot family has begun to diminish, especially amongst the younger and more educated people. From the study, *Child upbringing in Cyprus*, it was found that "church attendance" was amongst the lower ranked values which mothers had for their children<sup>12</sup>. Furthermore, in *The Cypriot Woman*, it was seen that though the Cypriot woman had in general great faith in God, her contact with the church was not so frequent, and she had reservations about dogma and religious practice<sup>13</sup>.

The endogamic characteristic of the Cypriot family appeared to undergo a rapid decline, due to the great demographic upheaval, which occurred in the island after its invasion by Turkey. This contributed to a change in the traditional values, which had been preserved in the close society life, especially in the villages. The participation of women in the labour force led to the elimination of the division line, which specified separated domains for the two sexes. i.e.: the man as supporter and protector of his family to the public and the woman as housewife and mother. It is worth noting that in the research, *Cypriot Woman*, it was found that the majority of Cypriot women, especially the younger and more educated ones, answered positively to the question: "should the husband of a working wife assist with housework." Despite the changes, many characteristic remnants of sex role socialisation can still be detected in the practices and attitudes followed by parents in the rearing of their children.

The survey, *Child Upbringing in Cyprus*, revealed that mothers had greater expectations from their daughters concerning the issue of "Love others" and as far as "housework" was concerned. On the other hand they were more concerned about the attribute of "honesty" for their sons; a possible explanation might be this attribute's relation to men's traditional role, as

representatives of their family to the public.

In the modern family, sharing between parents in the tasks of physical upbringing is increasing steadily. From the research, *Child Upbringing in Cyprus*, it can be seen that 34.3% of the fathers appeared to help often in feeding the child as against 37.1% who never helped<sup>14</sup>. This is a big step, considering that in the research, *Lysi*, it is mentioned that the father never dresses or feeds the child. From the study of Eleni Kalava, "The position and role of the Cypriot woman in the family", the majority of Cypriot families appeared to be democratic. Education and place of residence were significant in the distribution of authority between the spouses. Wives who were more educated or lived in urban areas had a greater share in decision-making in family matters. In addition, the degree of parent-children communication appeared to be very satisfactory. The study, *Family Structure*, showed that there was better communication between parents and children of the same sex. The majority of the sons [91.6%] appeared to discuss their problems with their fathers, while a larger number of daughters [95.5%] discussed them with their mothers.

The following table presents the answers of parents to specific social situations in relation to the children's sex:

TABLE 1: Answers of parents to specific social situations

Social situation	Answer	Sex		Place of residence	
		Male %	Female %	Urban %	Rural %
Free to go anywhere	Yes	42.6	20.8	35.0	26.8
	No	56.7	78.6	64.6	72.3
Free to return home anytime	Yes	24.1	9.6	18.3	14.3
	No	75.3	89.6	81.4	84.7
Dress as he/she likes	Yes	87.8	80.9	86.6	81.5
	No	11.7	18.7	13.0	18.1

Source: The structure of the Cypriot Family, p. 107

The restrictions placed by the parents in table 1 are explained, in the research, as a result of over-protection against possible moral or natural dangers<sup>15</sup>. It is difficult to find the real cause of the restrictions, but what is very revealing is the different attitude of parents towards male and female adolescents. Only 9.6 per cent of the girls as against 24.1 per cent of the boys were free to return home any time. Also 20.8 of the girls compared to 42.6 per cent of the boys were free to go anywhere. The attitude of urban compared to rural parents did not present great differences.

## CONCLUSION

The Greek-Cypriot family appears to be in a transitional stage where more democratic

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principles prevail. The autocratic right of the man imposed by the traditional values and attitudes is gradually being replaced by the participation of the wife and of the children as regards family matters. The involvement of women in education and the labour force, contributed to their changing attitude towards certain social and economic institutions; this has resulted in the general redefinition of sex roles in the family and furthermore in society. The Cypriot woman seems to be in a transitional stage towards her moral, psychological, social and economic liberation, while the Cypriot man appears to practise methods entailing more cooperation, equality and understanding. Despite the changes, the remnants of socialisation into the traditional gender roles still influence male and female behaviour. More specifically, the ideology of women as homemakers and men as breadwinners is responsible for other differences between male and female behaviour such as: participation in education, labour force and public life.

As Huston-Stein and Higgins-Trenk stated<sup>16</sup>: "The development of nontraditional gender role expectation in adolescence probably requires at least one "unusual" influence, be it a parent, a school program or a particularly potent peer or adult model." In the absence of such "intervention" the culture breeds a traditional male or female.

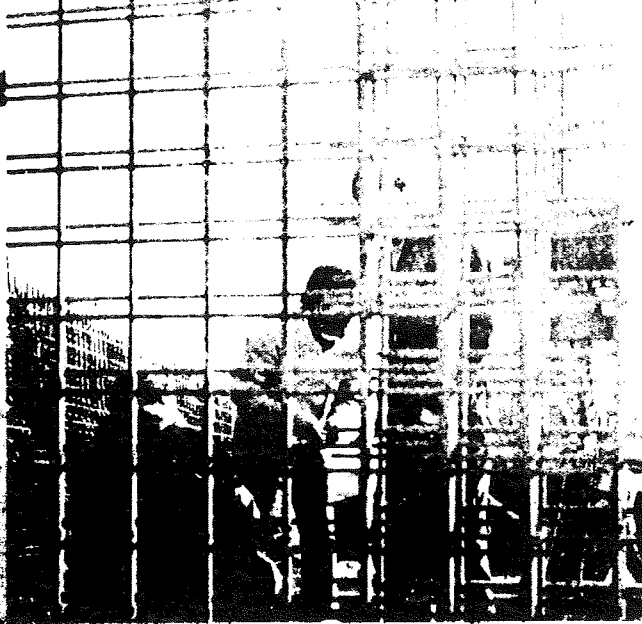
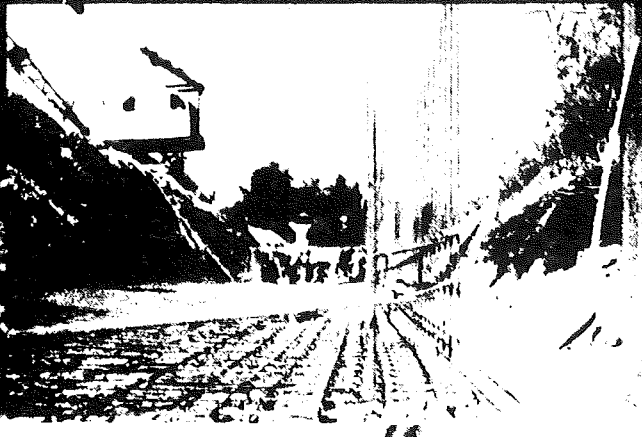
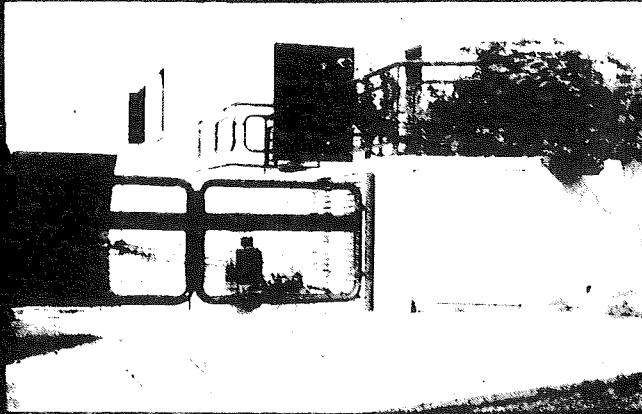
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δομικό πλέγμα

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# The Saliva dribbling problem of Cerebral Palsied Children and the present methods used to alleviate the problem

by A. K. Kaplanis  
MSc, CEng MIEE, MBES FIHospE  
Lecturer HTI

## ABSTRACT

Oral dribbling of Cerebral Palsied Patients has been a social embarrassment to them and their relatives.

Several techniques are practised at present in order to reduce the problem of dribbling in cerebral palsied children. None of the techniques, which are mentioned herewith, are however ideal in the management of drooling. One of the techniques using a device which reminds the children to swallow at regular intervals has been developed by the author, based on a preferred specification evolved after discussion with speech therapists at the London Bridge Hospital and the Chailey Heritage Craft School and Hospital in England.

The device has been accepted after clinical tests, for its effectiveness and simplicity.

## INTRODUCTION

Brain damage to a child, which may occur at birth or around the time of birth or even during development before birth, results usually in disorders of movement and or sight, of hearing, speech, intelligence. The term Cerebral Palsied is used to describe children and patients in general with the above disorders.

There are three main categories of Cerebral Palsy which are mentioned herewith and the present techniques used to improve the management of dribbling are described together with their advantages and disadvantages. One such technique, the Dribble Control Box has been used for children with one category of Cerebral Palsy, that of Bilateral Spasticity and what has been described as an improved version of existing devices, is given herewith.

## MAIN TOPIC

The following categories of cerebral palsy are recognised:

### 1) Hemiplegia

In this category of cerebral palsy the arm and leg of one side of children is affected. One third of Cerebral Palsied Children are of this category.

### 2) Bilateral Spasticity

Children in this category of cerebral palsy have difficulty in the movements of the upper and lower limbs.

Within this category are also children with weak muscles of the neck and trunk and have difficulty in speech and swallowing because of a stiffness in the relevant muscles.

The majority of cerebral palsied children, about two fifths, are said to fall within this category.

### 3) Athetoid Children

These are children whose movements are "quick", more so in the face.

About one fifth of the known cases of C.P. are Athetoid Children.

## PROBLEMS OF CEREBRAL PALSIED CHILDREN

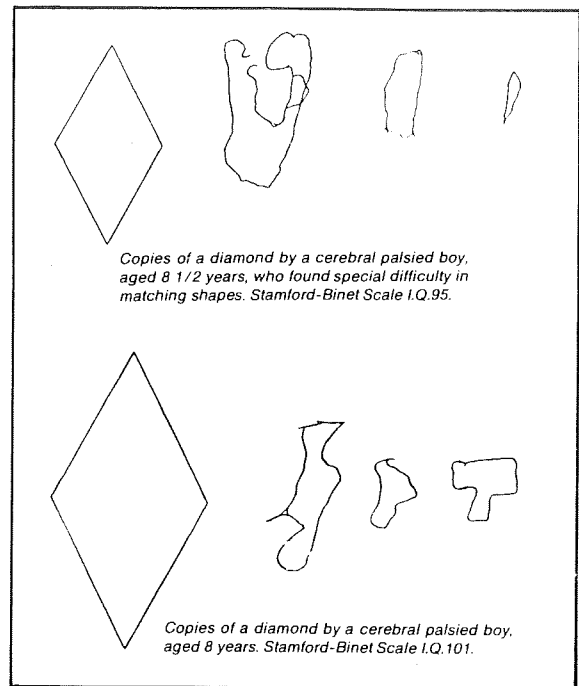
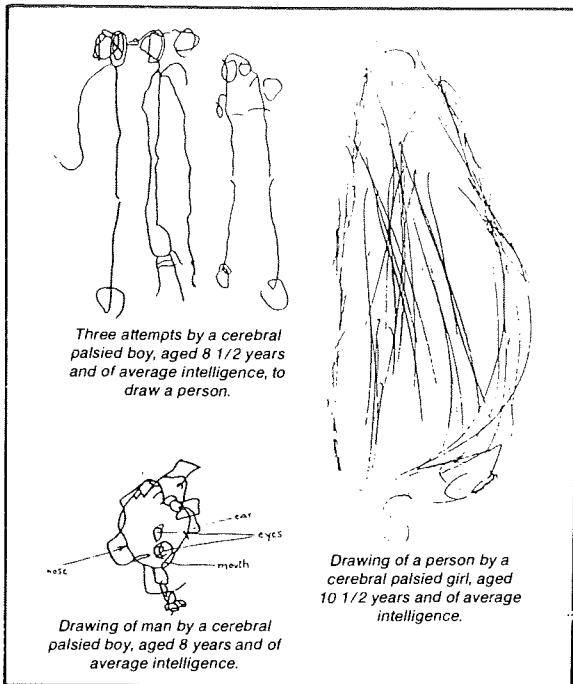
Due to the problem of dribbling, children who are aware of this predicament, feel embarrassed many of whom consider themselves unwanted and unloveable refusing to go out to meals, parties or other social events. The self-image and personality of the child may be damaged with further psychological and physical problems for them and people close to them.

Apart from the above mentioned problems there are also educational problems and disabilities although some of these children have an average intelligence.

There are children for instance who misjudge distances and very often they bump their head on the desk or fall down stairs.

Other children cannot match shapes, others cannot reproduce shapes from memory and others who can reproduce them from memory but cannot copy them.

The following figures show attempts of cerebral palsied children of average intelligence to draw some objects:



It must be stated however that not all cerebral palsied children suffer from the above mentioned difficulties or disabilities and such children may be found in a variety of schools, i.e. normal schools, schools for the physically handicapped, special schools etc. and although teachers can recognise such defects and plan special learning programmes, in other cases it is not so obvious and teachers are baffled by the children's behaviour and learning difficulties.

#### EXISTING TECHNIQUES USED TO ALLEVIATE THE PROBLEM OF DRIBBLING

The following methods are practised in order to reduce the problem of dribbling in Cerebral Palsied Children. But it must be emphasised that none of them is ideal in the management of saliva dribbling.

##### Method 1

###### *The use of parasympatholytic drugs.*

These block parasympathetic activity of the nervous system resulting in a "dry mouth", but with undesirable side effects.

##### Method 2

###### *Radiotherapy*

It is believed that this has been effective in atrophying salivary tissue. This too is "condemned" due to the side effects associated with radiotherapy.

##### Method 3

###### *Surgery*

The submandicular glands, which are said to produce about 90 to 95% of the total daily saliva, can be safely removed using the "Wilkie Technique".

##### Method 4

###### *The use of a Dribble Control Box.*

Such a technique was developed and used in the Meldreth Manor School for physically handicapped children.

It was an electronic device, pinned to the child's clothes, and produced audible bleeps at regular intervals. The child was asked to swallow his/her saliva on hearing the bleeps.

It was claimed that some categories of cerebral palsied children could be conditioned to swallow in response to an aural cue.

The maintenance of the habit however varies between individuals.

Some of the dribbling control devices used had one or more of the following disadvantages:

- (i) Saliva was getting in the device, causing malfunction.
- (ii) The device was pinned on to the children's clothes and proved to be a limitation. Some children wanted to hide it. They wanted to have the device in an inconspicuous position.
- (iii) If a group of children, fitted with such a device, happened to be together they would hear each others bleeps and caused confusion.
- (iv) The audible bleeps were disturbing if children and people in their company were watching television.

#### NEW VERSIONS OF THE DRIBBLE CONTROL DEVICE

The author has produced at least three new versions of the dribble control box which could eliminate some of the above mentioned problems



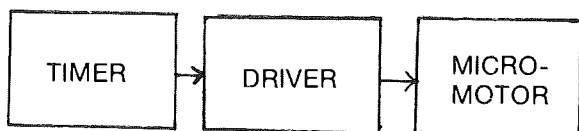
and were presented to speech therapists for clinical tests.

One of these was to give a short duration electric impulse like electro-acupuncture.

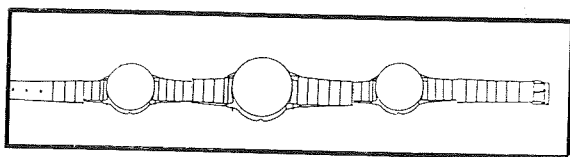
The second was using a signal of 190 Hz to a watch like piezo-electric vibrator worn on the wrist.

The third method was using a micromotor of 12 mm diameter and 12.5 mm in length, with an out of balance cam attached to the micromotor shaft. This third device was chosen by speech therapists and was recommended for its effectiveness.

A simplified version of the circuit diagram of the device is shown below, in block form, and it has been proposed as a commercial product because of its simplicity and effectiveness.



The same circuit could be produced, in a three compartment wrist-watch-like device, as shown below, using micro electronic components.



## CONCLUSIONS

There are no ideal methods of alleviating the problem of dribbling of cerebral palsied.

Perhaps the best known method of reducing the production of saliva dribbling is the Wilkie Technique using surgery.

However using: "dribble control devices", it has been found that people can be "conditioned to manage their saliva dribbling" and the Wrist-band watch-like vibrator type dribble control system developed by the author has been reported to be acceptable not only for its simplicity & effectiveness but also from the aesthetic point of view as well as on the fact that it is positioned in an inconspicuous position namely on the wrist of the subject.

Using micro-electronic technology and surface-mount components the device can be reduced in size still further and information published by Electro Mechanical System Ltd, UK, manufacturers of micromotors, speak of a micromotor of only 6 mm x 6.5 mm type which can indeed give a substantial reduction of the size of the watch-like dribble control system.

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*We were born to love and not to hate our fellow man.*

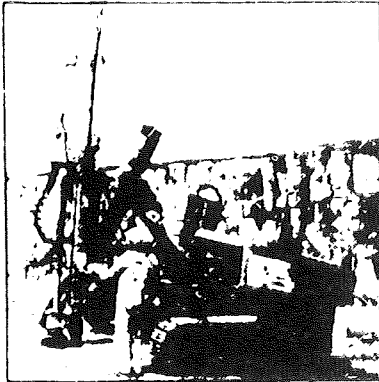
*Dante*

*There is no sacred war. Unavoidable, perhaps, but never sacred.*

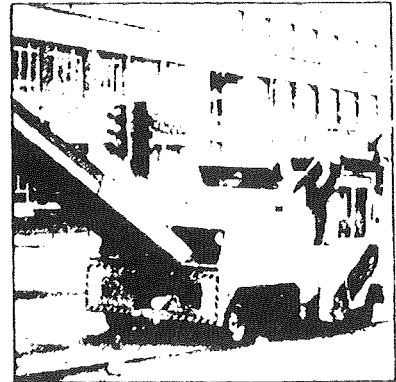
*P. Kanellopoulos*



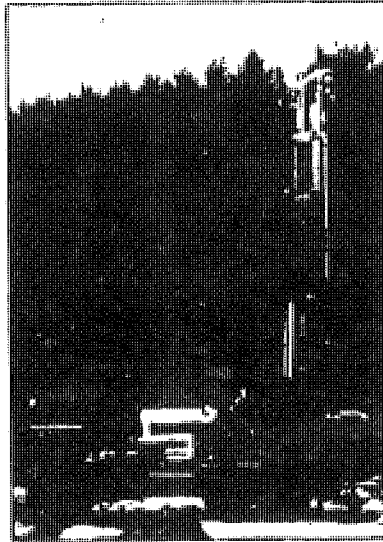
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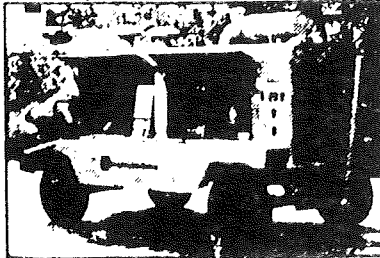
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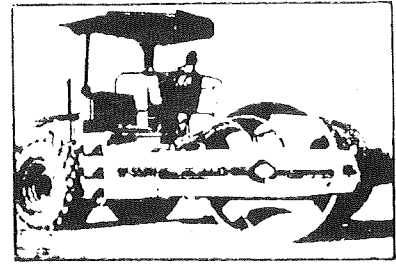
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# The 6th Extraordinary General Conference of IAESTE (16-22 January 1991, Nicosia)

*by Ch. Chrysafiades, BSc(Hons) CEng MIEE  
Lecturer, HTI  
National Secretary, IAESTE*

## **AIMS AND HISTORY OF IAESTE**

IAESTE (International Association for the Exchange of Students for Technical Experience) is a non-political, independent non-governmental organisation maintaining a consultative relationship with the following agencies of the United Nations: The United Nations Economic and Social Council (ECOSOC), the United Nations Educational, Scientific and Cultural Organisation (UNESCO), the United Nations Industrial Development Organisation (UNIDO) and the International Labour Office (ILO).

The aims of the Association are:

- (i) to provide students at institutions of higher education with technical experience abroad relative to their studies in the broadest sense;
- (ii) to promote international understanding and goodwill amongst the students of all nations.

The Association was founded in January 1948 at Imperial College, London, on the initiative of the Imperial College Vacation Work Committee.

## **INTERNATIONAL ORGANISATION**

The Association is composed of national committees which are responsible for the organisation of the exchange in their own countries. Membership is given after the establishment of a national committee in accordance with the statutes of IAESTE, together with a responsible permanent secretariat. New countries are accepted as associate members without voting rights. After a three-year period of successful activity associate members may be promoted to full members.

Cyprus joined IAESTE in 1980 and now is a full member.

Delegates of national committees of all member countries make up the General Conference as the only policy-making body of IAESTE, which meets every second year. The General Conference elects a General Secretary who is in charge of all international affairs of the Association. The General Secretary and three elected members form the Advisory Committee which makes recommendations for consideration by the General Conference. The working language of the Association is English.

The General Conference normally meets for one week in January every second year to take

decisions or make recommendations on important questions related to this programme.

During the General Conference and in the years between, during the Exchange Conference, the secretaries meet to arrange for the exchange of offers. In the case of urgent matters requiring a Conference decision, an Extraordinary General Conference may be convened in the year of the Exchange Conference and in connection with it.

## **PRINCIPLES OF THE EXCHANGE**

Each member country collects offers from industrial and other organisations for receiving students from abroad for a temporary training period in close connection with the students' fields. The offering companies or organisations are expected to pay students a wage sufficient to cover their cost of living during the actual training periods.

These offers are exchanged with other member countries on a reciprocal basis, normally during the annual conference in January.

Receiving countries arrange for necessary permits, lodging, and, in many cases, for social and cultural programmes during or after the training period. Sending countries insure the students against accidents and illness. Students pay their own transportation expenses.

## **PARTICIPANTS IN THE EXCHANGE SCHEME AND TRAINING PERIODS**

IAESTE exchange participation is open to bona fide students attending courses at universities, institutes of technology and similar high institutions.

Participating institutions in Cyprus are the Higher Technical Institute and the Hotel and Catering Institute.

The main aim of the Association is to exchange students during their long vacations, i.e. for 8-12 weeks. Bilateral arrangements can be made for longer training periods, i.e. between 3-12 months.

## **6th EXTRAORDINARY GENERAL CONFERENCE**

The 6th Extraordinary General Conference of the International Association for the Exchange of Students for Technical Experience (IAESTE) met in Nicosia on 16-22 January 1991 at the Cyprus Hilton.

The Conference was attended by 105

participants from 45 countries and it was highly successful in spite of the world tension prevalent at the time.

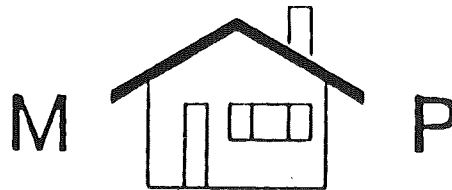
The event was enjoyed by all participants and the Conference warmly thanked the Cypriot National Committee for their splendid arrangements and the helpful manner in which they had seen to every detail in organising the Conference, so that all the participants were able to do their work efficiently and have a very pleasant time as well.

Present at the opening ceremony were: Mr George Anastasiades, Director-General of the Ministry of Labour and Social Insurance and Chairman of the HTI Board of Governors, Mr Achilleas Kallimachos, Director of Labour, Ministry of Labour and Social Insurance and Member of the IAESTE National Committee, Mr Demetrios Lazarides, Acting Director, HTI, Mr Stavros Anastasiou, Head of the Electrical

Engineering Department, HTI, Dr George D Christodoulides, ex-Director HTI and other members of the Academic Staff.

Dr Themos Drakos, former Director, HTI and Chairman of the Cyprus IAESTE National Committee, Mr Charalambos Chrysafiades, Lecturer HTI and National Secretary of the Cyprus IAESTE National Committee, Mr Pantelis Vassiliou, Inspector, Ministry of Education and Mrs Efstathia Papa, Secretary IAESTE Cyprus, were the delegates of the Cyprus IAESTE National Committee at the Conference.

During the Conference offers for training were exchanged with other member countries. As a result of the exchange 48 Cypriot students are expected to do their training abroad during the 1991 summer vacations. 32 foreign students will also be receiving training during summer 1991 in Cyprus.



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# HTI Calendar of Activities

## Academic Year 1990-91

*D. Charalambidou-Solomi,  
D.E.S BA MA  
Lecturer HTI*

### SEPTEMBER

- The total number of first year student enrolments for the academic year 1990-91 were: 63 for Civil Engineering, 60 for Electrical Engineering, 59 for Mechanical Engineering, 27 for Marine Engineering and 29 for Computer Studies.
- In September 18 students enrolled on the RTC Repair and Maintenance of Electromedical and Clinical Laboratory Equipment Technician Course. The course is scheduled to end in July 1991.
- Regular lectures commenced on 17 September.
- Mr G. Iordanou, Head of Mechanical Engineering Department, and Mr M. Pattichis, Senior Lecturer, participated in the short course of CAD/CAM conducted at the Technology Centre of Warwick University, U.K., between 23-30 September.

### OCTOBER

- HTI organised a 30-hour course in CAD Applications in engineering design and technical drawing. The course was attended by twelve professionals from various industries.
- HTI and IEE Cyprus Centre organised a course on "Programmable Logic Controllers and their Applications" between 6-22 October. Seventeen professionals participated.
- HTI staff and students donated blood on 7 October for the needs of the Blood Bank of the Nicosia General Hospital.
- HTI in collaboration with IEE Cyprus Centre organised a "Conference on Management Technology-Control Tools for the 90's" between 9-10 October. The conference was attended by 115 participants.
- HTI in collaboration with the Public Works Department (PWD) of the Ministry of Communications and Works organised a 24 hour course on "Highway Construction Materials" from 16-20 December. Fifteen technicians and engineers from P.W.D. attended the course. The HTI Lecturer, Mr John Economides, delivered the lectures.
- The HTI Regional Training Centre in collaboration with the Expanded Programme of Immunization of WHO organised a short course

on the Repair and Maintenance of Compression Refrigerators from 22 October-2 November.

- HTI technicians attended a 40-hour course on "Enrichment of Trainer Skills and CNC Milling M/C" which commenced in October '90 and ended in January '91.

### NOVEMBER

- On 4 November HTI students voted in a General Assembly to go on strike and to occupy the HTI premises protesting that their demands were not satisfied. The students' demands were:  
(a) to be accepted as professional members of the proposed Cyprus Technical Chamber and (b) the amendment of the existing legislation regarding professional rights of HTI graduates to cover all HTI specialisations. The strike ended on 3 December.
- In November the Head of Civil Engineering Dept, Mr D. Lazarides, in his capacity as the Secretary of the Professional Union of Civil Engineers and Mechanical Engineers, was invited to attend in London the Conference of Representatives of the Institution of Civil Engineers of the Areas of Asia and Oceania.
- Mr A. Loizides, Lecturer, participated in the seminar "Managing 200 Mile Exclusive Economic New Challenges" which was held 3-11 November. The seminar was organised by HTI in collaboration with the London School of Economics.
- The HTI Regional Training Centre in collaboration with the WHO Expanded Programme of Immunization organised a short course on the "Repair and Maintenance of Solar Refrigerators" which was attended by 20 technicians from 5-16 November.
- Dr. Marios Kasinopoulos, Lecturer, visited various universities in France between 5-9 November. This visit was the result of co-operation between HTI and the Nicosia French Cultural Centre.
- In November Ms Dena Charalambidou-Solomi, Lecturer, gave four lectures on "Business Correspondence" to the students of the Forestry College in Prodromos, Ministry of Agriculture and Natural Resources.
- Mr Charalambos Chrysafiades, HTI Lecturer, participated in the "Conference 90" which was held in Greece between 8-10 November. The

Conference was organised by the Greek National Committee for C.I.G.R.E. and the Public Power Corporation of Greece.

- Mr J. Michaelides, Senior Lecturer, participated in the "International Conference" in Nicosia, 8-9 November. The Conference was organised by EEC. Participants came from EEC and Mediterranean countries.

- In November Dr A. Mallouppas, Head of RTC, in his capacity as a WHO consultant organised a seminar in China on "Health Care Equipment Management".

- HTI and IEE Cyprus Centre organised a course on "PC Systems Strategy: A Cost Effective and Practical Approach" between 22-29 November. The course was attended by 7 professionals.

#### **DECEMBER**

- On 3 December the protest strike of HTI students ended and all lectures and normal activities were resumed.

#### **JANUARY**

- The HTI Mechanical Engineering Department in collaboration with the Cyprus professional Engineers Association organised a 60-hour course on "Energy Engineering and Management" between January-May. The course was attended by 15 professionals who were tertiary education graduates.

- HTI in collaboration with the Public Works Department (PWD) organised two 24-hour courses on "Soil Stabilization" which were attended by 58 participants from P.W.D. Both courses started in January and ended in March. The lecturer was Mr John Economides, HTI Lecturer.

- The 6th Extraordinary General Conference of the International Association for the Exchange of Students for Technical Experience (IAESTE) was held in Nicosia between 16-22 January at the Cyprus Hilton.

The Conference was attended by 105 delegates from 43 countries.

The Director-General of the Ministry of Labour and Social Insurance, Mr George Anastasiades, attended the opening ceremony. Other Government officials were the Director of Labour, Mr Achilleas Kallimachos, the HTI Acting Director, Mr Demetrios Lazarides, ex-HTI Director and chairman of the Cyprus IAESTE National Committee, Dr Themis Drakos, and the National Secretary of the Cyprus IAESTE National Committee, Mr Charalambos Chrysafiades, HTI Lecturer.

According to the current year IAESTE exchange programme 48 Cypriot students are expected to do their training abroad during their 1991 summer vacations while 32 foreign students will be doing their training with industries in Cyprus.

#### **FEBRUARY**

- The HTI in co-operation with the HTI Graduates' Association organised a course on "CAD Applications" of 30-hour duration which was sponsored by the Industrial Training Authority.

The aim of the course was to familiarise the participants with the use of computers in engineering design and draughting. Twenty one tertiary education graduates attended the course.

- The First Semester Exams were held between 11-25 February.

#### **MARCH**

- The City and Guilds Certificates were awarded to the HTI staff who participated in the two courses organised in the summer 1990 on "Instructional Techniques". These two courses were organised by STA College Letchworth in collaboration with the Cyprus Industrial Authority. Twenty-three HTI members of staff attended the two courses.

- Mrs Despina Sergidou, HTI Lecturer, participated in a seminar on "Energy Conservation in Buildings" on 30 March which was organised by the International Solar Energy Society, Cyprus Section.

#### **APRIL**

- HTI and IEE Cyprus Centre organised a course on "X25 Packet Switching Network" between 15-17 April. Twenty-seven professionals attended the course.

- HTI and IEE Cyprus Centre organised a course on "Electrical Services: Design, Installation and Maintenance" between 20 April-4 May. There were 17 participants.

- HTI and IEE Cyprus Centre organised two courses on "The IBM PC for Technical Staff and Managers". Forty professionals attended these two courses which were held between 22-26 April and between 29 April - 4 May.

- Mrs Despina Sergidou, HTI Lecturer, addressed the seminar on "Renewable Energy Resources" on 29 April which was organised by the International Solar Energy Society, Cyprus Section and the Association of Professional Engineers.

- The Second Mid-Semester Exams were held between 22-26 April.

#### **MAY**

- HTI in collaboration with the Public Works Department (PWD) organised two 24-hour courses on "Highway Drainage". Both courses started in May and are scheduled to finish in June. Sixty participants from P.W.D. attended these courses. Mr John Economides, HTI Lecturer, delivered the lectures.

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- HTI and IEE Cyprus Centre organised two courses between 6-10 May. The first course was on "Networking with Novell Netware" with 30 participants. The second course was on "Troubleshooting Novell Netware" with 25 participants.

- HTI staff and students donated blood on 7 May for the needs of the Blood Bank of the Nicosia General Hospital.

- Mr Demetris Lazarides, Head of Civil Engineering Department was appointed HTI Director. Mr Lazarides replaced Dr Themos Drakos who retired earlier.

- The Annual Graduating Students Dinner was held at the Philoxenia Hotel on Monday, 20 May. The Dinner was attended by HTI staff and official guests of HTI from the local industry. At the

beginning of the Dinner the newly-appointed HTI Director, Mr D. Lazarides, proposed a toast to H.E. the President of the Republic, Mr George Vasiliou. Mr John Leontis, General Manager Cyprus Petroleum Refinery Limited, proposed a toast to HTI graduating students. Mr Martinos Kyprianou, President of the HTI Students Union acknowledged.

#### **JUNE**

- The End- Semester Exams are scheduled for 11-21 June. The Diploma Project Reports are to be submitted Thursday, 6 June.

- The Graduation Ceremony is to be held on Wednesday, 3 July. H.E. The President of the Republic, Mr George Vasiliou, has been invited to attend.

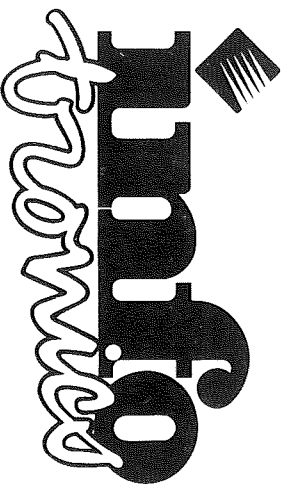
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**That person alone is pure who knows himself**

G. NAMAK

**He alone attains peace who recognises his true home**

G. A. DAS



PROFESSIONAL

# COMPUTER & MANAGEMENT TRAINING

## COMPUTER TRAINING

- Computer Fundamentals
- Lotus 1-2-3
- Excel
- Computerised Accounting
- Autocad
- Word Perfect
- Word
- MS-DOS, OS/2, V/386, UNIX
- "C" Pascal, Cobol, Basic
- Relational Databases
- DBase III/DBase IV

## MANAGEMENT TRAINING

- Increase profit through Executive Information Systems
- Decision Support Systems
- PC & Applications for Managers
- Financial solutions for Managers
- Planning & Directing Performance
- Developing Managerial Effectiveness
- Computerised Sales Management
- Strategic Information Value Analysis (SIVA)



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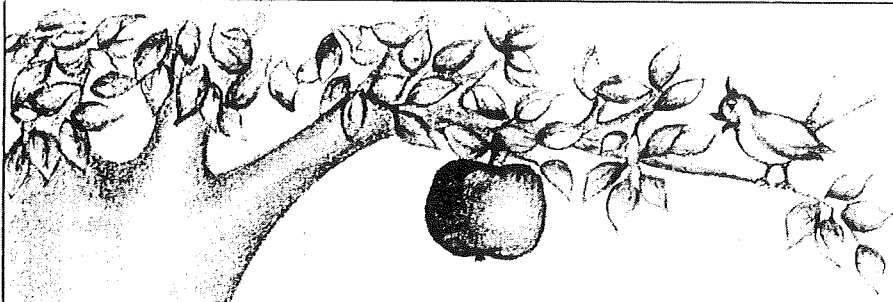
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Συνδυάστε την ασφάλεια σας με την πιο αποδοτική επένδυση που σας προσφέρει σήμερα η Πανευρωπαϊκή Ασφαλιστική. Γιατί όμως να επιλέξετε το Πανευρωπαϊκό Επενδυτικό Σχέδιο; Απλά γιατί:

- Επενδύει το μεγαλύτερο μέρος σε μετοχές δημοσίων εταιρειών εξασφαλίζοντας έτσι καλύτερα αποτελέσματα. (Το 1989 παρουσίασε αύξηση 21,7% που ήταν η μεγαλύτερη της αγοράς).
- Τα ασφαλιστρα απαλλάσσονται πλήρως από το φόρο εισοδήματος.
- Είναι ευέλικτο και παρέχει τη δυνατότητα αυξημένης κάλυψης.
- Παρέχει εγγυήσεις για κάθε ενδεχόμενο.
- Επιτρέπει την παροχή δανείου.

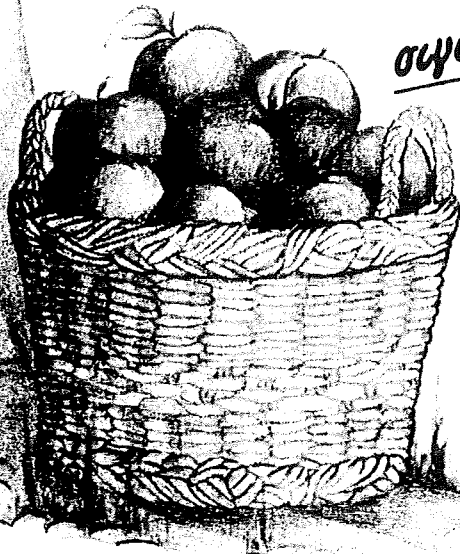
Ασφαλώς δεν χρειάζονται άλλοι λόγοι για να επιλέξετε και εσείς την καλύτερη επένδυση με... ασφάλεια.

*Πανευρωπαϊκό Επενδυτικό Σχέδιο: το πιο καρποφόρο.*



Πανευρωπαϊκή  
ασφαλιστική

*σιγουριά και ασφάλεια*



Για περισσότερες πληροφορίες απευθύνεστε στην Πανευρωπαϊκή Ασφαλιστική.

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S K F is an international group with factories in twenty countries, an international sales network, and its own service organisation spread around the world.

S K F bearings are made in 8,000 basic types and sizes and many thousands of variants ranging from 3mm to several metres in outside diameter and from a weight of 0.036 grammes to more than 6,000 Kg. There are S K F bearings which can run at a speed of 400,000 r.p.m. and others which at low speed can carry loads of more than 2,000 tons.

S K F research efforts stretch from theory right through applied mathematics by computer to manufacturing process and product development. To illustrate the degree of accuracy required we may cite the example of any one medium sized bearing where ball diametres must not deviate more than 0.00002in., and where errors in sphericity in one particular ball must not exceed 0.0000 lin.

## MUCH MORE THAN BEARINGS

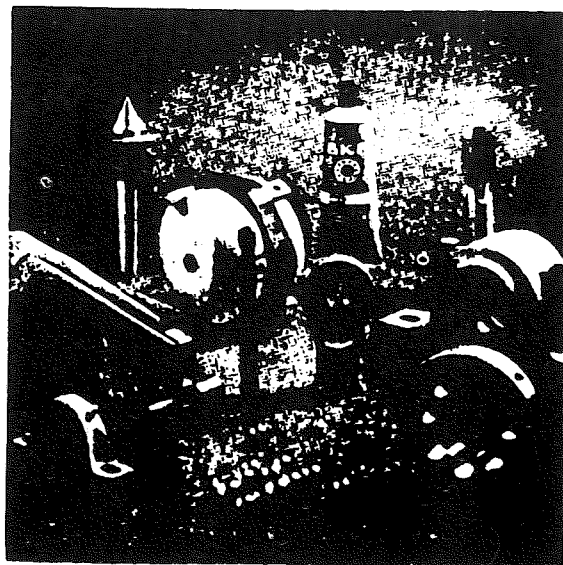
BALL BEARINGS

ROLLER BEARINGS

CASTINGS

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TOOLS



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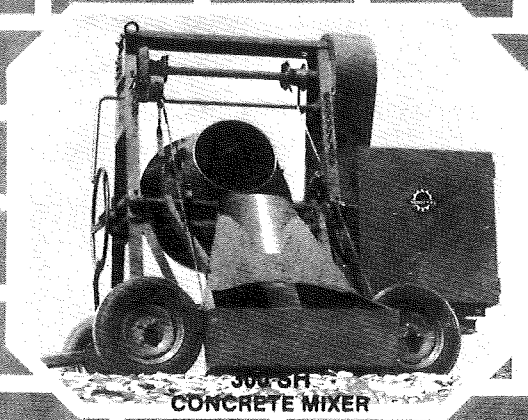
## SKF Best possible service to customers

Research and development in the S K F group is applied in three directions. The first is the development of production technology the second is the development of new products and the third is a continuous process of developing the traditional product ranges to changing market requirements.

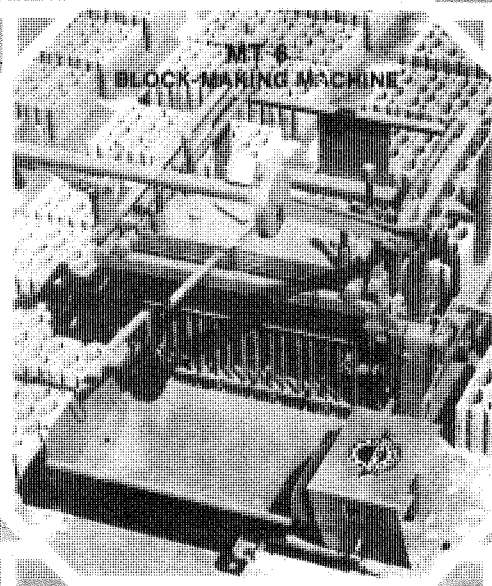
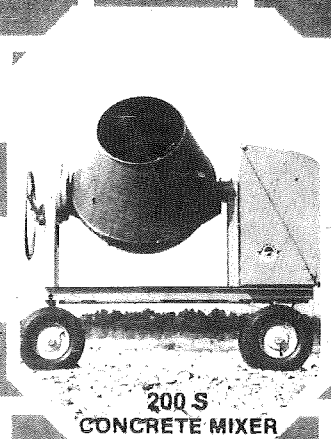
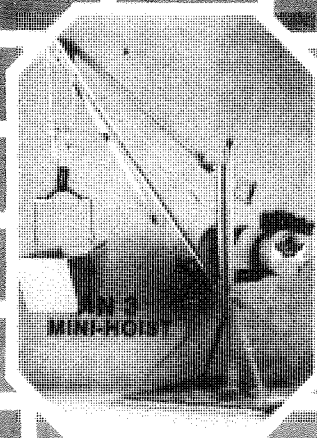
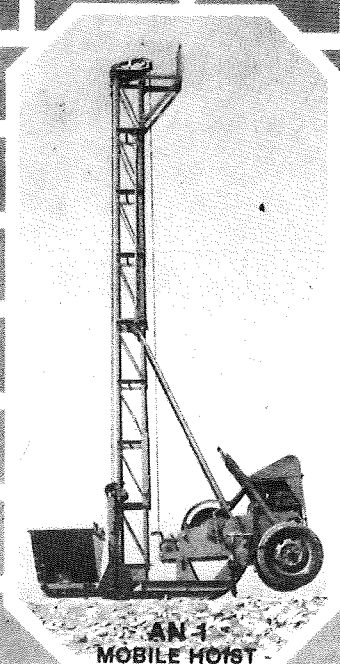
S K F faces strong competition in all the most important industrial countries. It is, however, true to say that S K F is foremost in the field of roller bearing engineering, in addition to being the most important exporter of ball and roller bearings.

S K F has attained this pre-eminent position for several reasons. One of them being that S K F was the first bearing firm to undertake systematic theoretical and experimental research in ball and roller bearing engineering.

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