No. 21 September 1992 Nicosia Cyprus

Review

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ΛΑΪΚΗ
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The Higher Technical Institute (HTI) was established in 1968 as a Government of Cyprus project with assistance by the United Nations Special Fund (UNDP), the United Nations-Educational Scientific and Cultural Organisation (UNESCO), the International Labour Office (ILO). Cyprus Government Executing Agency: The Ministry of Labour and Social Insurance.

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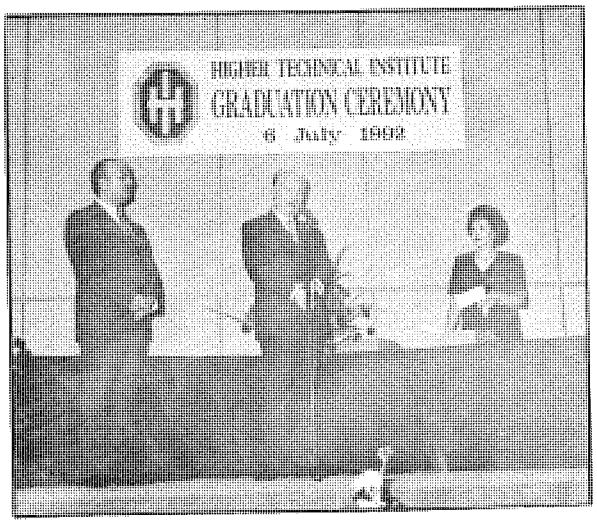

H.E. The President of the Republic, Mr. George Vassiliou, addressing the HTI Graduating Students.

Photo: by Photo Studio "Twins"

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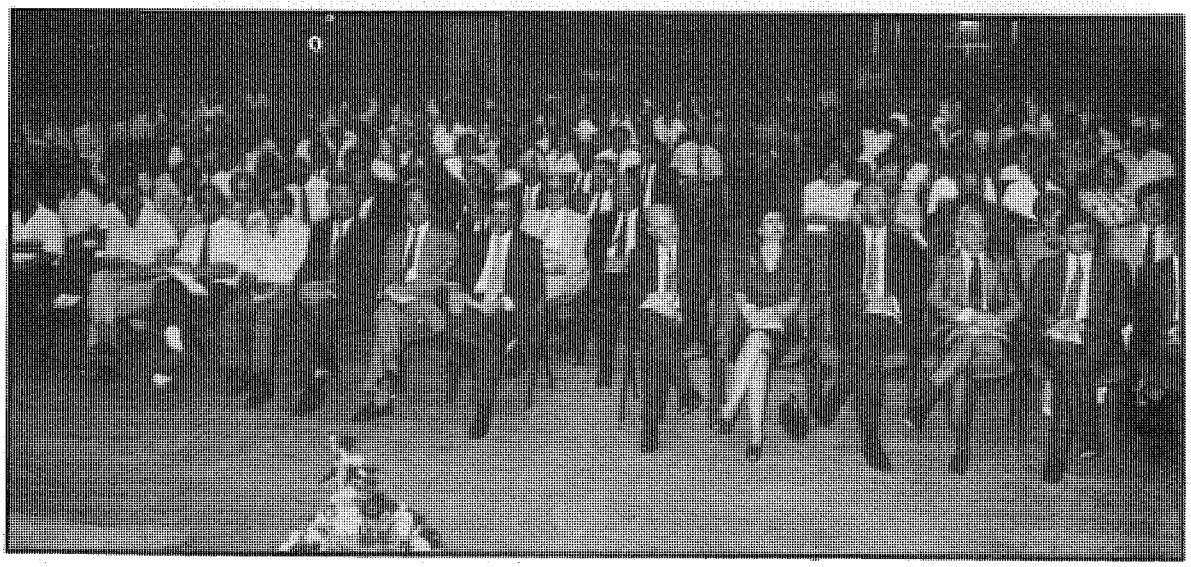
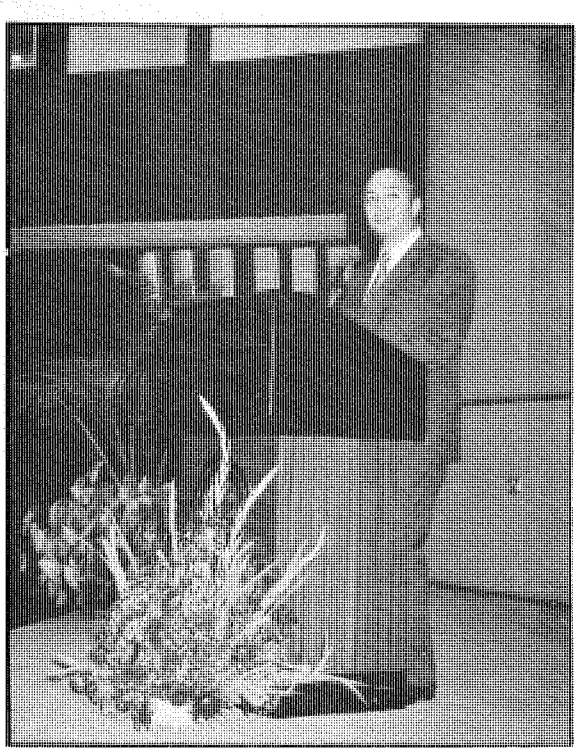
Graduation Ceremony of the Higher Technical Institute

The Graduation Ceremony of the HTI for this Academic Year took place on the 6th of July 1992 at the Cyprus International Conference Centre.

The President of the Republic Mr George Vasiliou, the Minister of Labour and Social Insurance Dr Iacovos Aristidou, the Minister of Communications and Works Mr Renos Stavrakis and the Minister of Health Dr Panicos Papageorgiou, the Chairman of the Board of Governors of the HTI Mr George Anastasiades, Ambassadors from various countries and other officials and guests from Government and the Private Sector, honoured the Ceremony with their presence apart from the parents of Students and friends of the HTI.



A general view of the Graduation Ceremony.



The Director of HTI delivering the Graduation speech.

The President of the Republic bestowing the Presidential Prize.

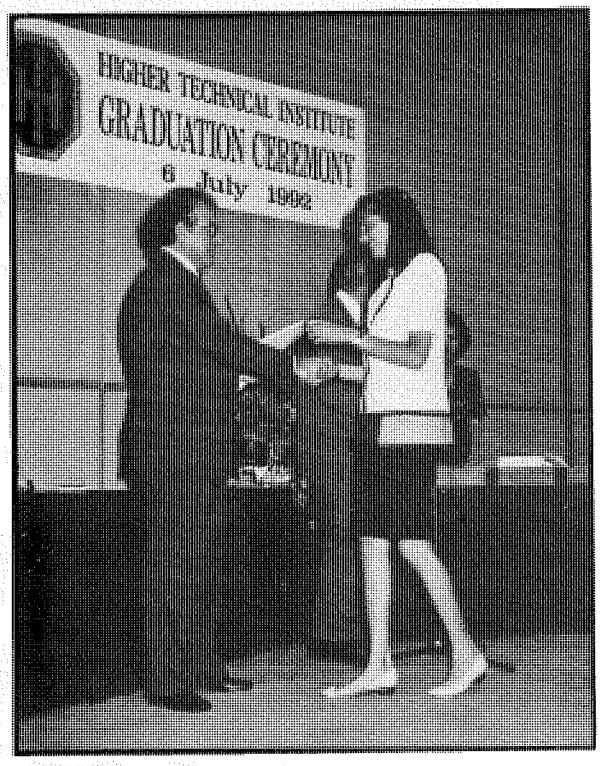
The President of the Republic Mr George Vasiliou addressed the Graduating Students and guests and praised the high standard of Training and attainement offered by the HTI to its Students.

"The HTI has indeed become an educational and training establishment worthy of every praise" said the President. "...As we all know, employers in Industry contend amongst themselves who will employ HTI graduates, because they have proved to be well trained, well equipped, knowledgeable and devoted to their work.

"With the Commencement and function of the University of Cyprus", the President of the Republic said, "not only the role of the HTI will not diminish, but on the contrary its role and importance will be strengthened..."

The President of the Republic stated that the aims and objectives of the HTI are to train students as to undertake leading posts in the Cyprus Industry, emphasizing that the economy of the country needs personnel at HTI level and also of University Graduates and looks forward to close co-operation between the HTI and the University of Cyprus especially in research programmes. The President expressed the hope that soon there will be Turkish Cypriot Students attending the HTI as before.

The Minister of Communications and Works Mr R Stavrakis bestowing the diplomas to the graduates of the specialization of Marine Engineering.



The Minister of Labour and Social Insurance Dr I Aristidou bestowing the Diplomas to the graduating students in the specialization of Civil, Electrical, Mechanical Engineering and Computer studies.

The Minister of Health Dr P Papageorgiou bestowing the Certificates to the W.H.O. & Commonwealth-sponsored graduating students in the specialization of Medical Electronics/Repair and Maintenance of Hospital and Clinical Electromedical Equipment.

Extracts of the Graduation Speech of Mr Demetrios Lazarides, Director of HTI are given below:

The Director welcomed all the guests who honoured this twenty-second Graduation Ceremony of the HTI and amongst other things he praised the dedication of the staff who he said "...together with the first class equipment and the excellent educational programmes, furnished to-days graduates with all the necessary training, knowledge and expertise as to make them ready to fulfill their role to the Cyprus Industry..."

"We are very proud indeed", the Director said, "that our graduates really fulfill the task for which they are trained for, and a good indication that this is the case, is that the demand for our graduates far outnumbers the supply. This year one hundred and sixty six, (166), students are graduating from the HTI.

Forty eight are from the specialization of Electrical Engineering, thirty six from Mechanical Engineering, forty seven from Civil Engineering, ten from Marine Engineering and twenty five from the specialization of Computer Studies.

In addition, fifteen W.H.O. and Commonwealth —sponsored students from 9 different countries are graduating from the one year course on Repair and Maintenance of Hospital and Clinical Electromedical Equipment...

Furthermore, the HTI in co-operation with various professional bodies has organised and successfully completed 21 short courses for engineers and technical personnel from Industry with a total of 381 participants. The said courses were all sponsored by the Industrial Training Authority..."

Mr Lazarides said that in the following Academic Year the HTI will encourage Research Projects in co-operation with the University of Cyprus as well as European Universities.

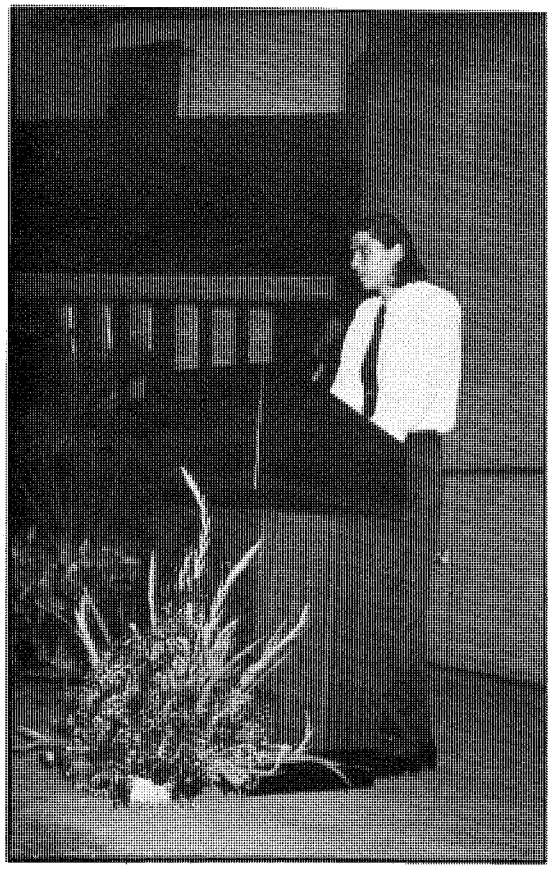
Addressing the Graduating Students the Director wished them well adding that the HTI is certain that they are well trained as to meet any challenges within the field of their specialization.

The President of the Students Union Mr Costas Konnaris also addressed the gathering for the Graduation Ceremony.

Extracts from his speech are given below.

"It is with great joy that we are here to day to attend the bestowal of the Diplomas to the Graduating Students of the Higher Technical Institute. I am sure that the parents of the graduating students are very proud to see their sons and daughters graduating this esteemed Institute. The graduates themselves must also be very proud. They do remember the hard work needed for the entrance examinations to get into the HTI, as well as the yet harder work for the three year course in their respective field of specialization namely in Civil, Electrical, Mechanical, Marine Engineering and Computer studies..."

Mr Konnari also mentioned the efforts of the students for their professional status and recognition, praising the students for their maturity and hard work. He also thanked the Government and especially the President of the Republic Mr George Vasiliou for the interest and support they gave to bring this problem to a fruitful conclusion.



Mr Konnaris delivering his speech.

An Investigation into the Performance and Economics of Domestic Solar Water Heating in Cyprus

I.M. Michaelides, BSc, Dipl Sol Eng. CEng MInstE
Senior Lecturer, HTI

ABSTRACT

A forced circulation solar water heating system, suitable for a block of flats, was simulated using the TRNSYS simulation programme. The performance of the system as a function of collector area was evaluated to determine the fraction of the domestic hot water load that was supplied by the solar system. A number of simulations were run to investigate the optimum collector area based on the system life cycle savings. An economic analysis was done to investigate the payback period and the cost effectiveness of the system over conventional systems.

1. INTRODUCTION

Solar water heating is the most popular application of solar energy in the world. The simplest water heating system is based on the thermosyphon principle and is the type of system most developed. Thermosyphon solar water heaters are considered a very attractive application of solar energy and have gained popularity in many countries. In Cyprus, for example, it is estimated that there are more than 130,000 units in operation, which means one solar water heater for every five people on the island [1]. Another example is Israel, where there are more than 600,000 units in operation, which are capable of supplying about 70% of a consumer's domestic hot water requirements [2]. However, for collective applications, i.e. blocks of flats, hotels and hotel apartments, the use of thermosyphon solar water heating systems is not practical and central forced circulation systems are more appropriate and perhaps more economic to use.

The cost effectiveness of a solar domestic hot water (SDHW) system is dependent upon two major factors: the cost of conventional sources of energy used for domestic water heating and the solar fraction of the hot water load supplied by solar energy. However, the solar fraction is dependent upon meteorological conditions, collector type, collector area and arrangement, annual load and load consumption profile. For a given location, hot water load and economic situation, it is possible to optimise the system design variables to yield the maximum life cycle savings. While there are many design variables influencing the performance of a SDHW system, the main design variable is the collector area. The present study aims to optimise the collector area of a forced circulation SDHW system and investigate its performance and cost effectiveness under the socioeconomic conditions of Cyprus.

2. THE SIMULATION MODEL

The performance of a SDHW system is dependent upon the prevailing weather conditions and the hot water consumption patterns. 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. Like most solar energy systems, a SDHW system is modular and the simulation model for the system can be formulated by connecting models of each of the system components. This component modelling approach is used in TRNSYS [3], which is capable of linking existing models of various components, such as collectors, storage tanks, pumps and controllers, to simulate the behaviour of a SDHW system. Several studies [4,5,6] have found that TRNSYS is capable of predicting the perfomance of such systems typically within 5%.

The simulation of a system requires hourly weather data which must be representantive of the location under investigation. The selection of typical weather conditions for a given location is very crucial in computer simulations for performance predictions and lead various investigators either to run long periods of observational data or to selcet a particular year, which appears to be typical from several years of data. Klein et al [7], have constructed the "average year" by selecting the monthly data from an 8-year period which corresponded most closely to the average monthly insolation and ambient temeperature. In the absence of such an "average year" for Cyprus, monthly average values for the years 1984-1987 of the daily solar radiation and air temperatures taken from the Cyprus Meteorological Service

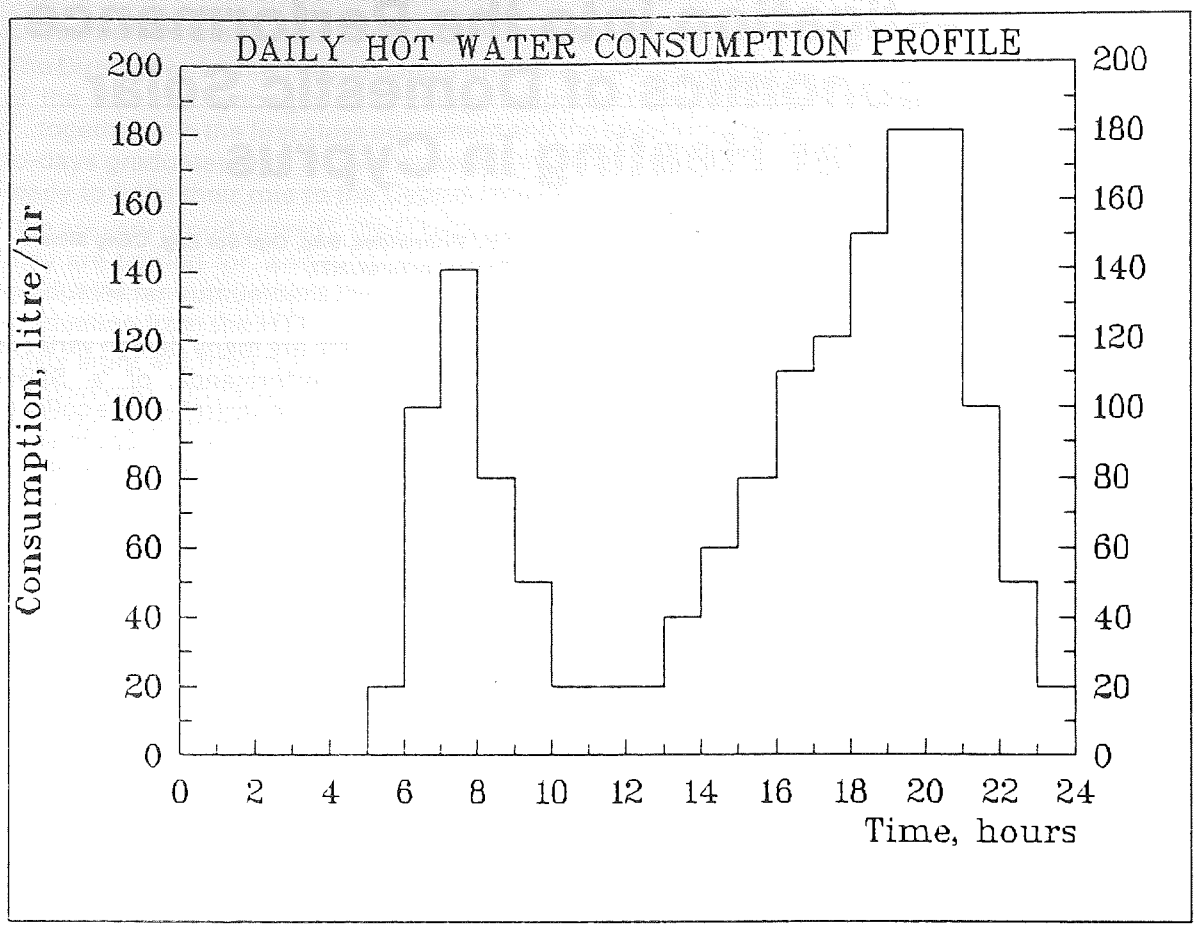


Figure 1. Daily hot water consumption profile.

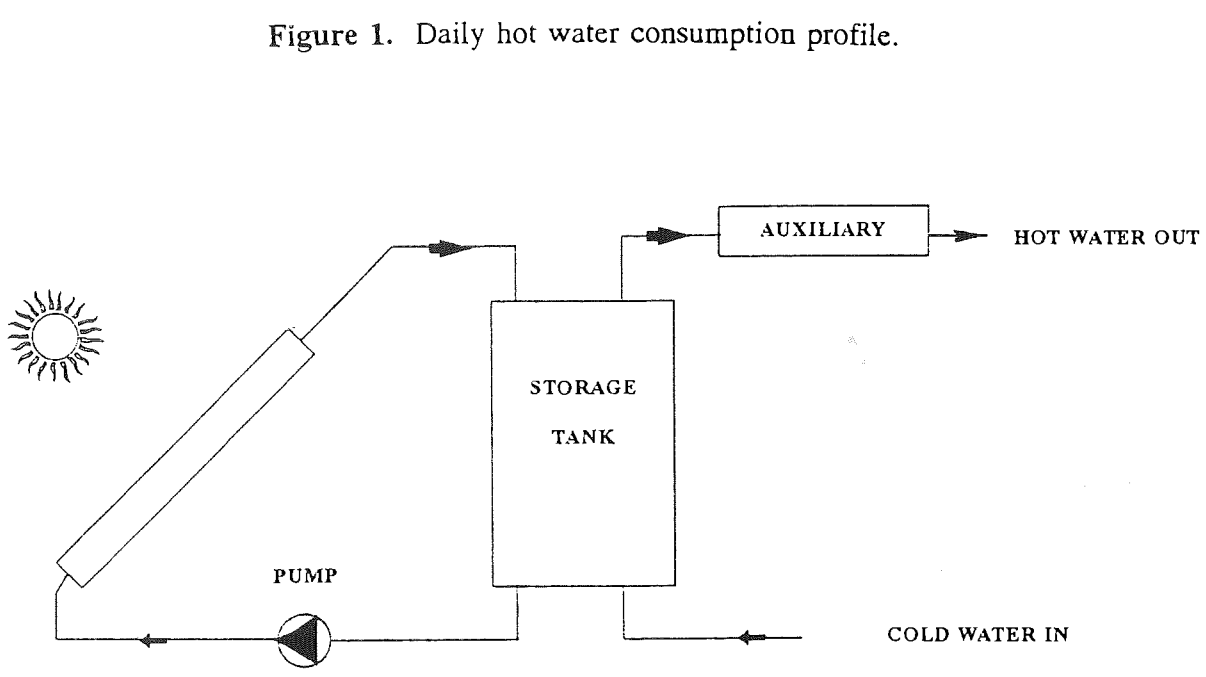


Figure 2. Schematic diagram of solar domestic hot water system.

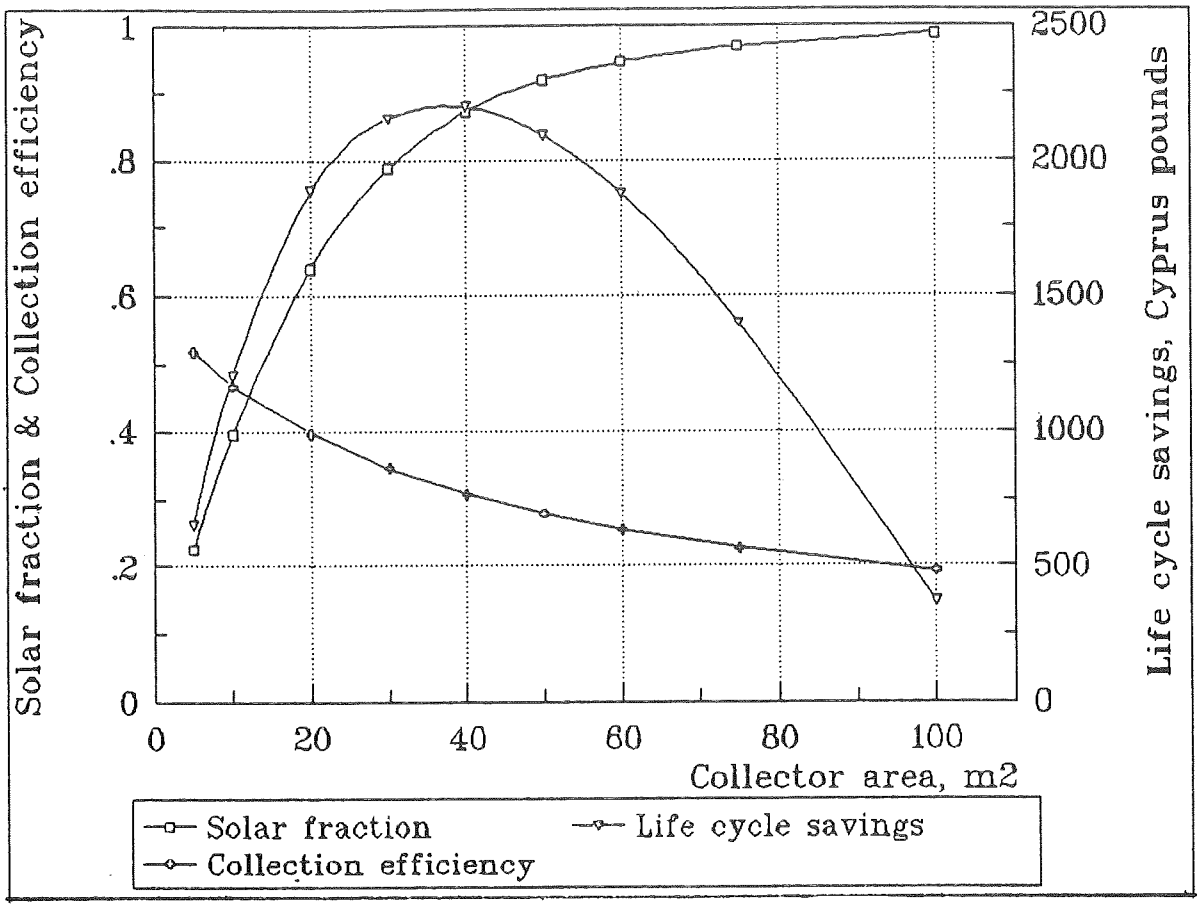


Figure 3. Variation of collector average efficiency, solar fraction and life cycle savings with collector area.

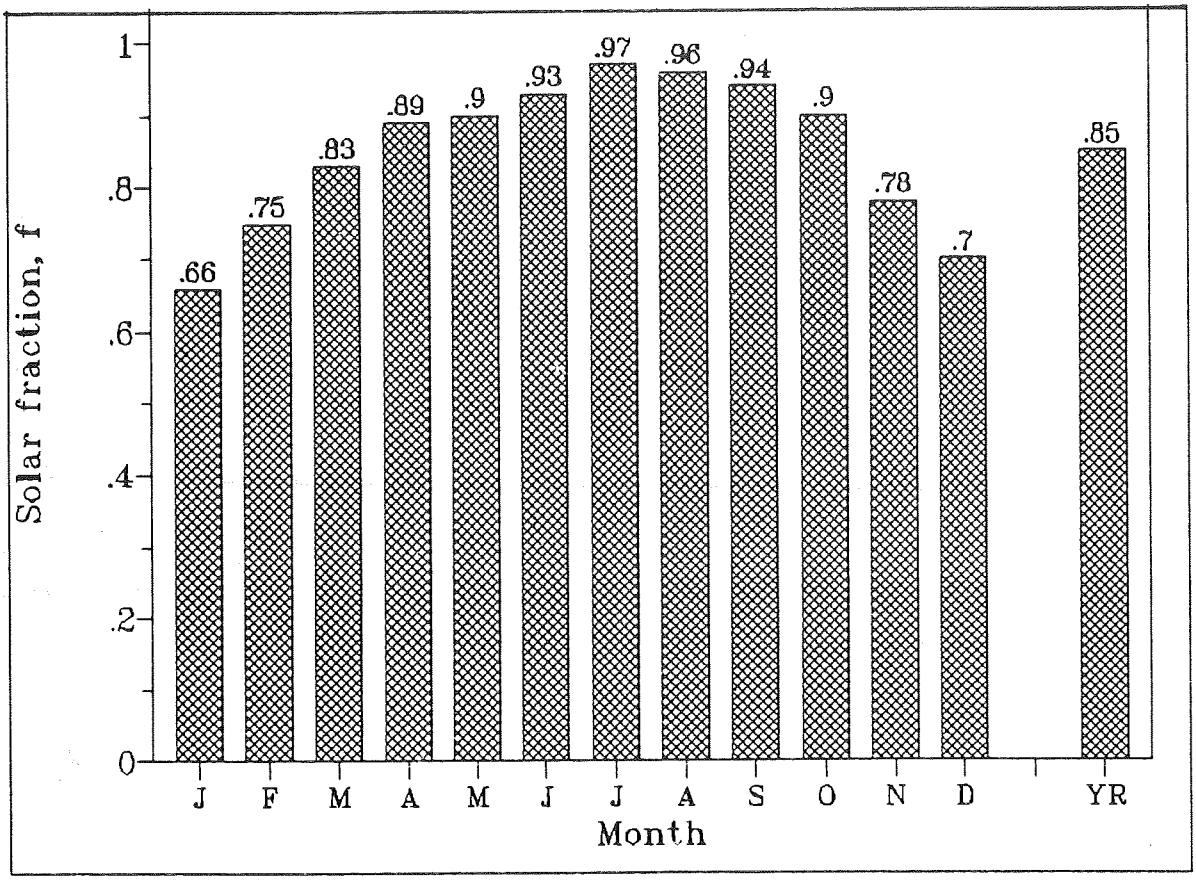


Figure 4. Predicted monthly solar fraction of the SDHW system at optimum collector area.

[8,9], have been used in the simulation. These are shown in Table 1. The TRNSYS weather generator subroutine was used to generate hourly data from the above monthly average values.

In this investigation, the system is designed to meet the hot water requirements of a block of ten flats, i.e. ten families of four persons each. A constant average daily hot water consumption is assumed throughout the year, as shown in figure 1. This consumpiton profile shows a high consumption of hot water at early morning hours and late evening, which is not best for use in conjunction with solar water heating. However, this is the consumption pattern representing the reality and the economic model will be based on this actual consumption pattern.

TABLE 1. Monthly average values of weather data for Nicosia, 35° N

Month	T_a (°C)	H_h (MJ/m^2 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

The schematic diagram of the system to be employed is shown in figure 2. It consists of a number of flat plate solar collectors tilted at 45^0 from horizontal, an insulated storage tank, a pump to circulate water from collector to storage tank, an auxiliary heating system in line with the taps and a number of controls to provide an efficient operation of the system. With regards to the auxiliary source of energy, it must be noted that two alternative solutions are investigated: diesel-oil fired boiler and electric immersion heater. The first alternative is associated with a high initial cost as compared to the second one which is cheaper to buy and install but more expensive to run.

3. SYSTEM PARAMETERS AND ECONOMIC ANALYSIS

A large number of parameters are required as imputs to the systems model. These include physical parameters, such as heat exchanger efficiencies and heat loss coefficients. A number of assumptions have been made for the system simulation, concerning the storage tank, solar collector configuration, pipe losses and controllers. The system is defined as having one, fully mixed storage tank at uniform temperature at any instant in time. The solar collector is defined as consisting of a single panel, regardless of the total area, and the working fluid in the collector loop is water. The collector loop circulating pump is activated whenever the collector outlet temperature is infinitesimally higher than the inlet temperature. When modelling the pump controller in TRNSYS, a one degree dead band is employed to present numerical instability [10]. Some of the parameters used in the simulation are shown in Table 2.

The economic evaluation of the system is done using the TRNSYS subroutine of economic

TABLE 2. System simulation parameters	
$F_R(\tau\alpha)_n$	0.78
$F_R U_L$	24.4 kJ hr^{-1} $°C^{-1}$ m^{-2}
G	50 kg hr^{-1} m^{-2}
G_{test}	54 kg hr^{-1} m^{-2}
b_o	0.1
β	45° from horizontal
ρ_g	0.2
U_s	1.2 kJ hr^{-1} $°C^{-1}$ m^{-2}

analysis, which performs a standard life cycle analysis based on the simulation of one year of solar system operation. It compares the capital and back-up fuel costs of a solar system to the fuel costs of a conventional non-solar system. It is assumed that the solar back-up system is identical to the conventional heating system, in that only the incremental costs of adding solar to the conventional system are considered. For this study, payback time is defined as the amount of time it takes for cumulative costs of the solar system to become equal to cumulative costs of the conventional system [12].

The detail of the economic output is dependent on the mode and parameters used. Mode 1 is the simplest method of calculation the life cycle costs and life cycle savings. It uses the P1 and P2 method as described by Brandemuehl and Beckman [11] and Duffie and Beckman [12]. Mode 2, which is used in the present simulation, uses various economic parameters to calculate the yearly cash flows, life cycle costs, life cycle savings and payback periods. It also provides the user with options to calculate the rate of return on the solar investment, to consider income producing buildings, and to include tax credits.

In both modes, the integrated cost of auxiliary energy use for the first year, i.e. solar backup, is given by the formula:

$$C_{AUX} = \int_0^t C_{FA}\, Q_{AUX}\, dt$$

The integrated cost of the toal load for the first year, i.e. cost of conventional fuel without sola is:

$$C_{LOAD} = \int_0^t C_{FL}\, Q_{LOAD}\, dt$$

In the present study, mode 2 is used. In this mode, the annual costs for both solar and nonsolar systems to meet an energy demand can be expressed as:

Yearly cost = $C_1 + C_2 + C_3 + C_4 + C_5 - C_6$

where, C_1 is the mortgage payment and includes interest and principal payment on funds borrowed to install the system;

C_2 is the fuel cost;

C_3 is the cost for maintenance and insurance;

C_4 represents the parasitic energy costs (running costs for pumps, fans, etc)

C_5 represents property taxes;

C_6 represent income tax savings, if applicable.

The difference between the cost of a convetional system and a solar system is the solar savings, and they are expressed as:

Solar Savings = $S_1 + S_2 - S_3 - S_4 - S_5 - S_6$

where S_1 represents fuel savings;

S_2 represents income tax savings, if applicable;

S_3 is the incremental mortage payment, ie the additional mortgage incurred by solar system;

S_4 is the incremental cost of maintenance and insurance;

S_5 is the incremental parasitic energy cost;

S_6 represents the incremental property tax, if applicable.

All of these costs and savings can be assumed to inflate at a fixed percentage each year. If a cost D is to be incurred at the end of the first year, at an inflation rate of i, the cost at the end of year N is:

$$D_N = D\,(1 + i)^N$$

The discounted cost (present worth) at the end of year N, at a discount rate of d, is:

$$PW_N = \frac{D\,(1 + i)^{N-1}}{(1 + d)^N}$$

These equations can be used to calculate the present worth of any cost in a series of inflating costs. A more detailed account of solar energy economics is given by Duffie and Beekman [12].

In this study, the performance of the solar heating system will be expressed in terms of its solar fraction, f, which is defined as the fraction of the hot water load provided by solar and can be calculated from the following relationship:

$$f = \frac{Q_{load} - Q_{aux}}{Q_{load}}$$

Where Q_{load} = hot water energy requirement
Q_{aux} = auxiliary energy supplied to the system

The economic parameters used in the simulation are shown in Table 3

collector heat losses to low levels. On the other hand, if the collector area is large, the water in the storage tank will have a relatively higher temperature and consequently the collector heat losses will increase.

With regard to the system solar fraction, the situation is completely different. Solar fraction is low at small collector areas and it increases as the collector area increases. The rate of change is high at low collector areas and slows down at larger collector areas. However, larger sizes of collectors are associated with higher capital cost and the question which arises in such cases is what is the optimum economic size of the collector. This is investigated by the economic analysis which takes into consideration a number of economic parameters related to the system. The results of

TABLE 3. Economic Parameters used for the economic analysis

Parameter	*Value*	*Parameter*	*Value*
C_{FA}	18 x 10^{-6} CYP/GJ	d	8%
C_{FL}	3.7 x10^{-6} CYP/GJ	M_S	1%
N_E	20 years	i	5%
D	30%	t	9%
m	9%	N_D	20 years
N_L	3 years	i_{FCF}	5%/yr
i_{FBUP}	5%/yr		

4. RESULTS AND DISCUSSION

The system was simulated at one hour time-steps. A number of simulations were run to investigate the monthly and annual performance of the system in terms of collector size. The collector average efficiency, the system solar fraction and the system life cycle savings were determined for different collector areas and were plotted in fig. 3.

It is interesting to observe the variation of the collector average efficiency with the collector area. A small collector area is associated with a high efficiency while a large collector area is associated with a low efficiency. This can be explained by the fact that in the case of small collector area the relatively high demand for hot water keeps the water temperature in the storage tank and consequently in the collector at low levels; as a result of this, the temperature difference between the collector and its environment is small, thus reducing the

the simulations showed that the life cycle savings increase as the collector area increases to reach a maximum corresponding to a collector area of approximately 40 m² and then decreases as the collector area increases. Thus, the optimum collector size is approximately 40 m² which corresponds to 4 m² per flat or 1 m² per consumer. This is slightly greater than the case of a thermosyphon solar water heater where 3 m² of collector are used for a family of four, i.e. 0.75 m² per person. Under the above optimum condition, i.e. 40 m² of collector coupled to a 2000 lt storage tank, the collector average efficiency is about 30% and the system solar fraction is approximately 85%. The monthly solar fraction of the system is shown in fig. 4.

Under these conditions, where the back-up fuel is diesel oil, the payback period is 8 years. This means that it takes 8 years to get the investment

back by savings in fuel. The rate of return on the solar investment is 25.3% and the annualized total cost with solar is 5.5 CYP/GJ as compared to 8 CYP/GJ without solar. The situation is, however, different and in favour of solar when the comparison is done with electricity as back-up energy, assuming the same collector area. The payback period in such a case is 4 years and the rate of return on the solar investment is greater than 100%. The annualized total cost with solar is 6.5 CYP/GJ as compared to 20 CYP/GJ without solar. The payback period is slightly greater than that reported by Michaelides et al [13] for thermosyphon solar water heating systems using electricity as back-up energy. It is therefore evident that solar water heating is a cost effective option as an alternative to electric water heating but it is no competitive to a diesel-oil fired water heating system.

Another interesting piece of information is that the mortgage period does not bring significant changes in the optimisation of the system. This is illustrated in fig. 5 where life cycle savings are plotted against collector area for various terms of mortgage and payment, i.e. 15 years mortgage with 10% down payment, 7 years mortgage with 10% down payment and 100% down payment. There is a slight reduction in the life cycle savings in the case of 100% down payment but the optimum collector size is about the same in all three cases.

5. CONCLUSIONS

A forced circulation solar water heating system for a collective application, i.e. a block of flats, was simulated using the TRNSYS simulation programme. The results of the simulation lead to the following observations:

1. The optimum collector size in temrs of number of consumers was found to be 1 m^2 per consumer, assuming a storage factor of 50 lt/m^2 of collector.

2. The annual solar contribution of the optimised system is approximately 85%.

3. Solar water heating systems are very competitive when compared to conventional systems using electricity as energy source but they are uneconomic when compared to diesel-oil fired systems.

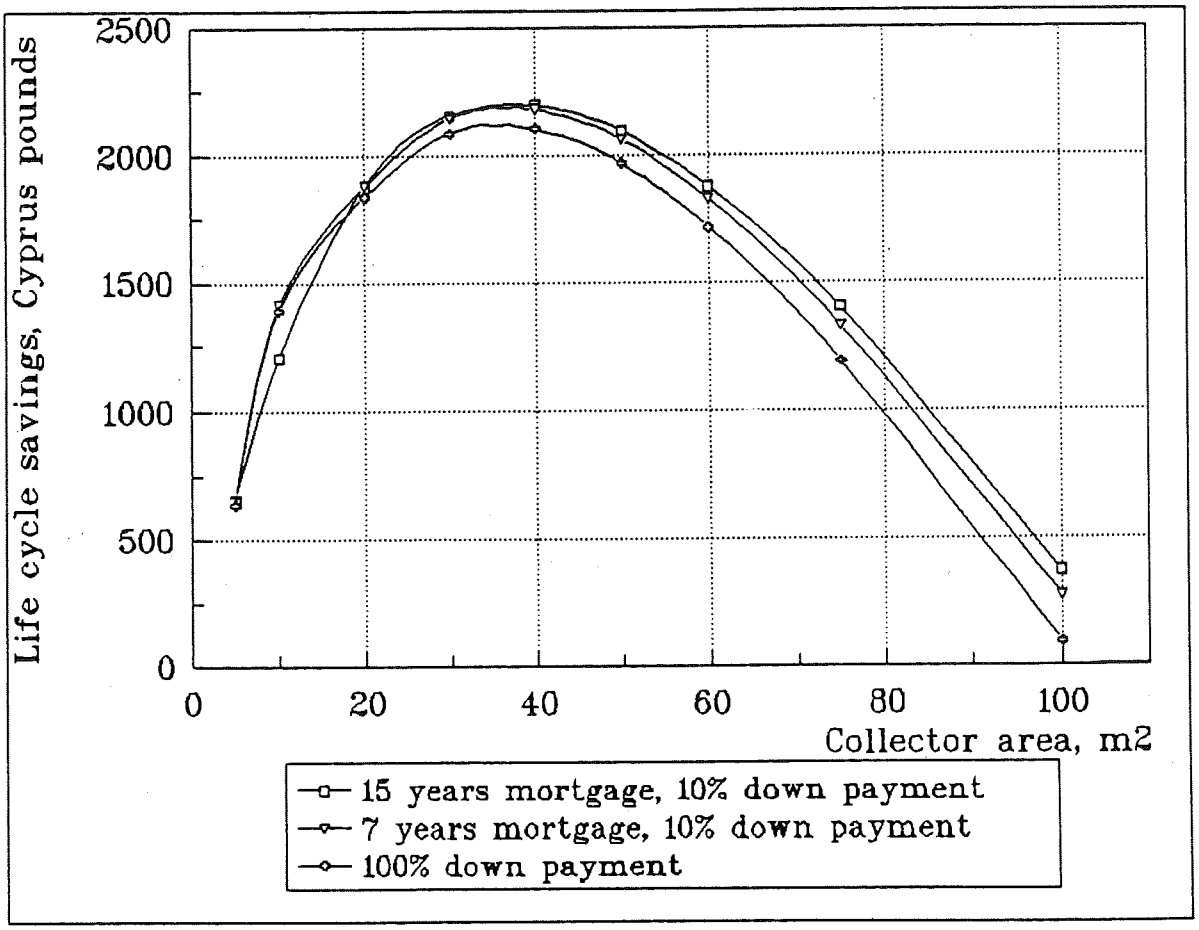


Figure 5. Effect of mortgage period and down payment on system life cycle savings.

NOMENCLATURE

A_c	Collector area, m^2
b_o	Incidence angle modifier constant
C_A	Area dependent costs
C_E	Fixed costs
C_{FA}	Auxiliary energy cost rate
C_{FL}	Conventional fuel cost rate
C_{LOAD}	Fuel cost of the conventional system
c_p	Specific heat of working fluid
CYP	Cyprus pound
d	Market discount rate
D	Down payment, % of original investment
f	Solar fraction (fraction of the load that is met by solar)
F_RU_L	Slope of the collector efficiency curve, kJ hr^{-1} K^{-1} m^{-2}
$F_R(\tau\alpha)_R$	Intercept of the collector efficiency curve
G	Collector flow rate per unit area of collector, kg hr^{-1} m^{-2}
G_{test}	Collector flow rate per unit area of collector at test conditions, kg hr^{-1} m^{-2}
H_h	Monthly average of the daily solar radiation incident on a horizontal surface, MJ m^{-2} day^{-1}
i	Inflation rate
i_{FBUP}	Backup (auxiliary) fuel inflation rate
i_{FCF}	Conventional fuel inflation rate
LCC	Life cycle solar costs
LCS	Life cycle solar savings
m	Mortgage, yrs
M_s	Extra insurance, maintenance in year 1, % of initial investment
N_D	Useful life for depreciation purposes, yrs
N_E	Period of economic analysis, yrs
N_L	Term of loan, yrs
PW	Present worth
Q_{aux}	Auxiliary energy supplied to the system
Q_{load}	Hot water energy requirement
Q_u	Useful solar energy collection
t	Effective income tax rate, %
T_a	Ambient air temperature, ^0C
T_{evn}	Environmental temperature for losses from storage, ^0C
T_s	Thermostat set temperature, ^0C
U_s	Heat loss coefficient of storage tank, kJ hr^{-1} K^{-1} m-
v	Wind velocity, m s^{-1}
V_s	Storage tank volume, m^3
β	Collector tilt angle, degrees from horizontal
ρ_g	Ground reflectance

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An Enhancement for Eliminating Problems in Wire Fence Knitting Machines

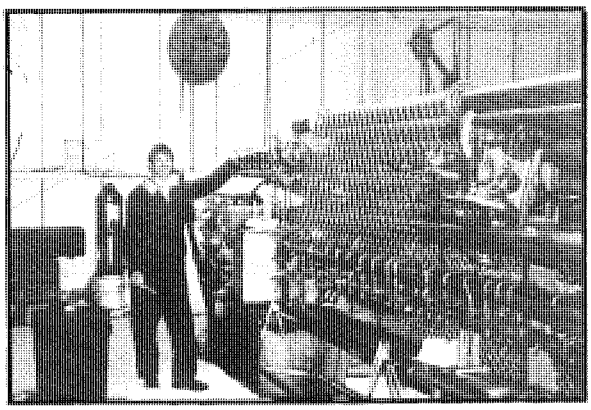
A Stassis PhD

ABSTRACT

A dedicated microprocessor system is used to improve control of a Wire Fence Knitting Machine at low-cost so that waste and downtime are reduced.

Wire's physical properties change along its length and during knitting this results in wrong bending and therefore wrong knitting or even complete failure of the machine to knit at all.

The method uses a series of Light Activated Switches (LAS) to sense the edges of the knit fence. Every time the wire ends pass in front of the Light Activated Switches a combination of numbers is stored in the micro-computer's memory. The computer reads these combinations, and determines if there is a possibility that a malfunction could occur; when this happens it sounds an alarm for the operators to take-care, or adjust a tensioning device to compensate for the changing properties of the wire. Light Emitting Diodes are used to indicate what is wrong. When the machine fails to knit the Microprocessor sends signals to stop the machine altogether.



MODE OF OPERATION OF THE WIRE-FENCE KNITTING-MACHINE

The machine is fed by two coils of wire. The wire from each coil is fed into a parallel pair of helical grooves on a rotating Mandrel. Before the wires go into the Mandrel they pass through a tensioning device. This device determines how the wire bends.

As the Mandrel rotates two strands of interwoven fencing come off. The two free ends

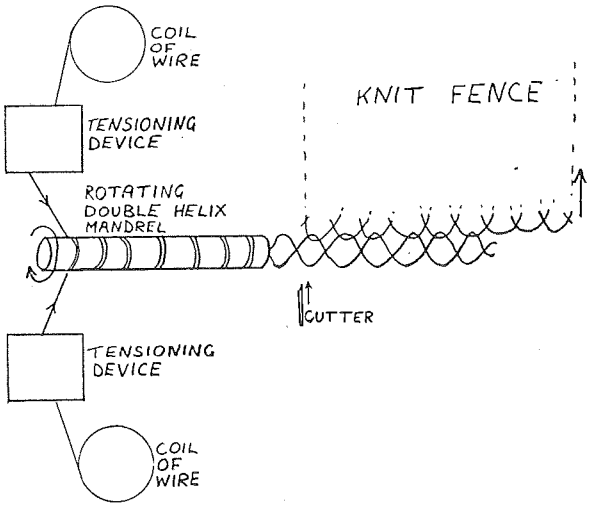


Fig.1: Schematic Diagram Showing Principle of Knitting Machine Operation.

of the rotating strands loop through the existing mesh of the knit fence.

At an appropriate time the wires coming off the Mandrel are cut, the knit fence is moved on and the next pair of interwoven strands are then looped into the previously knit fence and the cycle repeats.

THE PROBLEM

Because of the variation in the physical properties of the wire along its length it is necessary to adjust regularly the tension in the wire using the tensioning device.

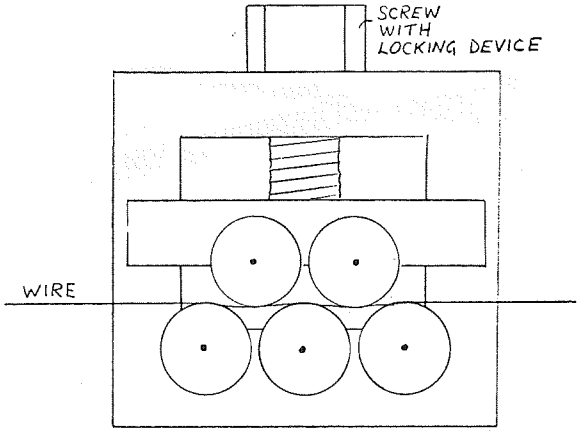


Fig.2: Schematic Diagram Showing Principle of Tensioning Device.

The change of the physical property of the wire has the effect of changing the springiness of it; after passing through the mandrel where it is bent, if it does not conform to an expected shape, bending within reasonable limits, the knitting cannot be done properly. A solution for this is to adjust the tension in the wire before it goes onto the mandrel to allow for the changes in physical properties.

An experienced operator had to watch the machine closely to see that the wire fencing was being knitted correctly and to adjust the tension accordingly; this is done by loosening a lock nut, altering a screw and redoing the lock nut (see Figure 2). Because of having to keep his eyes all the time on the fencing the operator was not able to do other jobs such as preparing the next batch or moving rolls of completed fencing. Not only did eye strain occur from having to watch the wire fence, but being near the noisy machine all the time induced fatigue due to the sound.

THE SOLUTION

The solution is to determine whether the ends of the formed section are within a fixed tolerance. The wire is monitored by 3 Light Activated Switches. As the knitted section moves on, the logic of the Microprocessor program can determine whether or not both ends of the wire have passed the Light Activated Switches correctly. (See Figure 3). Light Emitting Diodes are used as indicators to show to the operator the state of the wire fencing, e.g. "Wire A too short", "Wire A too Long" etc. (See Figure 4).

The correction of the tensioning device can be done either manually or motorised by the use of two stepper motor arrangements.

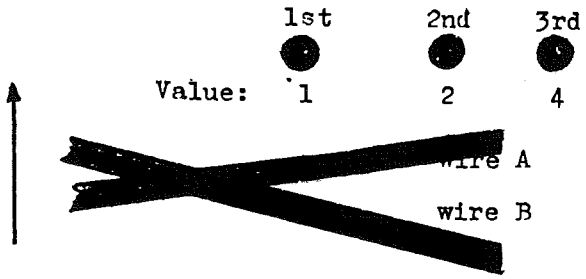


Fig.3: LAS In Line.

Whenever there is a wire out of tolerance an alarm sounds. When there is no alarm, the operator knows that everything is all right.

When the machine fails to knit the Microprocessor System sends signals to switch off the machine. Because different speeds are used a selection of switching off times for the machine is available.

THE HARDWARE

A sensor using 3 LAS in line was developed (see Figure 3). Using two LAS it was impossible to determine which one was the longest and which one the shorter of the two wires.

The solution was to use another LAS to tell which one was the longest or the shortest by recognising one of the various combinations of patterns the wires could make in passing infront of the sensors.

The tolerance is also to be adjusted for different wire thicknesses therefore LAS number 3 has to be adjustable.

Only a minimal microprocessor system is required.

This consists of a Microprocessor, Memory and Input/Output Interface connected together and synchronised by a quartz crystal.

A relatively small single board can hold these components. The program can be stored in EPROM memory which is ideal as it prevents any contamination from electrical interference.

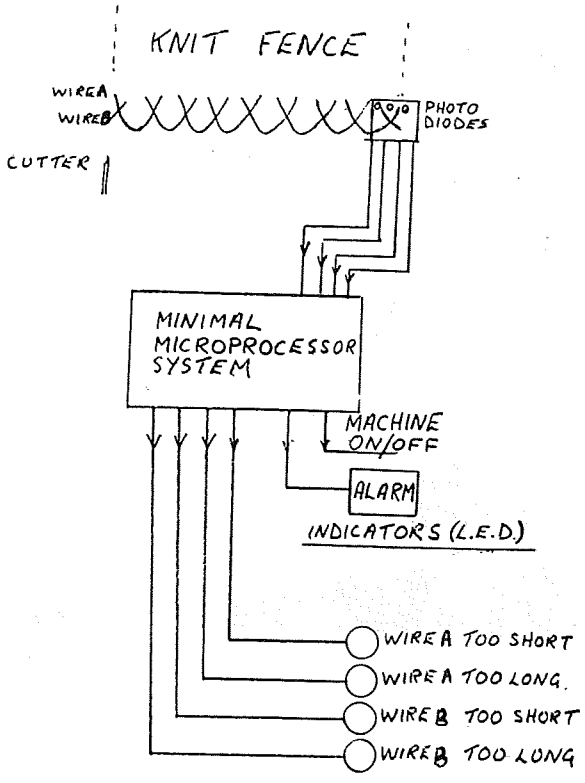
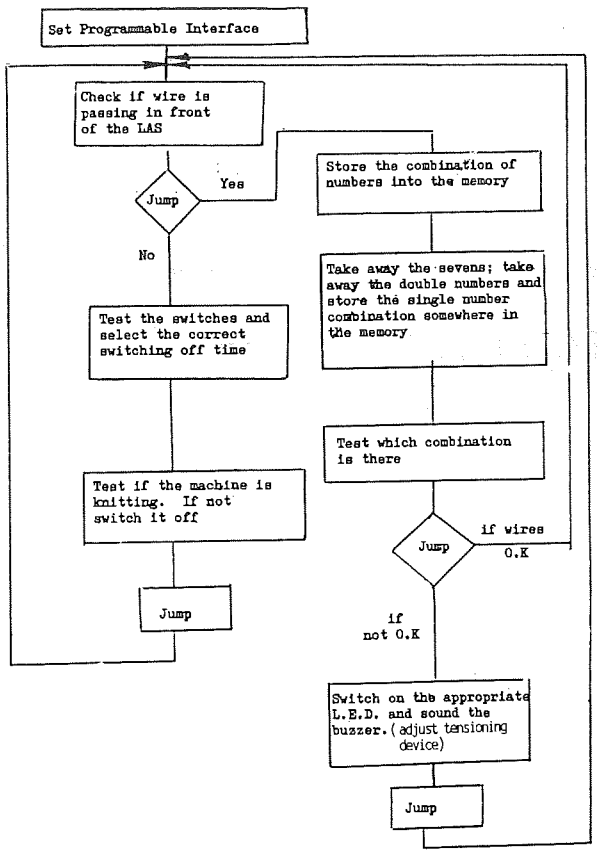


Fig.4: Outline of Hardware.

THE PROGRAM

A machine code program has been developed to be accommodated in the single board microcomputer. The logic can be seen in the flowchart.



The Program Flowchart.

Figure 3 shows the LAS as they are used in this project. If ON the LAS are given the values, 1,2 and 4 respectively, and zero if OFF, so that if all the switches are on, the sum of the values is: 1+2+4=7.

If the first switch is off the sum is 6
If the second switch is off the sum is 5
If the third switch is off the sum is 3

The sensor has been designed so that one switch is off at a time.

For example if passing the wire is as required the sequence of switching off the switches is: Second - First - First - Second, giving the combination: 7
5
7
6
6
7
5
7

The program removes the 7s and all the numbers that occur consecutively more than once giving more simplified: 5
6
5

This combination means that both wires A and B are correct.

Considering other possibilities, wire A too long or short or wire B too long or short and working the same way as before gives the following combinations:

A Long	3 5 6 5	A Short	6 5
B Long	5 6 5 3	B Short	5 6

The computer checks the combinations and acts appropriately.

When the machine fails to knit there will be no wire detected by the LAS. After say 10 seconds, without any wire being detected, the microprocessor is programmed to switch off the machine. Since the speed of the machine can be changed, say to knit every 12 seconds, there is a selection of switches available to change this switching off time.

CONCLUSION

In this Industrial Project a dedicated microprocessor system was used on a wire fence knitting machine to eliminate the need for a skilled operator to stand eight hours a day next to it suffering from noise and eye strain. The system checks if a wire is out of tolerance and then calls the operator to adjust the appropriate wire using a tensioning device on the machine. As a result the possibility of the machine to fail due to changing properties in the wire is eliminated. The system identifies any failure of the machine to knit which causes discontinuation of the wire fence, switches off the machine, and at the same time calls the operator to come to sort out the problem.

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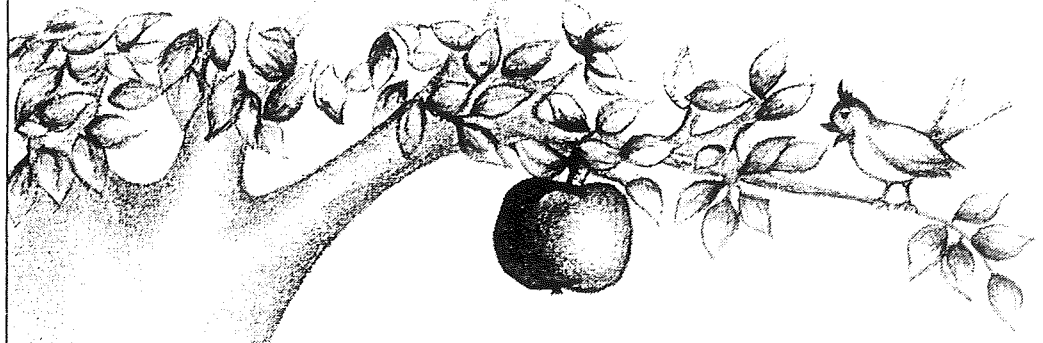

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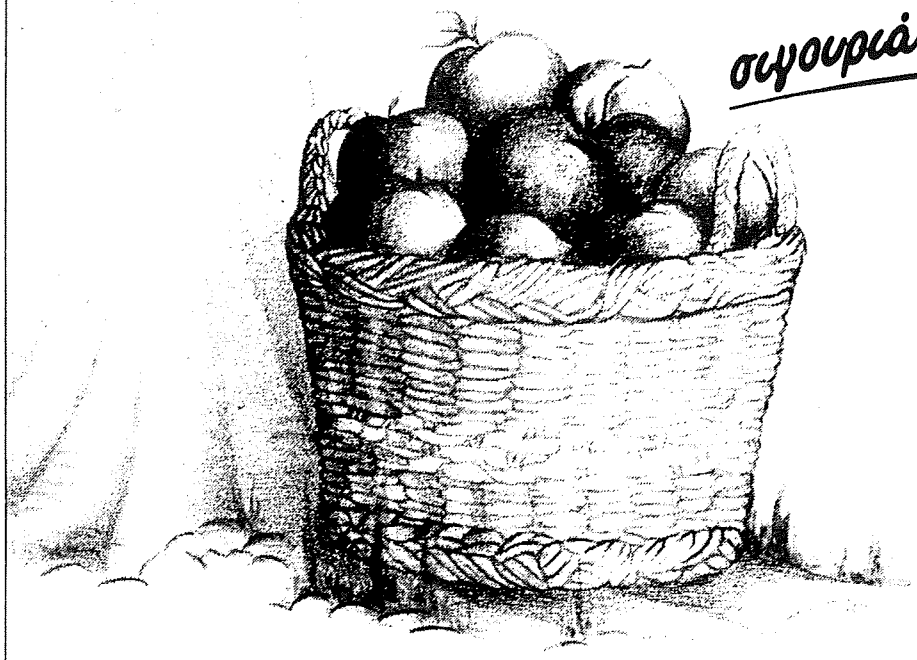

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The Hazards of Ultraviolet Radiation

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ABSTRACT

Mankind, unavoidably is exposed to Ultraviolet radiation, basically because the largest source of this kind of radiation is the Sun. Overexposure to this kind of radiation can result in harmful biological effects. This article reviews the sources of overexposure and the available protection methods that can be used to protect mankind.

INTRODUCTION

Of the various types of non-ionizing radiations, Ultraviolet (UV) is of special interest because of its relatively high photon energy as compared to the other types included in this group[1]. This leads to greater variations in biological response. On the other hand, its low penetration will restrict most of the direct biological responses to the superficial tissues.

Although UV can arise from a large number of man-made sources[2], the Sun is the main source and both the general public and people working outdoors will be exposed to it. This natural background radiation and the variations in its magnitude must be taken into account when exposure limits are discussed.

The UV radiation spectrum occupies the electromagnetic continuum from 200-400 nm. Biological and physical characteristics allow its convenient division into three bands[3]. UVC (200-280 nm) is absorbed by the stratospheric Ozone layer and does not reach the Earth's surface. UVB (280-315 nm), the most biologically active waveband in sunlight, leads to sunburn, tanning, hyperplasia, cancer and ageing of the skin. UVA (315-400 nm), the remaining portion of the UV spectrum, has similar effects to UVB but it is around 1000 times less efficient except in its role in photosensitization reactions associated with certain drugs and chemicals[4]. The best known is the production of vitamin D_3 which is necessary for the prevention of Rickets in man.

SOURCES OF OVEREXPOSURE

The risk of damage following either acute or chronic exposure to UV is encountered in a number of situations.

Solar UV is the most important source of such exposures. All who work outdoors are potentially at risk from overexposure, the consequence of which may be both acute and long-term effects. The fashion of exposing a large part of the body to sunlight has during recent years increased the exposure of the skin, resulting in quite high UV doses. This is true only for outdoor work but is now also normal during leisure periods, as exemplified by the holiday exodus of a large part of the population of the northern European countries to the Mediterranean coast.

UV-emitting arcs are an integral part of the working conditions at a number of workplaces. In welding, such arcs constitute a serious risk. Not only UV, but also visible and infrared radiation as line spectra with a continuous component are emitted during welding. The shape of such spectra will be different for the different welding procedures.

The use of UV in some graphic reproduction techniques also represents an exposure risk for the workers concerned.

UV, and especially UVC, is used for the sterilization of food and air, and pathological effects due to accidental exposures, often are small but of long duration, may result.

A number of sources available to the general populations are known to emit UV, either as a normal part of the emission or after accidental breakdown. The normal white-light fluorescent tubes usually emit small amount of UV. This may be enough to induce a phototoxic reaction if a photosensiizer is present. Under certain conditions the UV output of lighting tubes is by itself large enough to contribute appreciably to a worker's annual UV dose. In addition, UV sources have for many years been available for home use, partly for the semi-cosmetic purpose of tanning. This may result in overexposure if the instructions on the equipment are not followed. The spectrum of fluorescent sunlamps is not always restricted to the solar spectrum. It differs greatly from that of solar radiation in the UVB range, and UVC components may be present.

The use of black-light lamps to control the effectiveness of tooth brushing will, in general, not constitute a hazard as the sources are weak and the exposure short. The same is true where fluorescent black-light tubes are used, for instance for crack detection, chromatography, philately, mineral identification or document inspection.

Accidental short-term exposures with resultant symptoms has, however, occurred after breakage of the protective shield around high-pressure mercury lamps used for lighting.

Medical irradiation in the form of phototherapy is at present expanding. In the blue light phototherapy of infants with neonatal jaundice (hyperbilirubinaemia), incorrecly selected fluorescent tubes have given rise to erythema. The use of certain photodynamic dyes and light for the treatment of herpes, or of psoralens and UVA for other skin diseases such as psoriasis (PUVA), will expose the patient to risk. Up to now the action spectrum that has been studied the most extensive is that for ultraviolet erythema. The action spectrum of the effect on psoriasis appears to be similar and the same applies to the carcinogenic action spectrum. If adequate safety precautions are not taken, the treatment personnel may also be at risk.

Excimer lasers may pose new problems, as these produce high-intensity radiation of wavelengths as short as 193 nm, which have not been available to any great extent from conventional sources. At present little is known about the biological effects of these short wavelengths.

DOSIMETRY

From the point of view of establishing standards, it is desirable not only to be able to make measurements of emitted radiations but also to be able to record the doses received by the persons to be protected. It must, however, be appreciated that the dose absorbed by the sensitive cells may be difficult to estimate. Most of the equipment available for dose measurements in relation to protection is cumbersome and delicate and not well adapted for field use. In general, a phototube (photomultiplier) or photodiode detector is used. When it is necessary to determine the spectral distribution the different wavelengths can be separated, e.g. by a difiraction grating monochromator or by filters, and the transmitting optics must be made of quartz to allow all the UV to pass. The quality of broad-band measurements can be good, but considerable errors may be introduced when a full spectral description is required. One such error is the lack of precision in narrow wavelength bands when filters are used.

Instruments have been constructed that weight the radiation according to a sensitivity curve representative for certain biological effects, such as the action spectrum for UV erythema or a more generalized ultraviolet hazard curve.

Personal dosemeters integrate the effective dose received by people over time, for instance during their work. The device consists, for instance, of a piece of polysulfone film in a badge carried by the person. The method is still under development, but has already produced several useful results.

SAFETY STANDARDS

Any safety standards developed must take into consideration not only the harmful effects of UV radiation but also the need for a certain minimal irradiation, so as to ensure that sufficient vitamin D_3 is produced. This is of greatest importance during infancy and childhood. Vitamin D is supplied in two ways:

a) through diet
b) by production in the skin

Yet deficiencies do occur, especially among children and elderly people. In children this leads to rickets and in the elderly to osteomalacia.

The synthesis of vitamin D_3 in the skin, its regulation and metabolism have been studied in recent years. A photoregulation process ensures that there is no danger of overproduction leading to vitamin D intoxication. The action spectrum for the production of vitamin D_3 shows some similarity to that for UV erythema. It is therefore possible to estimate the UV doses needed for a sufficient production of vitamin D_3 in terms of erythemally effective radiation.

From recent measurements it may be calculated that for production in the skin of the daily vitamin D requirement of 400 International Units (IU), a UV dose on the head, neck and hands of about 60 MED per year is necessary.

Another reason that the skin needs at least some UV radiation, especially in long winters, is that it helps the skin to maintain some of its tolerance to UV. Many people have difficulty in adapting when UV irradiance increases again in the spring. This leads to many patients developing photodermatoses in regions with long winters. This difficulty may be prevented by maintaining some tolerance in winter. Doses required are of the same order of magnitude as those required for the production of vitamin D_3.

On the other hand, too much UV is not beneficial either. Up to now the standard established by the American Conference of Governmental Industrial Hygienists (ACGIH), which specifies a threshold limit value, has been used in preparing guidelines for other countries. This is based on the action spectrum for photokeratitis and erythema in normal white-skinned individuals. This means that acute effects have alone been taken into consideration. For the UVB region and at lower

wavelengths, it states that the radiant exposure in an 8-hour period must not exceed the value given in the Table below. For the wavelength range 320-400 nm, the total irradiance on the unprotected skin or eye must not exceed $10 Wm^{-2}$ for periods exceeding 10^3 seconds (about 17 minutes). For radiant exposures of shorter durations, it should not exceed $10 kJm^{-2}$.

A procedure has been suggested for characterizing the relative levels of UV from illumination sources and derived guideline numbers given for the maximum illumination level of the source that will not exceed the ACGIH standards.

Wavelength, λ (nm)	TLV (J/m^2)	Relative spectral effectiveness, S_λ
200	1 000	0.03
210	400	0.075
220	250	0.12
230	160	0.19
240	100	0.30
250	70	0.43
254	60	0.50
260	46	0.65
270	30	1.00
280	34	0.88
290	47	0.64
300	100	0.30
305	500	0.06
310	2 000	0.015
315	10 000	0.003

Table giving the threshold values (TLV) and relative effectiveness by wavelength for any 8-hour period of exposure.

The values given in the table apply directly only to sources emitting essentially monochromatic UV. The maximum permissible exposure for a broad-band source can be calculated by summing the relative contributions from all its spectral components, each contribution being weighted by means of the relative spectral effectiveness, as given in the Table. In addition, the guidelines should not be used to determining exposure limits for photosensitive individuals.

The guidelines discussed so far do not take into account the long-term risk of skin cancer. As the action spectrum for UV carcinogenesis appears to be similar to that for UV erythema, the cancer risk may also be discussed in terms of erythemally effective doses. Thus the Health Council of the Netherlands has tried to define "acceptable levels" for long-term unitended exposures to UV radiation. The reasoning was based on the clinical observation that skin cancer in the Netherlands occurs mainly in outdoor workers even though there are many more indoor workers. The difference in the UV doses received apparently bring the outdoor workers into the risk zone. The difference in erythemally effective UV doses received by outdoor workers and indoor workers was estimated with the help of data collected with Robertson-Berger meters and personal dosimeters. The acceptable level for long-term occupational exposures from man-made sources was defined as a small fraction of this difference. This led to an acceptable level corresponding to an average daily exposure of 3-9 minutes of full local summer sunlight.

This is a rather strict limit, but those given in the Table of short-term exposure are equally strict. Where these limits are observed there appears to be little need for additional limits for long-term exposure.

PROTECTION

Solar ultraviolet radiation

The weak penetration of UV makes a simple form of protection possible, since it is excluded by most types of clothing. This, of course, may not provide protection for the face and hands during work outdoors. Furthermore, it should be remembered that not all clothing will adequately exclude UV. Relatively open-weaved clothing or that made of UV-transparent material may result in sunburn being caused by sunlight penetrating the clothing. It is also the experience of dermatologists that synthetic material used for dresses and shirts permits sufficient UV to pass for a skin reaction to occur when phototoxic substances are being tested. Apart from clothing, protection may also be afforded by the application of sun-blocking or sun-screening substances that act by absorbing or scattering the radiation. Of the former, p-aminobenzoic acid or some of its esters have proved to be the most successful. They can easily be applied as a lotion, a cream or prefereably in an alcoholic solution. The results are a decrease in UVB induced erythema and a slower rate of suntanning.

Industrial sources

Protection against UV in the working environment should preferably consists of containment of the radiation by appropriate design of the source or of the appratus in which it is placed.

As mentioned previously, a large number of sources can be shielded by the use of an appropriate covering, which may be a filter that selects only those wavelengths corresponding

to the purpose for which the lamp is to be used. In the case of high intensity lamps containing UV sources, attempts are being made to introduce safety devices that will interrupt the emission if the covering glass is broken.

When containment is not possible and the irradiance is high, appropriate eye protection is mandatory together with protection of the skin. This may consist of appropriate clothing or the application of effective sunscreens. Standards for eye protection exist in most countries. Welding is an example of a type of work where sufficient protection can be obtained by suitably designed and fitted welding masks or hoods. When welding is started, however, the shield may have to be removed and this can give rise to photolesions of the eye.

It is fortunate that a certain degree of the hazard can be achieved by the welder himself, as the eyelid reflex respond to bright light and thus acts as filter of sufficient absorbing capacity in the visible light at wavelengths close to UVA. It is not sufficient to protect the welder himself. The surrounding area must also be monitored and screened so as to ensure that nobody is accidentally exposed. This requires fixed shielding between and around welders. Such shielding work must be treated with non-reflecting paint in order to protect the neck of the welder from exposure by reflection.

CONCLUSIONS

All people are exposed to UV radiation from sunlight, and the risk to health varies with geographical, genetic and other factors. Similar risks are involved in the increasing exposure of people to UV from artificial sources, such as those used for suntanning, in phototherapy and in industrial processes. The biological effects of a single exposure differ significantly from the effects of repeated and cumulative exposures. Both types of risk increase markedly with excessive exposure.

For UV radiation exposures the spectral composition fo the source and action spectrum weighted irradiance (Wm^{-2}) and radiant exposure (Jm^{-2}) are the important parameters that determine the biological effect.

The essential measurements and determination of the hazard should include:

a) careful estimation of the output of the source in narrow intervals (1-5 nm bands)
b) knowledge of the action spectrum for the effect of concern
c) the irradiance in the individual wavelength bands
d) the exposure duration
e) the distribution of the radiation impinging over the exposed area
f) the characteristics of the reflecting surfaces
g) the frequency of the repetition of the exposure
h) the effective irradiance (dose rate) in repeated exposures.

The interation between biological tissues and UV radiation depends on:

a) the spectral distribution of the source
b) the radiant exposure (dose) weighted against the action spectrum
c) the number of exposures.

The interaction of UV radiation and biological tissues is mainly photochemical. However, there are some UV sources that emit sufficient energy to produce thermal effects in tissues.

Because of the relatively superficial absorption, the major biological effects are on the skin and the eye. Through its optical properties, the eye has an increased vulnerability to injury to UV radiation.

The major health hazards to the skin are both acute and chronic. Acute hazards are sunburn and photosensitized reactions, the chronic hazards are accelerated ageing and photocarcinogenesis. The major health hazards to the eye are photokeratitis, corneal burns, ocular inflammation, photochemical cataract, and photochemical injury to the retina.

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Stress Management and the Educator

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This article will first attempt to define stress and burnout; secondly it will outline the causes of stress in a school-environment and finally it will attempt to describe some mechanisms of managing stress in the teaching environment.

There are many definitions of stress but in simple terms stress can be defined as "the psychological reaction to any situation or event. Stress may develop as a reaction to either a positive or a negative experience" (Woronoff, 1986).

When stress is prolonged, when it lasts for months or years, it may result in burnout - "the inability of the individual to utilize his coping mechanisms effectively so that his capacity to function in a specific role is severely impaired" (ibid, 1986).

1. CAUSES OF STRESS

There is a school of psychologists who believe that some people are born with personality traits which make them more susceptible to stress. Most research tends to support the conclusion that the individual differences in emotional sensitivity and resiliency are due to the combined interaction of autonomic nervous system functioning and early environmental conditions. The former tends to be inherited as indicated by studies on identical twins, paired siblings and paired unrelated children. While this evidence of genetic influence is significant, the importance of environment cannot be ignored.

Friedman and Rosenman (1974) studied coronary patients and developed the concept of TYPE A and TYPE B personalities. According to their research two traits are commonly associated with type A personality: an excessive competitive drive and a chronic sense of time urgency. Time pressures tend to leave the Type A person frustrated, nervous and hostile. According to Friedman and Rosenman, the Type A person suffers a deep-seated insecurity, judging his accomplishments in terms of numbers: how many law cases won, how many operations performed, how much his production volume increased. Besides, this individual shows an inability to enjoy genuine leisure, spontaneous sexual activity or a peaceful unstructured day.

According to the same researchers Type B persons generally value leisure; they are able to relax without feeling guilt. Such individuals do not need to measure themselves against others. Thus they are more often successful in their chosen vocations.

By comparison Type A persons usually show higher serum - cholesterol levels. Strong Type A personalities exhibited blood fat and hormone abnormalities similar to those found in a majority of coronary patients.

Apart from the genetic factor, the environment external to the individual also induces stress. According to the scale (0-100) developed by Thomas H. Holmes the events in life which produce high stress to individuals are: Death of Spouse (100), Divorce (73), Marital Separation (65), Jail Term (63), Death of Close Family Member (63), Personal Injury or Illness (53), Marriage (50), Fired at Work (47), Retirement (45)... (Holmes et al, 1967).

2. EFFECTS OF STRESS

According to H. Selye stress provokes biological changes in the organism resulting in the enlargement and hyperactivity of the adrenal cortex, the atrophy of the thymus and the lymph nodes, and the appearance of gastrointestinal ulcers (Selye, 1974).

Prolonged stress leads to burnout the symptoms of which may take the form of high blood pressure, sleeplessness, gastrointestinal disorders, fatigue, listlessness, anxiety, irritability, headache, and rapid heart beat.

The sufferer may seem to show personality changes including social withdrawal, loss of interest in sex, temper outbursts, extreme impatience, lack of attention and an inability to concentrate, and other symptoms of depression such as forgetfulness, weeping, and a sense of hopelessness. It has also been noted that prolonged stress tends to produce premature aging.

Some researchers tend to believe that the prevalence and severity of ulcers, cervical cancer, arthritis and venereal diseases are associated with stress (McGrath, 1970).

3. TEACHING ENVIRONMENT AND STRESS

The school environment is considered to be potentially high in stress. According to the research carried out by the Chicago Teachers

Union (Cichon, 1978) the issues which provoke stress are

(a) **student issues:** Control disruptive children, threat of personal injury, physical assaults against colleagues, and serving as targets of verbal abuse.

(b) **administrative climate:** involuntary transfer, assignment to overcrowded classrooms, notice of unsatisfactory performance, re-organisation of programmes and classes, implementation of educational goals, denial of promotion or advancement, and disagreements with supervisors.

Teaching is believed to be highly stressful as a profession for teachers have limited control over decisions that affect them, and are responsible for other people's professional development and careers (McGarth, 1970).

Stress is induced by various factors: student behaviour, colleague behaviour, administrators, parents, inspectors, curriculum goals, educational policies and student exam results.

Moreover, stress is heightened by lack of money, facilities and teaching aids thus increasing one's sense of frustration and futility.

Besides, teachers no matter how well qualified they are, they do not possess a-one-approach, a ready-made recipe or method which would work wonders for every individual child. The result of this is that teachers end up usually having low self-esteem.

Mr John Ryder, former president of the National Education Association (USA), paints poignantly the sense of frustration and futility that teachers feel in this extract from the **NEA Reporter** (October 1979): "Don't bother coming into my classroom to tell me what's wrong. I know what's wrong. There are too many kids in this classroom, and that's what's wrong. There are too few supplies to teach with, and that's what's wrong. There are too many children who come to school hungry, tired, unloved, and unsupervised, and that's what's wrong. There are too many children who are emotionally and physically abused, and that's what's wrong.

"At times it seems the whole society is dumping all of its problems in our classrooms, expecting us to be minister and parent and social worker and police officer. That's what's wrong. It's hard enough to find the strength within myself to be the teacher these kids need, and that's what's wrong. And there's far too little support from people like you, Mr. Politician, and that's what's wrong.

"So unless you have some help to offer, go away because I'm doing the best I can every day to teach these children in spite of all the problems they have to overcome and in spite of my own human shortcomings. And unless you can help me you just get in the way and make things worse".

4. STRESS MANAGEMENT

Why are some teachers able to maintain their equilibrium while others grow increasingly distraught? Are there really functional ways of dealing with stress that any educator can use?

First of all we should find out whether we have a disposition sensitive to stress. The questionnaire below is a simple instrument which will help evaluate one's predisposition to stress.

QUESTIONNAIRE

	Yes	No	Don't Know
1. I have always considered myself to be a tense person.	[ ]	[ ]	[ ]
2. My mother is (was) very calm in crises.	[ ]	[ ]	[ ]
3. My father is (was) a heavy drinker.	[ ]	[ ]	[ ]
4. I am not one of those people who worries about things.	[ ]	[ ]	[ ]
5. I have trouble sleeping, especially when I've been disappointed or hurt about something.	[ ]	[ ]	[ ]
6. I'm very confident of my abilities to deal with crises.	[ ]	[ ]	[ ]
7. I feel like eating something much of the time, even if I've had substantial meals.	[ ]	[ ]	[ ]
8. I really feel I know how to relax.	[ ]	[ ]	[ ]
9. I have a constant need to get things accomplished.	[ ]	[ ]	[ ]

(Continued)

10. I´m very rarely bored.	[ ]	[ ]	[ ]
11. My sex drive is low.	[ ]	[ ]	[ ]
12. I have always looked forward to seeing my parents for a visit.	[ ]	[ ]	[ ]
13. I really don't know what I want to do with my life.	[ ]	[ ]	[ ]
14. I am very comfortable in social situations.	[ ]	[ ]	[ ]
15. My doctor tells me that my blood pressure is high.	[ ]	[ ]	[ ]
16. I look forward to the weekends I spend with my spouse.	[ ]	[ ]	[ ]
17. I lose my temper a lot.	[ ]	[ ]	[ ]
18. I think I can be easily hypnotized.	[ ]	[ ]	[ ]
19. I don't have any real hobbies.	[ ]	[ ]	[ ]
20. I get along well with my supervisor.	[ ]	[ ]	[ ]

After you have completed this Questionnaire see end of article for evaluation of your answers.

Stress management is achieved mainly through positive personal adaptation and effective professional administration sensitive to stress effects.

(a) Personal adaptation in coping with stress

The simplest way to cope with stress on a personal level involves physical activity, provided that you do not have a medical problem which precludes this option. Just choose the type of physical exercise that suits you and which you would enjoy doing e.g. jogging, walking, the stationary bicycle etc. Avoid the physical exercises which do not suit you for instead of reducing stress, they would certainly increase it.

The second factor is diet which is admittedly much more difficult to control. Many psychologists have emphasised the inter-relationship between food and stress. You should avoid sugar, caffeine, cola drinks and alcohol. We should strive for a balanced diet of carbohydrates, protein and fat. Needless to say that drugs, tranquilisers and barbiturates should be avoided as people become dependent on them, and addiction increases anxiety which leads to stress thus creating a vicious circle.

In USA where the value of stress management has been recognised, stress management workshops are set up in schools and organisations run by specialist psychologists. These workshops teach relaxation techniques the most common of which are: (i) muscle relaxation response, (ii) relaxation response, (iii) auto-suggestion or self-hypnosis (Woronoff, 1986).

All these techniques are simple tools taught to and practised by the participants of these workshops. They aim at relaxing the muscles, helping with breathing, activating the left-side of the brain (the seat of logic), inducing meditation/hypnosis, and thus refreshing the participants.

(b) The Administrator's Role in Stress Management

It has been observed that administrative personnel tend to be unwilling to recognise stress as a significant issue affecting school environment. Even in USA it is usually the teaching staff and the staff unions that seek professional help rather than the administrative staff.

In many countries, even nowadays, administrators seem to agree with President Truman who was quoted as saying "if you can't stand the heat get out of the kitchen." Research, however, has pointed out that for an educator to reach a burnout point it is not only his/her genetic predisposition to be blamed but also the school environment which exacerbates the genetic traits.

As stress has a detrimental effect on the attainment of objectives of school programmes and activities, the school adiministrator should wish to become more familiar with the effects of stress on his/her staff.

According to Woronoff (1986) a professional administrator should not neglect the effects of stress on performance, and should bear in mind that **task achievement** is **increased** when

(i) the school environment is relatively relaxed and pleasant.

(ii) staff have a significant voice in determining issues affecting their professional responsibilities.

(iii) the opportunity for expressing frustration is readily available.

(iv) there is administrative back up for

teachers who require it when they are acting in appropriately professional ways.

(v) when teachers' actions are questionable, constructive approaches are employed first.

It is highly recommended that school administrative personnel take a course in stress management in order to become more sensitive to the impact of stress on their personnel for, if problems remain unresolved, they usually lead to interpersonal confrontations, absenteeism and psychosomatic complaints. It is important for the administrator to be aware that his/her behaviour and mood affect the whole of the staff. It is also believed that the unpredictable behaviour of the administrator is more stressful to the subordinates than consistent unpleasantness.

It is undeniable that the "favourites versus the unfavourites" is a common staff schism created by the insensitive administrator. Aloofness is acceptable, if not desirable, when all are subject to it indiscriminately.

Thus a professional and stress sensitive administrator facilitates easy access of staff to him for personal grievances, ensures that effective staff committees are set up and their recommendations are implemented. These mechanisms help reduce stress and frustration; staff's self esteem is boosted up for they feel that they participate in decisions which affect their job and work.

According to the research of Kahn and Katz cited by Woronoff (1986) effective leaders (defined in terms of productivity and morale) are those who tend to **delegate** authority and decisions and stimulate the development of group-pride and cohesiveness.

An administrator should be sensitive to the stress syndrome and be alert to the following behaviour changes in teachers:

(i) was usually outgoing but has become withdrawn

(ii) generally behaves in a controlled manner but has begun to suffer frequent emotional outbursts.

(iii) seemed healthy but now experiences numerous physical complaints.

(iv) has had an excellent attendance record but has recently begun to build up a significant number of absences.

(v) becomes difficult to work with after a long period of relatively harmonious interpersonal relationship.

(vi) had been a favourite of students but is gaining the reputation as a teacher students wish to avoid.

Teachers who exhibit the changes described above are potential sufferers of significant stress disturbance and should be offered help.

It is worth mentioning Liebe's theory cited by Woronoff (1986) that experienced teachers whether aged 30 or 50, will experience a mid-life professional crisis. The determining factor is the number of years of teaching not chronological age. She advocates that teachers in career-related individual conferences, assessment of their needs, and an analysis of their teacher-job-environment match.

More recently, research has found that women competing in a male-dominated environment are under constant stress and that professional women experience more stress than housewives or men.

5. EFFECTIVE STRESS MANAGEMENT

The key issue is how to control stress. In a teaching environment this can only be achieved if the following factors contribute to set up effective mechanisms which can combat stress which is a by-product of the pace of modern life:

First of all, the individual teacher should learn how to adapt his/her life-style in order to cope effectively with stress: She/he should aim at a change of diet, physical exercise, relaxation, meditation.

Secondly, the educational administrator should ensure a friendly, strife-free school environment where the teaching staff would feel that they are treated equally, are given equal opportunities for advancement while they are made to feel that they can participate in decision-making and have ways of voicing their feelings and opinions, have access to the administrator and feel that they can count on him/her for support. The administrator should be aware of and alert to the stress syndrome and its impact on his/her staff behaviour and, consequently, on the achievement of his/her school.

Thirdly, the colleagues should bear in mind that a friendly supportive environment will help interpersonal relationships and help reduce stress.

Fourthly, staff unions should aim at effective representation of staff on committees which will take up stress inducing issues.

Finally, a local or national council or forum, (on which staff, administration, local authorities, boards of education, ministries are represented), should aim at finding ways of relieving stress for example through sabbatical leaves, professional courses to boost high self-eteem, staff security, staff evaluation/

promotion, improvement of teaching facilities and teaching environment, providing professional help and setting up, stress management workshops for stress sufferers and burnout victims.

These mechanisms outlined above would ensure to a large extent an effective outgoing process of stress management badly needed in a stressful environment like the teaching milieu on the threashold of the twenty-first century if we want teachers to be able to "stand the heat of the kitchen" for the sake and benefit of education and society.

KEY to QUESTIONNAIRE: If you answered YES to most or all of the even-numbered questions and NO to most of the odd-numbered items, stress is not a significant problem; if you responded YES to the odd-numbered items and NO to the even-numbered questions, stress may be a problem.

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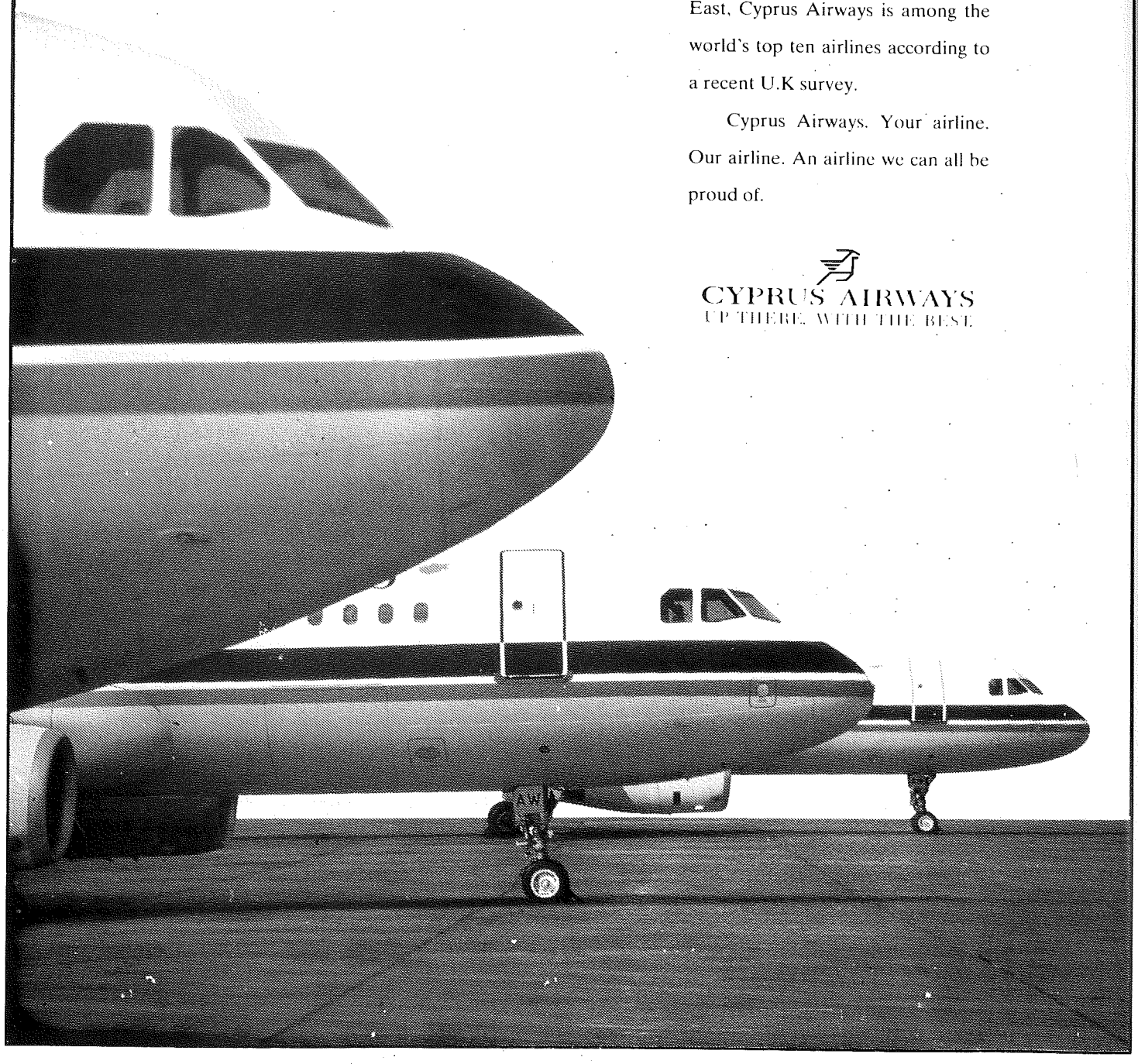

Fresh Water from Solar Desalination Systems

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Water is a basic necessity of man along with food and air; the importance of supplying hygienic potable water can hardly be overstressed. Man has been dependent on rivers, lakes and underground water reservoirs for fresh water requirements in domestic life, agriculture and industry.

However, the rapid industrial growth and population explosion all over the world has resulted in a large escalation of demand for fresh water. Added to this is the problem of pollution of the rivers and lakes by the industrial wastes and the large amount of sewage. In fact on a global scale man-made pollution of natural sources of water is turning out to be the single largest cause for the fresh water shortage **(1)**.

The only inexhaustible sources of water are the oceans. Their main drawback, however, is the high salinity of such water. One of the attractive schemes to tackle the problem of water shortage is the desalination of such water; which may be mixed with brackish water to increase the amount of fresh water and bring the concentration of salts to around 500 ppm **(1)**.

Solar desalination is used by nature to produce rain which is the main source of fresh water supply. Solar radiation falling on the surface of the sea is absorbed as heat and causes evaporation of the water. The vapours rise above the surface and moved by the winds. When these vapours cool down to their dew point, condensation occurs and fresh water precipitates as rain. All available manmade distillation systems are a duplication, on a small scale, of this natural process. In this paper, after a historical introduction, a survey of the solar assisted desalination methods is presented.

1. HISTORY OF SOLAR DESALINATION

Solar distillation has been in practice for a long time. The earliest documented work is that of an Arab alchemist in the fifteenth century reported by Mouchot in 1869 **(1)**. Mouchot reported that the Arab alchemist has used polished Damascus mirrors for solar distillation.

The great French chemist Lavoisier (1862) used large glass lenses, mounted on elaborate supporting structures, to concentrate solar energy on the contents of distillation flasks **(1)**. The use of silver aluminium coated glass reflectors to concentrate solar energy for distillation has also been described by Mouchot.

Solar stills were the first to be used on a large scale distilled water production. The first distillation plant constructed was a system built at Las Salinas, Chile in 1874 **(1,2)**. The still covered 4700 m^2 and produced up to 23,000 l of fresh water per day, (4.9 lt/m^2), in clear sun. The still was operated for 40 years and was abandoned only after a fresh-water pipe was installed supplying water to the area from the mountains.

The renewal of interest on solar distillation occurred after the first world war at which time several new devices have been developed such as: roof type, tilted wick, inclined tray and inflated stills. A survey of these simple methods of distilled water production, together with some other more complicated ones is presented in section 2.

The use of solar concentrators in solar distillation has been reported by Pasteur (1928) **(1)** who used a concentrator to focus solar rays onto a copper boiler containing water. The steam generated from the boiler was piped to a conventional water cooled condenser in which distilled water was accumulated.

2. SURVEY OF DESALINATION SYSTEMS

Desalination can be achieved by a number of techniques including distillation, reverse osmosis and electrodialysis (see Fig 1). The distillation of sea-water can be achieved by utilising a thermal energy source. Such thermal energy can be obtained from a conventional fossil fuel source, nuclear energy or from a non conventional solar energy source.

A short description of these systems is given in this section. The conventional distillation systems are similar to the solar ones as the same equipment apply. Their prime difference is that in the former ones a conventional boiler is used to distill the sea-water whereas, in the latter ones the solar energy is applied. The rapid escalation in the costs of fuels has made the solar alternative more attractive and as the two systems are similar only the solar ones will be analysed here.

2.1 SOLAR STILLS

The conventional solar stills use the

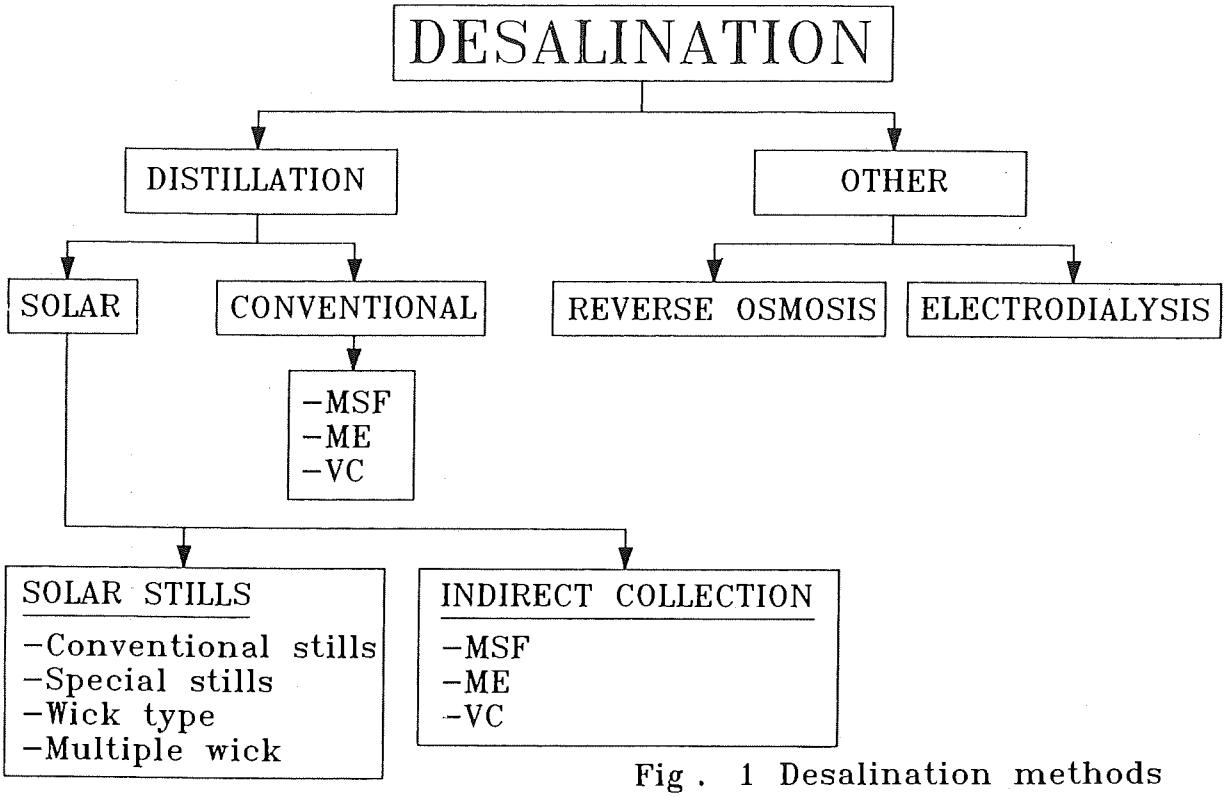

Fig . 1 Desalination methods

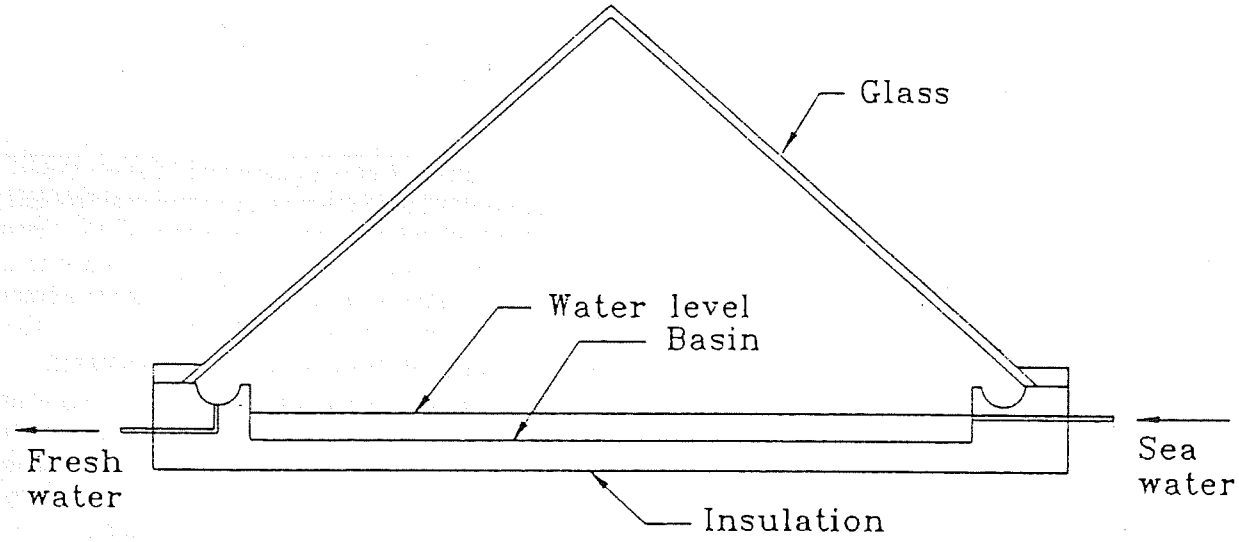

Fig 2 Solar still

greenhouse effect to evaporate the salty water. It consists of a basin into which a constant amount of sea-water is maintained enclosed in a vee-shaped glass envelope (see Fig 2). The sun's rays pass though the glass roof and are absorbed by the blackened bottom of the basin. As the water vapour is condensed on the underside of the roof and runs down into the troughs which conduct the distilled water to the reservoir. The still acts as a heat trap, because the roof is transparent to the incoming sunlight, but it is opaque to the long infrared radiation emitted by the hot water (greenhouse effect). The roof encloses all the vapour and prevents its loss and at the same time keeps the wind from reaching the salty-water and cooling it. The stills require frequent flushing which is usually done during the night. Flushing is performed to prevent salt precipitation **(3)**. The design problems encountered with this type of stills are **(3)**; the brine depth, the vapour tightness of the enclosure, the distillate leakage, the thermal insulation, and the cover slope. shape and material. The typical still efficiency is 35% (max) and their daily production is about 3-4 lt/m² **(4)**

Several attempts were made to use simple and more economic materials such as plastics **(4)**. These have advantages over glass stills in that they are cheaper, less beakable, lighter in weight for transportation, and easier to set up and mount. Their main disadvantage is their shorter life **(4)**.

A lot of variations of the basic shape shown in Fig 2 were developed by various researchers to increase the production rate of solar stills **(5,6)**. A number of techniques for performance enhancement has been reported by others.

Rajvanshi **(7)** used various dyes to enhance the performance of the solar still. He concluded that with the use of black napthalamine at a concentration of 172.5 ppm, the still output could be increased by as much as 29%. The use of these dyes is perfeclty safe because the evaporation in the still was performed at 60°C whereas the boiling point of the dye is in the order of 180°C. Thus, only the water evaporates.

Akinsete et. al **(8)** were successful in increasing the production of a still by lining its bed with charcoal. In particular, the presence of charcoal lead to a marked reduction in the start-up time by reducing the thermal inertia of the system. This is due to the capillary action exhibited by the charcoal whenever is partially immersed in a liquid, its reasonably black colour and its surface roughness.

Lobo et. al **(9)** developed a simple multi-effect basin type solar still. This still provides 40-55% increase in the fresh water produced as compared to the standard one depending on the solar radiation. The idea was to use two stills one on top of the other, the top one being made completely from glass or plastic and separated into small partitions.

A different category of stills is the wick type in which a black cloth is used (usually inclined), which by capillary action draws salty water from a sink which is evaporated on the cloth surface. Sodha et. al **(10)** developed a simple multiple wick type solar still in which blackened wet jute cloth forms the liquid surface. A series of jute cloth pieces of increasing length were used, separated by thin black polythelene sheets, resting on a foam insulation. Their upper edges are dipped in a saline water tank where suction by capillary action of the cloth fibre provides a thin sheet of liquid on the cloth which is evaporated by solar energy. The results showed a 4% increase in the efficiency of the still as compared with the conventional stills.

2.2 INDIRECT COLLECTION SYSTEMS

The general principle of these systems is the implementation of two separate subsystems, one for the collection of solar energy, collectors, and one for transforming the collected energy into latent heat of evaporation, plant. The collector subsystem will not be discussed here. The plant subsystem can be based on one of the following operating principles **(3,11)**:

1. Multistage Flash (MSF)
2. Multiple Effect (ME)
3. Vapour Compression (VC).

The operating principle of all these processes is oriented towards re-using the latent heat of evaporation to preheat the feed whilst at the same time condensing the steam to produce fresh water.

2.2.1 Multistage flush process

The multistage flush (MSF) process is composed of a series of elements, called stages. In each stage condensing steam is used to preheat the sea-water feed. By fractionating the overall temperature differential between warm source and sea-water into a large number of such stages the system approaches the ideal total latent heat recovery. The operation of this system requires pressure (vacuum) gradients in the plant **(3,11)**. The process is shown in Fig 3. Current commercial installation are designed with 10-30 stages (2°C temperature drop per stage) **(11)**. The typical daily output of these systems are 60-100 lt/m^2 depending on the number of stages **(11)**.

A disadvantage of this process is that exact levels of pressures are required in the different stages and therefore some transient time is required before the normal running operation of the plant. This makes the MSF relatively unsuitable for solar energy applications unless a storage tank is used for thermal buffering **(12)**.

Moustafa et. al **(13)** reports on the performance of a 10m^3/day solar MSF desalination system tested in Kuwait. The system consisted of a 220m^2 parabolic trough collectors, 7,000 litre thermal storage and 12-stage MSF desalination subsystem. The thermal storage subsystem was used to level off the thermal energy supply and allow the production of fresh water to continue during periods of low radiation and night-time. The output of the system is reported to be over ten times the output of the solar stills for the same solar collection area.

2.2.2 The Multiple effect process

The multiple effects (ME) process, shown in Fig 4, is again composed of a number of elements,

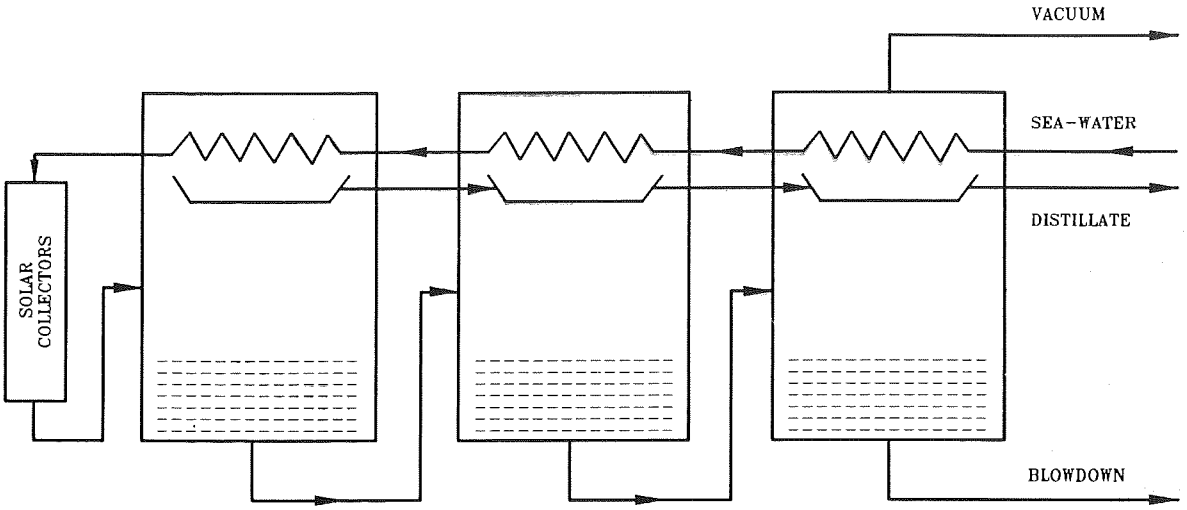

Fig . 3 MULTISTAGE FLUSH SYSTEM

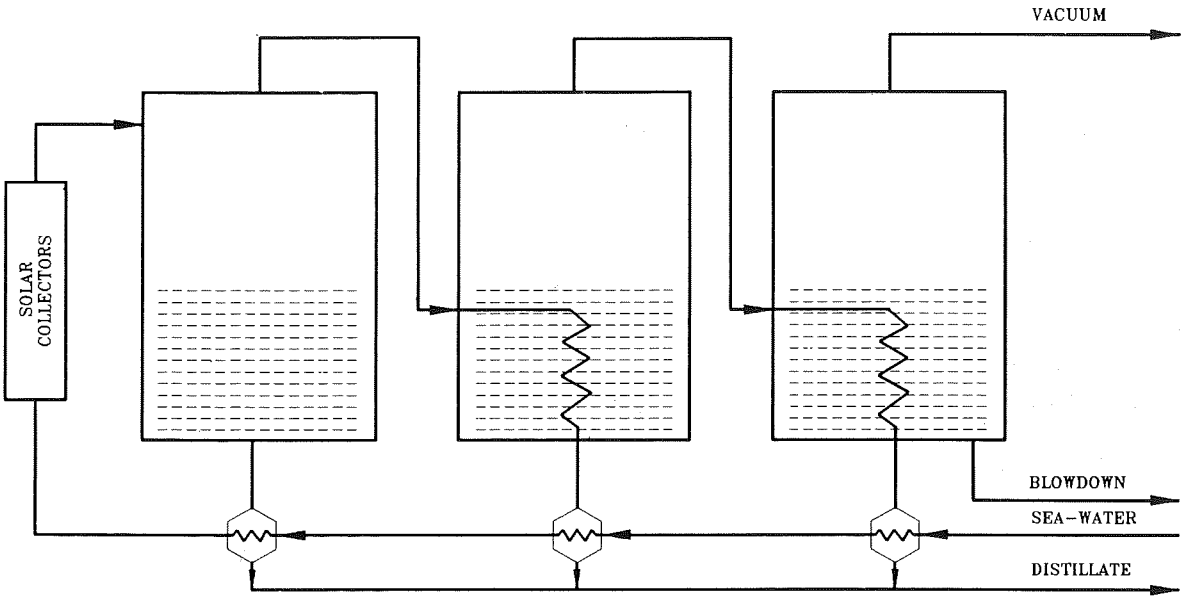

Fig . 4 MULTI-EFFECT SYSTEM

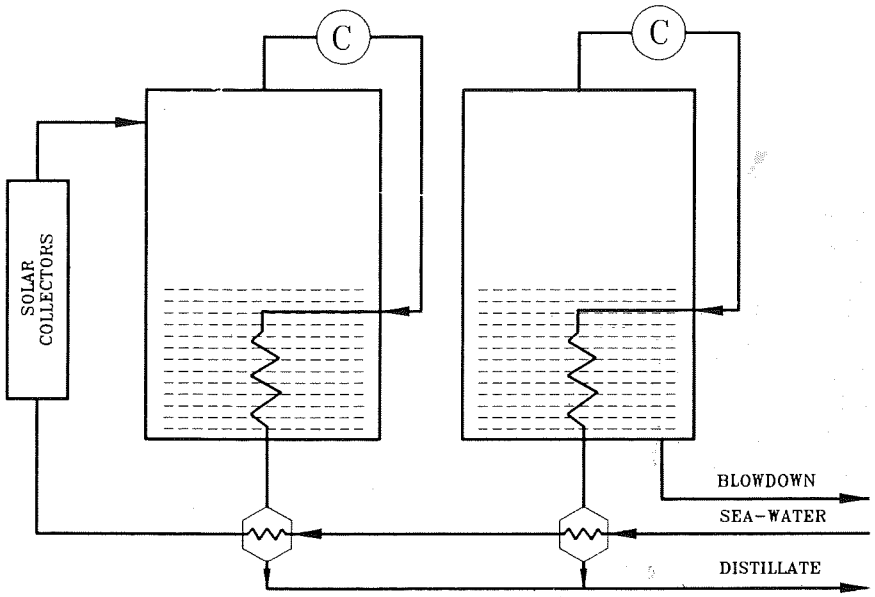

Fig . 5 VAPOUR COMPRESSION

which, in this case are called effects. The steam from one effect is used as a heating fluid in another effect which, while condensing causes evaporation of a part of the salty solution. The produced steam goes through the following effect, where, while condensing, makes some other solutions evaporating and so on. For this to be possible the heated effect must be kept at a pressure lower than that of the effect from which the heating steam is coming. The solutions condensed by all effects, is used to preheat the feeding **(3)**.

The main difference between this process and the MSF is that the steam of each effect just travels till the following effect and it is immediately used for preheating the feeding. This process requires more complicated circuit equipment in comparison with MSF; on the other hand, it has the advantage that is suitable for solar energy utilisation because the level of equilibrium is less critical **(12)**.

2.2.3 The vapour compression process

The vapour compression (VC) plant base the heat recovery on raising the pressure of the steam from a stage by means of a compressor, see Fig 5. Condensation temperature is thus increased and the steam can be used to provide energy to the same stage it came from, or to other stages **(3,11)**.

Parametric cost estimates and process designs have been carried out and showed that this type of plant is not particularly convenient, unless it is combined with an MSF section. Further, it appears that the mechanical energy requirements have to be provided with a primary drive such as a diesel engine, and cooling the radiator of such an engine provides more than enough heat for the thermal requirements of the process, making the solar collector subsystem redundant **(14)**.

2.3 REVERSE OSMOSIS

This system depends on the properties of certain semipermeable membranes which, when used to separate water from a salt solution, allow fresh water to pass into the brine compartment under the influence of osmotic pressure. If a pressure in excess of this value is applied to the salty solution, fresh water will pass from the brine into the water compartment. Theoretically, the only energy requirement is to pump the feed water at a pressure above the osmotic one. In practice higher pressures must be used in order to have a sufficient amount of water passing through a unit area of membrane **(15)**.

Solar energy can be used with RO (reverse osmosis) systems in two ways:

1. With a solar thermal plant producing steam which drives the pumps; and
2. With the direct production of electricity by photovoltaic (PV) panels **(16)**.

The output of RO systems is about 500-1000lt per day per square metre of membrane, depending on the amount of salts in the raw water and the condition of the membrane.

Tabor **(17)** analysed a system using a RO desalination unit driven by solar PV panels or from a solar-thermal plant. He concluded that the cost of the fresh water is about the same when compared with RO system operated from mains power supply. This is due to the high cost of the solar equipment.

2.4 ELECTRODIALYSIS

The system works by reducing salinity by transferring ions from the feed water compartment, through membranes, under the influence of an electrical potential difference. Saline feedwater contains dissolved salts separated into positively charged sodium and negatively charged chlorine ions. These ions will move towards an opositively charged electrode immersed in the solution, i.e. positive ions (cations) will go to the negative electrode (anode). If special membranes, alternatively cation-permeable and anion-permeable, separate the electrodes, the centre gap between these membranes will be depleted of salts **(18)**. As the energy requirements of the system are proportional to the water's salinity, electrodialysis is more economic when the salinity of the feedwater is not more than about 6,000 ppm of dissolved solids (brackish water). Similarly, due to the low conductivity which increases the energy requirements of very pure water, the process is not suitable for water of less than about 400 ppm of dissolved solids.

Solar energy can be used with electrodialysis by directly producing the voltage difference required with photovoltaic panels.

3. CONCLUSIONS

Distillation processes are preferred for desalination because water is boiled, something which, ensures that the distilled water does not contain any microorganisms. In addition, the non distillation processes have certain disadvantages which make them unsuitable for Cyprus. The RO system suffers from membrane killers which are present in highly polluted water like the mediterranean sea. The mediterranean sea has also a salinity of about 39,000 ppm. This constitutes the electrodialysis non viable as the 'maximum

salinity this process can handle economically is about 6,000 ppm.

With respect to solar distillation two different approaches are possible as described above:

1. A low technology integrated approach, in which, trapping solar energy and using it to evaporate water is done in the same piece of equipment (solar stills). This is a low yield and low investment cost approach which is limited to the production of relatively small quantities of water **(11)**. This is because of the large area requirement which makes the system non viable when the cost of land is high.

2. A high technology high cost approach, whereby the two processes are carried out separately by means of specialised subsystems (see section 2.2). These indirect collection systems give outputs well above that of the still type distillers but they have two major disadvantages:

1. The high cost of specialised equipment (cost of collectors, storage and evaporators).

2. Frequent maintenance requirement.

From a survey conducted recently by the author, on the water consumption in Cyprus, it was concluded that a possible application of desalination would be a system suitable for the size of a two hundred rooms hotel.

From all the above it is concluded that the target for a desalination system would be towards a system which would utilise only solar collectors. These collectors have efficiencies well above that of a solar still. The objective is for the evaporation and latent heat recovery to take place at the collector itself. For this purpose a Parabolic Trough Collector (PTC) will be used which is suitable for high temperature applications. The receiver of the PTC will be designed in such a way so as to accommodate all the above functions. The collectors of such desalination system can be located on the rood of the hotel.

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The Origin and Evolution of the Universe

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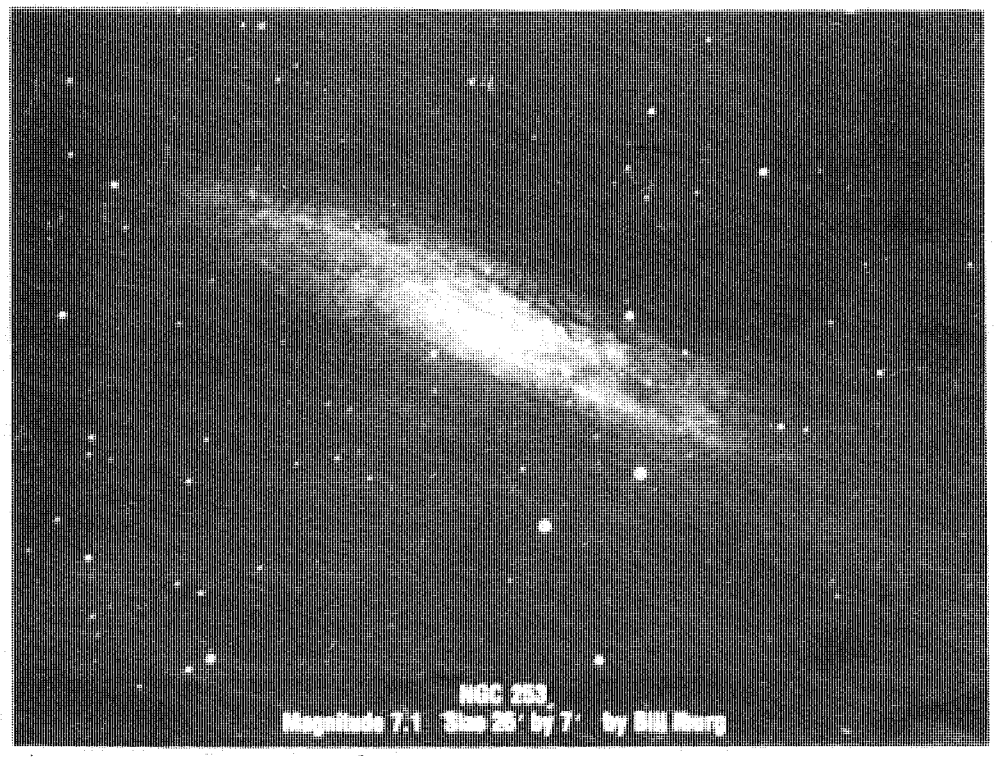
THE BIRTH OF THE UNIVERSE:

All mythologies and most religions tell a story about the birth of the Universe. Colorful, fascinating and often violent, they all include a sequence of events from chaos to order, initiated and supervised by one or many gods. Our modern picture of the Universe is due in large part to the American astronomer E. Hubble who in 1923 proved that the Milky way, the great concentration of stars to which our sun belongs was just one galaxy among thousands of millions of others scattered throughout the vastness of space. Hubble also found that the wavelength of the light from most of the distant galaxies was "red shifted" indicating that most of the galaxies are receding from the milky way with a velocity proportional to its distance from the Milky way. In other words the Universe is expanding! and the farther away the galaxy the faster it is receding. One conclusion therefore was inescapable; the Universe must have been smaller in the past. There must have been a moment when the whole Universe of the millions of galaxies and the trilions of stars was a superdense dimensionless point called a "singularity" giving birth to the Universe 18-20 billion years ago. This violent act of creation is known as the Big-Bang theory and it is widely accepted by most cosmologists. This idea of a Big-Bang means that the red shifts of galaxies observed in their emission spectra are not really due to a Doppler effect but they arise because in the time that light from distant galaxies has been travelling across space to us, the Universe has expanded "stretching" the wave length of light. The picture of a Universe which is expanding need not have been a surprise to anyone. If A. Einstein had only faith in his equations of his general relativity he could have predicted it in 1915. But Einstein hung on desperately to the idea that the Universe was static unchanging without beginning or end, an idea which was in accordance with the astronomical observations of those days.

The vision of a static Universe appealed strongly even to the modern astronomers and in 1948 three British astronomers H. Bondi, T. Gold and F. Hoyle proposed the steady state theory of the Universe. The Universe was



The NGC 253 Calaxy Photograph by an Amateur

expanding they said but perhaps it was unchanging in time.

The steady state theory proposes that our Universe is in a constant and homogeneous state governed by the same laws every where. Changes such as the birth and death of stars and galaxies can take place, but the overall features of the Universe remain the same at all times. But since the Universe is expanding, matter should be created constantly from nothing to fill the gaps. If this is so, then a side from the obvious question of where this matter comes from, new galaxies should be formed next to old ones something not yet observed. The steady state theory held its own as the principal challenger to the Big-Bang theory for two decades. Then in the 1960s two astronomical discoveries dealt it a fatal blow. The first discovery came from M. Ryle and his colleagues at Cambridge. They were studying the distribution of radio galaxies for almost 15 years and they found that there were many more radio galaxies at large distances than near by. The excess of radio galaxies at great distances had to mean that conditions in the remote past were different from those today. A Universe which changes with time ran counter to the steady state theory. Then in 1965 A. Penzias and R. Wilson two scientists at the Bell Telephone Labs in New Jersey detected an odd signal with a radio antena, they were using for satellte communications. The signal did come from all over the sky and it was equivalents to the energy emitted by a body at 3 Kelvin degrees above absolute zero.

There could be no doubt. Penzias and Wilson had discovered the remnant of the radiation from the Big-Bang, the cosmic microwave back ground radiation. They shared the Nobel prize and after this the steady state theory was dead.

THE EVOLUTION OF THE UNIVERSE:

In the earliest moments of the Big-Bang the stuff of the Universe occupied an extraordinary small volume and was unimaginably hot. It is of course an extraordinarily grand picture of creation. Yet astronomers and physicists, armed with a growing mass of evidence to back their theories are so confident of the scenario that they believe they can predict the detailed conditions in the early Universe as it evolved instant by instant. Unfortunately when it comes to answering the ultimate question -just how could space and time matter and energy have come out absolutely of nothing-the theories are not yet good enough. The best that Physics can do is to attempt to describe what was happening when the Universe was already about 10^{-35} seconds old. What do physicists think the Universe was like a mere 10^{-35} seconds after the Big-Bang[2]. Well the volume of space that was destined to become the entire visible Universe, thousands of millions of light years across was contained in a volume roughly the size of a pea!! and the temperature of this superdense material was 10^{28} Kelvin degrees. At this temperature energy was materialized producing the strange particles X-Boson and its antiparticle X antiBoson. The X-Boson is a strange particle with a mass 10^{15} greater than that of the proton and has not yet detected in the laboratory because it is impossible to recreate in a laboratory the exreme conditions that existed just 10^{-35} seconds after the Big-Bang.

It is reasonable to ask how far can physicists probe in their laboratories. The answer is to a time when the Universe was about one hundredth of a second old. At that time the Universe had grown to fill a volume roughly the size of the Sun. By then it had cooled down to 10^{14} Kelvin degrees a temperature not beyond the reach of experiments. Actually in 1983 physicists at CERN in Geneva managed to recreate these conditions in a particle accelerator and they created the W and Z Bosons, particles which vanished from the Universe one-hundredth of a second after the Big-Bang. The gap between 10^{-35} and one-hundredth of a second is really gigantic. It is certain that for most of this period matter was squeezed together more tightly than the most compressed matter we know of that inside the nuclei of the atoms. And as the temperature falls, so the energy level of photons declined creating smaller and smaller particles and antiparticles which were annihilated when colliding producing energy in the form of photons.

At some point the hypothetical building blocks of protons and neutrons, the undetectable quarks, came into being. Unfortunately no one has developed yet a satisfactory theory which explains how a "quark soup" behaves so this period is still unkown to physicists. By about one hundreadth of a second the "civil war" between matter and antimatter has ended and due to a strange asymmetry between matter and antimatter, the Universe was dominated by particles that are familiar to us today: photons, electrons, positrons and neutrinos. These mysterious neutrinos have no electric charge or mass and travel with the speed of light and therefore hardry interact with matter. They are emitted from the stars continuously and nobody knows the role they play in the present and the future of the Universe. There also

neutrons and protons but not many of them. In fact they were a small contaminant in the Universe.

The next important stage in the history of the Universe was at about 100 seconds after the Big-Bang. The temperature had dropped to 10^9 Kelvin degrees and the particles began to move more slowly, allowing them to fuse together to form helium nuclei. Solitary neutroms decay into protons in about 10 minutes, so any neutrons that were left over after the helium form became protons. According to physicists calculations roughly 10 protons were left over for every helium nucleus that formed. And these protons became the nuclei of hydrogen atoms. This constant proportion of hydrogen and helium is the strongest pieces of evidence that the Big-Bang really did happen. Eons later when the temperature had fallen considerably the hydrogen and helium nuclei picked up electrons to become stable atoms. Today when astronomers measure the abundance of elements in the Universe- in stars galaxies and interstellar space - they still find roughly one helium atom for every 10 hydrogen atoms.

At one time, almost all the electrons and their antiparticles, the positrons were colliding and cancelling each other forming photons. There were roughly 10^9 photons for every proton and neutron in the Universe, a ratio which persists to this day. But a slight asymmetry in the laws of physics meant that at about half an hour after the Big-Bang at the end of all the collisions there was a tiny number of electrons remaining. Ten thousand years after the Big-Bang, the Universe had cooled down to 3000^0 K slow electrons could fall into orbits around nuclei to form primeval atoms. Up to this time matter and radiation were inseparable in a "foggy" cosmic oven. Now radiation separated from matter and light traveling trhough space gave meaning for the first time to the words "brightness" and "darkness". This early nadiation, a fossil of the Big-Bang, unleashed into an expanding Universe cooled off slowly. We can still detect photons from this period. No longer creating matter, they have been flying freely through the Universe for about 18-20 billion years and astronomers observe them as the so called cosmic microwave background radiation. Whereas these photons started their journey when the temperature was 3 000 Kelvin degrees the Univerese has expanded a thousand times while they have been in flight. This has decreased their energy by this factor so that now the cooled fading of the Big-Bang like a giant energy echo bears testimony of the titanic explosion as faint microwave signal of 2,7 Kelvin degrees.

The temperature dropping to about 3000^0 K degrees also signalled another event, the point at which the energy levels of the radiation, of photons, in the Universe fell below that of matter. From then on the Universe was dominated by matter and by the force of gravity acting on that matter.

The building of elements however had stopped abruptly after the Universe had reached an age of 100 seconds and the protons and neutrons had formed the nuclei of hydrogen and helium for elements such as carbon and oxygen to form higher temperatures were needed but the Universe was getting colder all the while. The heavy elements like Iron, Nickel, Lead Uranium etc in the planets and in the living organisms were created billions of years later in the nuclear furnaces of stars. Instead as the Universe continue to expand gravity caused clamps of matter to accumulate in large "islands". These "islands" were to become the galaxies. The galaxies continued their head long rush into the void fragmenting into smaller clumps which became individual stars producing heat and light by nuclear reactions deep in their cores. At one point about ten billion years after the Big-Bang a yellow star accompanied by nine planets was born towards the outer edge of a great spiral whirlpool of stars called the Milky Way. The star was our sun and one of the planets was our home planet, the Earth.

THE FATE OF THE UNIVERSE:

The Big-Bang was not at all like the explosion of a lump of material in which fragments are blown away into an existing void. There was no void. Space and time popped suddenly into existence 18-20 billion years ago and the Universe began expanding. The critical question naturally arising is whether the Universe will expand for ever or stop. The astronomers assert that the important parameters to the question are the total mass of the Universe and the speed of its expasion. If there is not enough mass the Universe will continue to expand forever diluting its energy into larger and larger space and eventually dying as a "frozen" dark Cosmos. Such a Universe is known as "open".

If on the other hand, the mass of the Universe is large enough to slow down one day fall back into a tiny volume of compressed matter a "big crunch". This kind of Universe is known as "closed" and if the process repeats it self in an infinite number of "bangs" and "crunches" the Universe will "oscillate" for ever.

The total mass of the Universe is not easily determined but a rough estimate is possible by

adding the mass of all visible matter in the Universe. It was found that it can provide only 10 percent of the gravity needed to hold back the expansion. Even the addition of invisible objects, such as black holes and X-ray and infrared stars could not add up to the critical mass needed for a closed universe. There is another possibility, which depends on whether neutrinos have mass. There are as many Big-Bang neutrinos in the Universe as there are photons which are massless particles. If it is supposed that 100 million of these neutrinos to equal the mass of one atom; they could still make 90 percent of the mass of a Universe with enough gravity to slow down the expansion. Unless there is some mass "hidden" in the Universe as "strange matter" the fate of the Universe is decided definitely and uniquely by gravity.

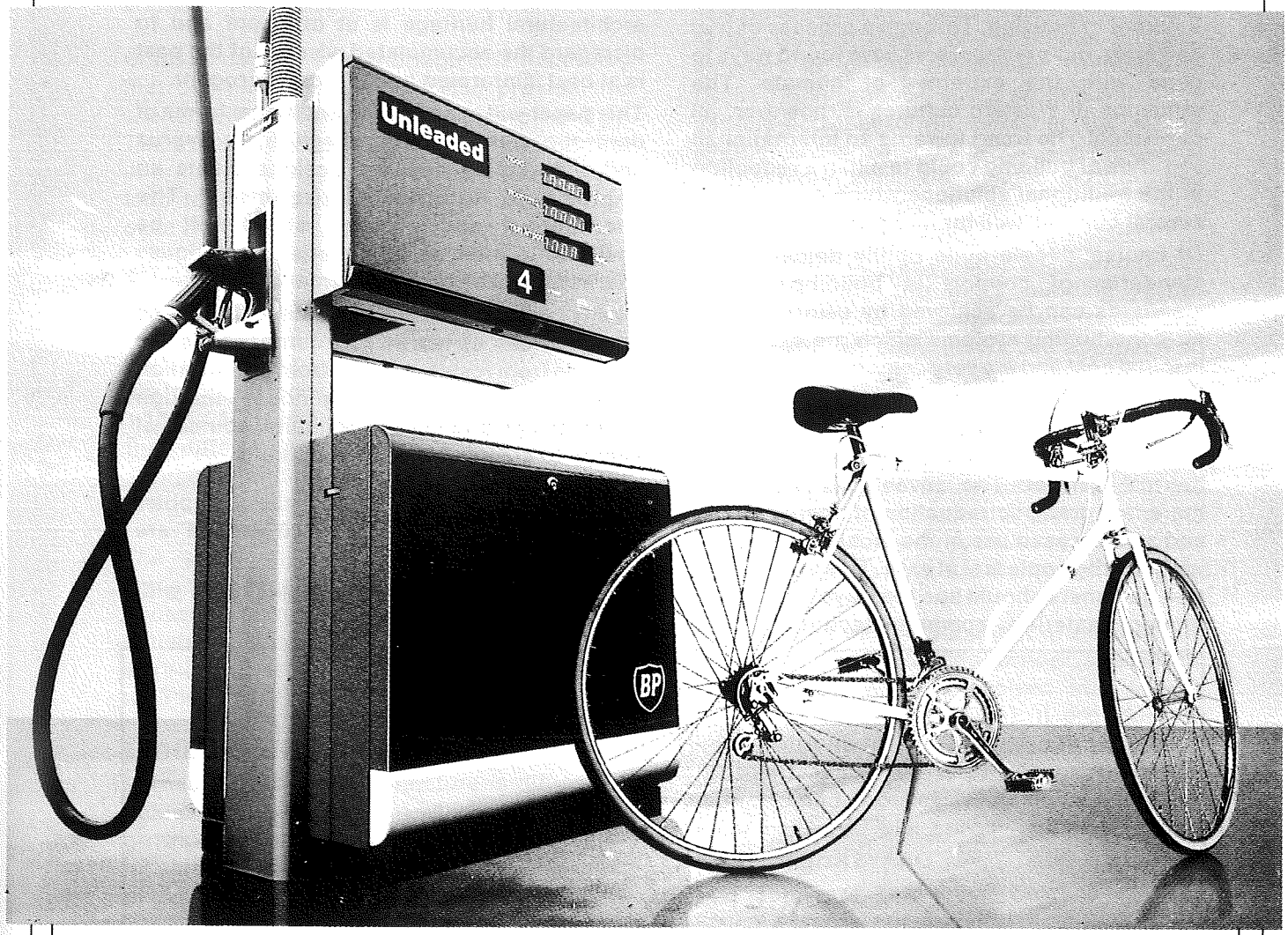
Why are things as they are?

In 1988 a high level scientific meeting was held on a topic that scientists have been discussing for years: The anthropic principle. This principle tries to maintain that human beings as observers are necessary to the very existence of the Universe. It might seen that the opposite is true. Here we are on a small planet of an average star lost in a galaxy that contains hundreds of billions of stars with additional stars in a hundred billion other galaxies. Why should there be so unimaginably huge Universe just for us. The answer is that the smaller the Universe the less time it takes for it to expand and then contract out of existence. The Universe must be as huge as it is in order for us to have had time to evolve. In addition the laws of nature are such that atoms can form. If these laws were slightly different the formation of atoms would be impossible. Again the events after the Big-Bang seem to have been such as to allow star and galaxies to form slight difference would have made them impossible. If it weren't for atoms' and stars' and galaxies' just happening to be possible we ourselves would not be possible.

Quantum theory also makes it look as if we are indispensable. According to quantum theory there are conditions in which it is impossible to tell just what an electron is doing until it is actually observed. When the electron is not observed it is not even theoretically possible to decede what is doing. Some scientists take this to mean that the Universe can't exist without observers. A Universe must have observers according to this theory and it must have observes from the start to the end. But then even the sumplest human beings didn't evolve till the Universe was 15 billion years old. The Earth itself wasn't formed till the Universe was 10 billion years old. Does that mean there are other forms of life on other planets that did the observing? Or does it mean that the Universe was formed just for the benefit of human beings by God? And that God is answer to all observers through all of eternity? This postulation might seem necessary according to the "strong anthropic principle". However most scientists prefer a "weak anthropic principle" stating that there are other Universes each with a different set of laws of nature. In perhaps all but one of these Universes the laws of nature don't allow life to exist. In only one of them do the laws of nature allow for the existence of life. This one Universe will be at how exactly suitable the Universe is for us. But this has nothing to do with us really. We find our Universe is perfect only because it is the only one we could exist in. May be in other Universes where life (as we know it) could not exist other kinds of life or other types of unimaginable phenomena might prevail. And every one of these laws or phenomena that had the capacity to wonder would wonder why their Universes are so fit for them.

Our existence therefore depends on a combination of coincidences and on the even more dramatic concidences of nuclear energy levels predicted by Hoyle. Unlike all previous generations we know how we come to be here. But like all previous generations we still do not know why.

BP Αμόλυβδη.
Η αμέσως καθαρότερη λύση.



Αν σας ταιριάζει το ποδήλατο, καμμιά αντίρρηση. Αν όχι, διαλέξτε την αμέσως καθαρότερη λύση. Την Αμόλυβδη βενζίνη της BP που χρησιμοποιείται από τα τελευταίου τύπου αυτοκίνητα - εφοδιασμένα με κινητήρες αμόλυβδης βενζίνης - για προστασία του περιβάλλοντος από το μόλυβδο.

BP Αμόλυβδη λοιπόν, για καθαρότερο περιβάλλον και ανώτερη ποιότητα ζωής.

Αυτή είναι η ποιότητα της BP - της πρώτης εταιρείας πετρελαιοειδών στην Κύπρο - της εταιρείας που πρώτη εισήγαγε την Αμόλυβδη στην Κυπριακή αγορά. Ανακαλύψτε την σ' ένα από τα πρατήρια BP.

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Δυναμικά Μπροστά!

The Architectural Heritage is at Risk

Paper Presented at the International Conference on Applications of Solar and Renewable Energy, Cairo April 1992 and Published in ISES SunWorld.

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ABSTRACT

Domestic vernacular architecture has evolved over many years to address the problems inherent in housing. Through a process of trial and error, our predecessors have found ways to cope with the extremes of climate. The influence of Western cultures is, however, all pervading. The trend towards an internationalised style of building could result in a reduction in the traditional solutions which have served several cultures well for many centuries.

Of course, people quite rightly demand high standards of comfort in buildings. Such standards can be achieved by using modern air-conditioning systems which are expensive in initial cost and are very demanding of energy in the long term.

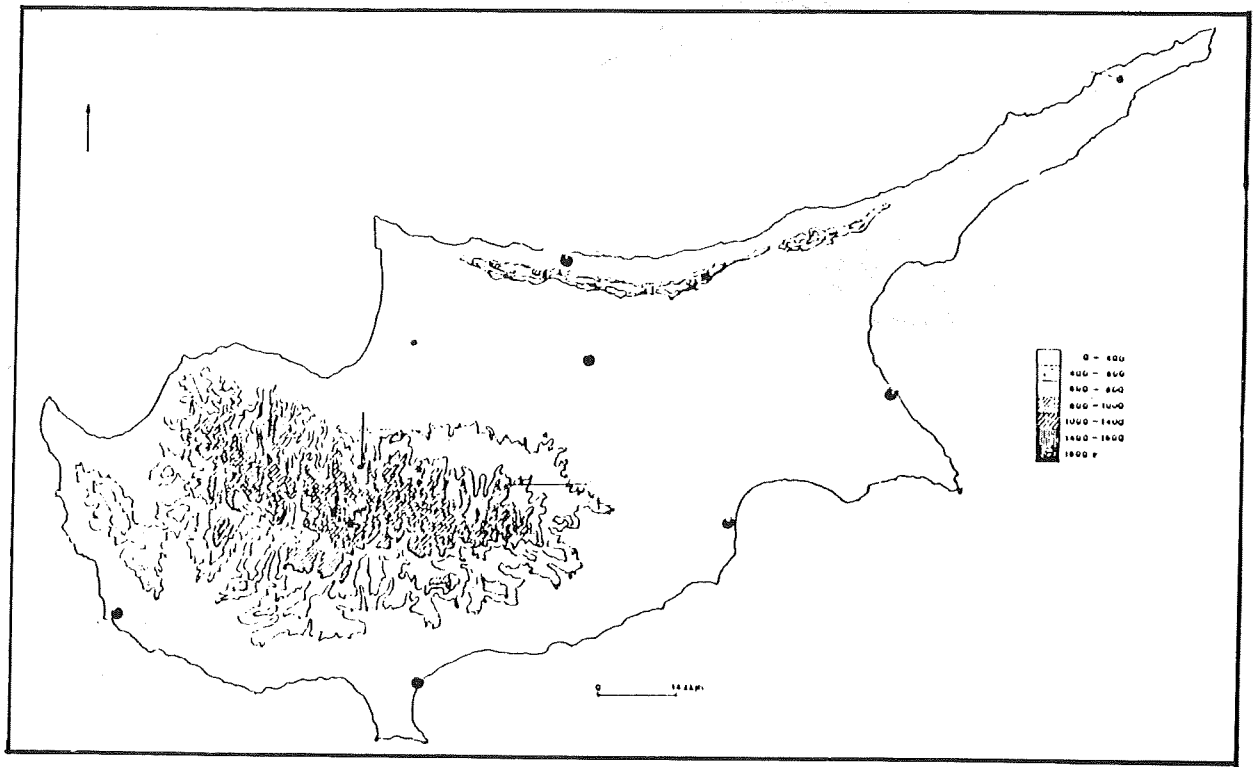
It is possible to create the standards required with the careful use of traditional techniques of thermal control. The advantages are clear, there is a dramatic reduction of energy needs and an increased use of the architectural style with which people feel at ease. This is not to say that designers should ape the ways of the past. Modern materials, computer technology and innovative construction techniques must be used in the search for efficiency and cost-effectiveness. However, to ignore our architectural heritage is at our peril and to disregard the accumulated wisdom of the past is at best illinformed and at worse arrogant.

This paper will examine the traditional forms of domestic vernacular architecture in Cyprus and will explain how the designs create an appropriate internal environment. The international and evolving styles will be analysed to indicate how modern techniques address the problems of thermal control.

Finally comparisons will be made to determine if lessons can be learnt. The comparisons will be made from results derived from optimization studies fo the contemporary house, through varied design and the use of natural sources of energy to achieve comfort conditions.

For the optimimization studies microcomputer version of "SERI-RES" and "5000 Method" are used.

The paper will be extensively illustrated with slides.



Map 1.1: Cyprus

1. ARCHITECTURAL TRENDS AND THE BIOCLIMATIC APPROACH

The traditional Cypriot houses, with great wisdom, provided shelter from the extremes of climate in a variety of ways without consuming very much energy. The coolness of old buildings on a hot summer afternoon never fails to impress not only visitors but even the locals and make one wonder how the indigenous builders could create such comfortable buildings without the aid of scientific knowledge.

In these days of fuel shortage it is necessary that our modern buildings also provide this shelter with the least expenditure of energy. There is today a vast accumulation of technical information and yet our present-day houses tend to be less comfortable than traditional ones (Ref: 1.24).

A retrospective examination of traditional architecture is necessary to determine how our predecessors tackled thermal design problems, both in the context of their life styles and with the tools and techniques available to them (Ref: 1.16, 1.21). It is also important to understand the differences between the present-day approach and strategies and those of the indigenous builders.

The study in depth of the evolution of vernacular architecture reveals in the form of houses, a complex of cultural values, needs, influences, wishes and dreams, and how they were influenced by the climatic conditions of their locality (Ref: 1.7, 14, 1.16, 1.21).

2. THE TRADITIONAL HOUSE

Vernacular Cypriot architecture is difficult to define; like the land from which it springs or grows it reflects the varied life style of its inhabitants and the availability of the resources of each region.

The variety of terrain on the island (plains, hills, mountains, seashore (Ref:1.13), spawns a variety of needs, building materials and hence building form (Map:1.1). In addition, the long experience of local builders and their devotion to tradition, intermingled with the ability to receive and assimilate foreign cultural preferences are reflected in the variety of habitats creationed on the island (Ref:1.9).

3. THE ARCHETYPE

Tracing the evolution of vernacular Cypriot architecture, an archetypal form of a single, long, rectangular roomed building ("Makrinary"=Long room) is revealed as the simplest basic shelter of the Cypriots. (Ref:1.16, 1.21).

The division of this room, ("Dhichoron"= Double=space), the addition of the Portio ("Heliakos"=Solarium), and other rooms plus the courtyard, developed the layout into various configurations which interrelated with a specific lifestyle, needs, climatic conditions and topography (Fig:1.4.1).

4. THE SOLARIUM

The Solarium is an indispensable solar feature of the Cypriot house and a unique building element in Greek vernacular architecture (Ref:1.12). It is a focal space around which the various activities of all the other spaces are synthesised whether the house is in the plains, in the mountains, the villages or the cities (Fig:1.4.4).

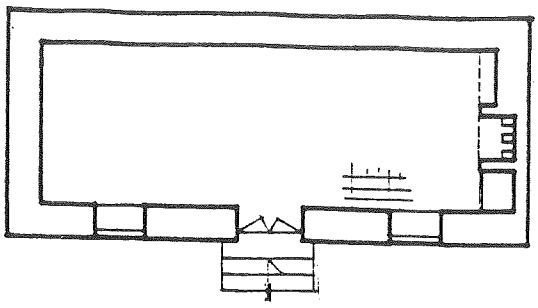
The Solarium acts as a transit space and unites the outer with the inner building layout (Fig:1.4.5). It is a significant architectural feature and an early instinctive approach to passive solar design. It is an extension of the house outwards and simultaneously of the courtyard inwards. An internal space with its south side open accommodates the functions of the "Dhichoron" in the summer and in the sunny winter days. Also the activities of the courtyard are transferred to the solarium when the weather does not allow them to take place in the open air.

Its solar role was predominent whether acting as a portio, as an archaded corridor, as a central axis or even when it evolved into a self-contained space (Fig: 1.4.1). It provided the house with its focal space even in periods of prosperity when the construction of bigger multiroomed houses was financially and technically possible.

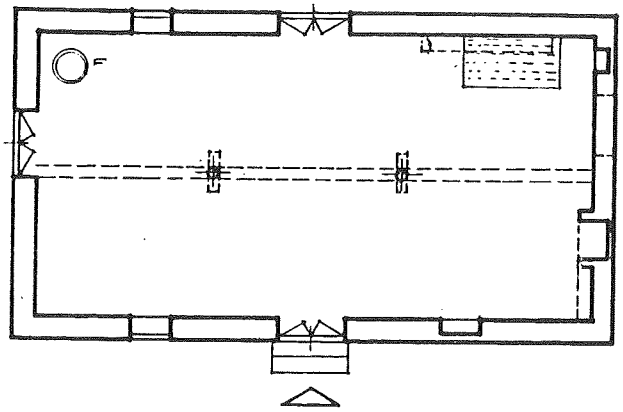
5. THE COURTYARD

The courtyard is another building element which acted as a climatic modifier in the Cypriot house. It is an arrangement which evolved naturally from the climatic conditions, the needs of the family and the social structure of the community (Fig:1.4.3).

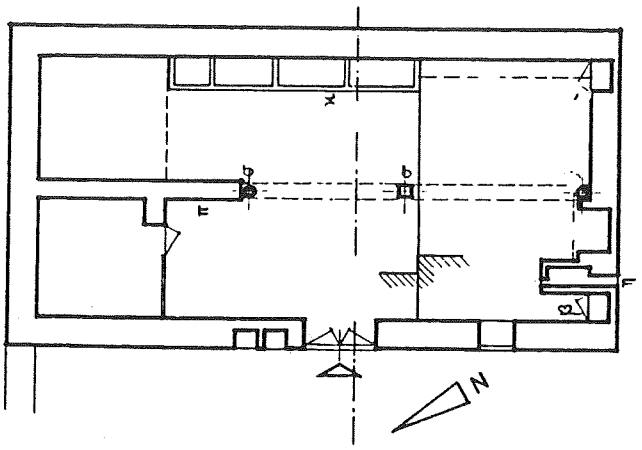
Whether it opens onto the road allowing social contact, or is secluded at the rear of the house for privacy, protected with high abode walls or the house volume itself, it always creates a micro-climate that moderates the climate surrounding the building. Planted mostly with deciduous vegetation like grape-vines, pomegranates, fig trees etc., offers shade in the summer and admits sun in the winter. It also creates windy sides which are most valuable



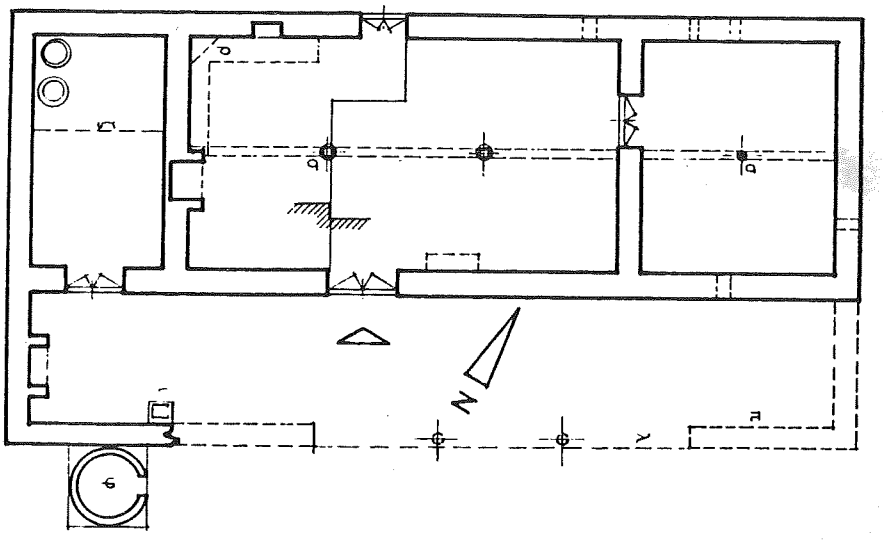
(a) "Makrinari"
(Long Room)



(b) "Dhichoron"
(Double Space Room)



(c) "Sospiton"
(Inner Room)



(d) "Heliakos"
(Solarium)

Fig. 1.4.1: Evolution of the Cypriot House

when one seeks the breeze in the summer and calm corners in the winter. Arched arcades at the perimeter are indispensable to shield the overhead midday sun (Ref:1.8, 1.11).

6. THE INHABITANTS

Besides the solarium and the courtyard, the two fundamental means, used in traditional building design, to temper extreme weather conditions, there exist numerous other architectural aspects and building elements in the old houses reflecting the wisdom of tradition (Ref:1.11, 1.20(iv), (v)).

The inhabitants themselves however were the single most powerful contributors to the success of their climatic designs (Ref:1.24). Their genuine approach to problem solving, and their tendency for self-sufficiency, is expressed in their willingness and ability to organise daily activities in such a way so that all spaces were used dynamically without having to be maintained at equal levels of comfort. At any given period the active use of the building could be restricted to those areas most comfortable at that time. Furthermore the inhabitants were attending the use they made of the building and thereby changing its thermal charàcteristics; the variations taking place according to the time of the day or according to the seasons. By this method it was possible to protect the building interior from solar radiation in summer, to retain warmth or coolness as required and even to cool the building interior by evaporation of water from the skin and the surrounding courtyard and vegetation.

7. DEPARTURE FROM TRADITIONAL WISDOM

The traditional thermal considerations used in building design have been contemporarily forgoten or abandoned and there are no signs in the new houses to remind us the wisdom of the old (Ref: 1.7,1.11).

The Cypriots left behind the sincerety and warmth of the Greek life style of close human contact and modelled their lives on Western social prototypes. This brought about different socio-economic relations. The small size of the Cypriot community and hence the strong identity of the individuals, exaggerated the "status" influence on the society and was soon reflected in their homes. The cramped spaces copied from the West left no option or even consideration for traditional orientation.

Furthermore the imposition of general regulations, such as the 3m set back from the boundaries, predetermined that houses were built in isolation. This is in contrast to the natural, organic evolution of the traditional grouping of buildings close to each other using common walls which create thermal envelopes as "sunshadows" and "windshadows".

The influence of the post-war movement for "International", mass production architecture, due to:

— Training of architects in various countries
— Mass media
— Tourism demands
— Uniformity of materials and technology
— Quick, cheap and easy approach to design solutions,

has further resulted in Cypriot buildings which are climatically inept. Buildings 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 aggrevated adverse climatic conditions. Adoption of foreign architectural solutions in Cyprus often accentuates the extremes of the climate.

The buildings hae become enclosures for our artificial enviroments and often their shells act as an additional obstacle to the efficient use of their mechanical installations. By behaving "worse than the climate itself" such designs demand more consumption of auxiliary energy through mechanical equipemnt simply to control their indoor environment (Ref:1.20 (v)).

In addition to the above influences, there are more interrelated factors which increase the complexity of the architecture of the contemporary Cypriot house.

The trend towards greater standards of comfort in recent years, coupled with the tendency of the human animal to adapt to its environment has led to the increasing use of air conditioning systems, and more energy demand than the common sense approach of our predecessors.

As our society becomes more demanding and litigatious, the safety factor in engineering increases not only for present but even more so for future demands. These cost increases are passed on to the ultimate user of the building (Ref:1.11).

8. THE MODERN VILLA

The architectural scene in Cyprus today is in discord and disharmony with the natural environment. The attempts at originality are obvious in building design, but also obvious is the lack of wisdom to confront the harsh climatic conditions. The result is modern villas which are struggling to achieve indoor comfort conditions and consequently devour large amounts of energy.

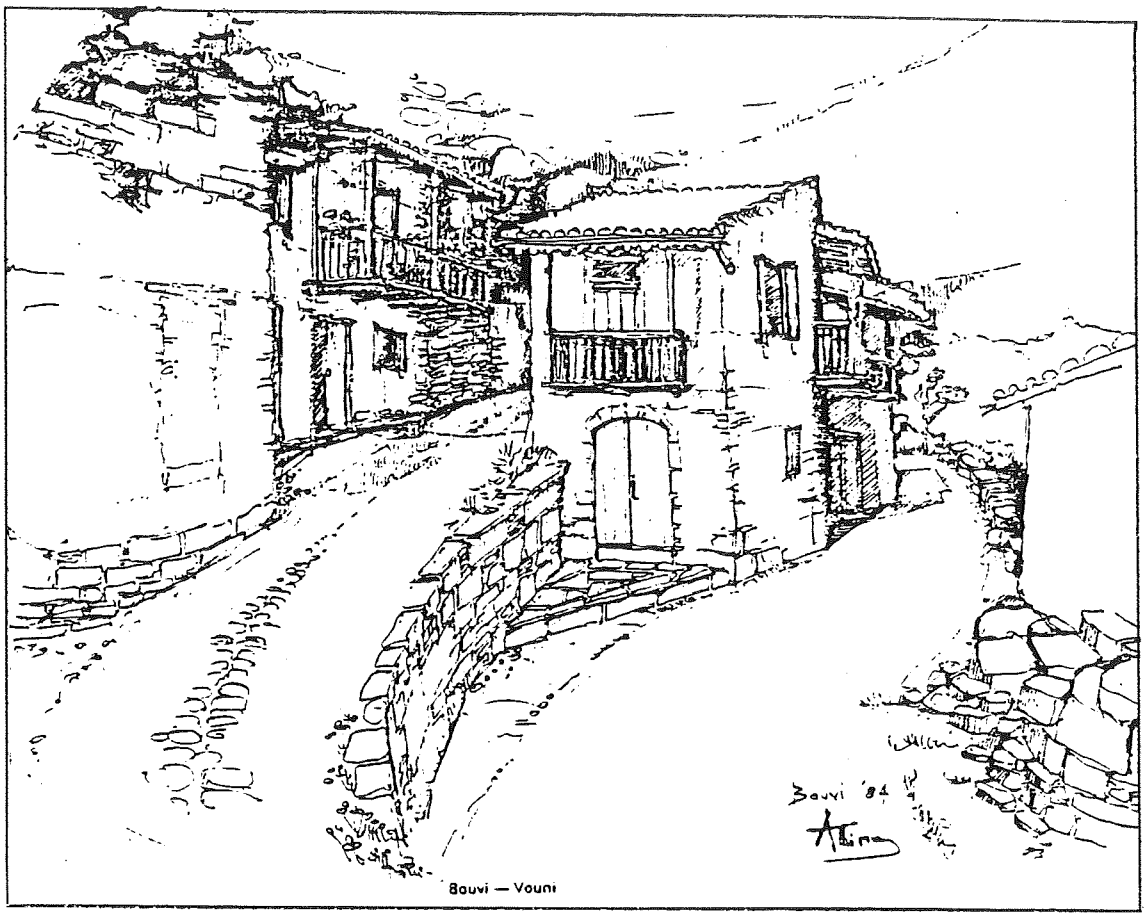


Fig. 1.4.2: Traditional Village

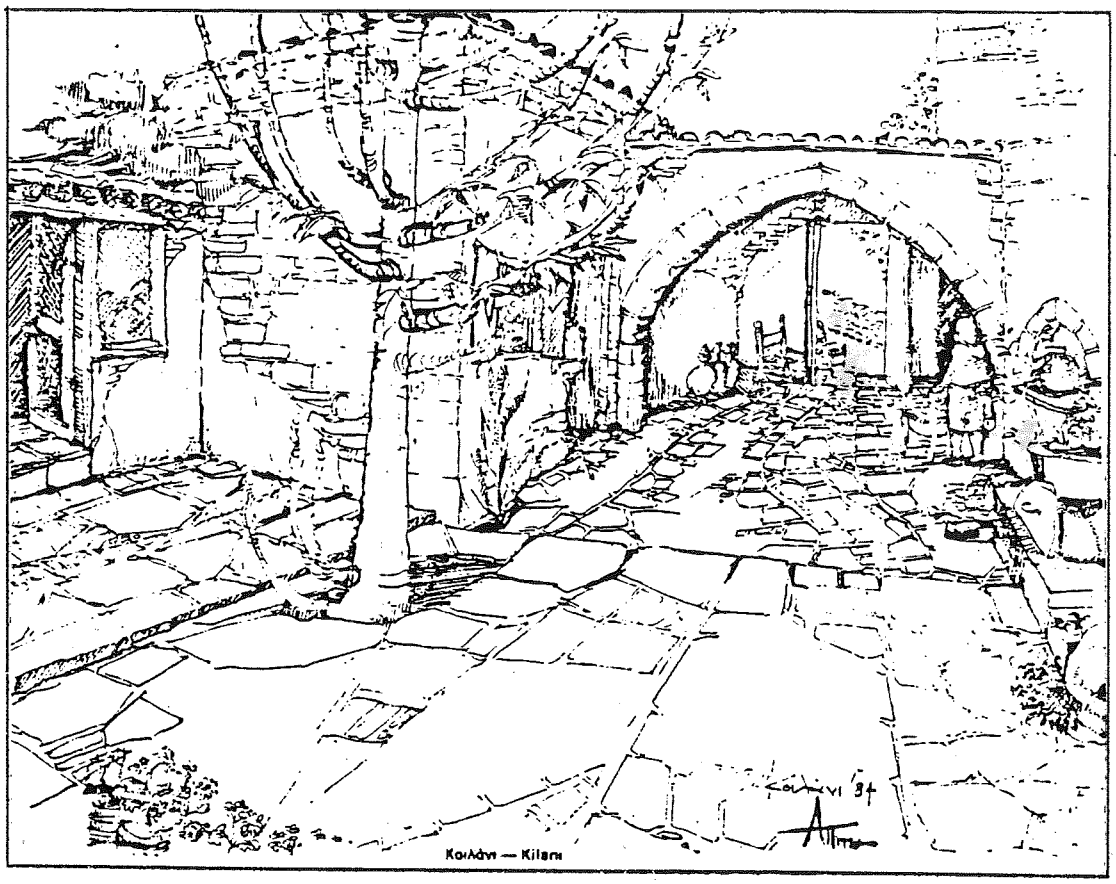


Fig. 1.4.3: Traditional Courtyard

Maximum exposure of the external envelope of the house to the sun is inappropriate for Cyprus. It will also be colder in the winter. The tendency to elevate the building on columns (pilotis) with the prospect of integrating shops or stores in the future or to house the car of the family, results in similar problems (Fig:1.4.4). More of the surfaces are exposed to ambient temperature fluctuations. Elevated buildings no longer have that contact with the earth that keeps a constant 10 to 13 degrees centigrade temperature.

However with a wind, the raised pilotis creates a higher velocity (venturi effect) of air moving under the house which causes the temperature to drop significantly. This is convenient in the summer, but detrimental during the winter (Ref:1.11).

The modern villa does form a court but it is typically underneath the building with no solar access in winter. It no longer serves as the welcome social, transit space between outside and inside, public and private as the traditional courtyard. Its traditional range of functions; children rearing, containment of the animals, and space to live during the majority of the seasons are reduced to the storage of garbage and car parking.

The solarium is no longer a solar feature or indeed the focal space of the Cypriot house. It became the manifestation of social status and no longer resembles its original form and functions. Its name has also changed; it is replaced by its European version "Entrée" and "Hall".

This contemporary scene brings about a sense of nostalgia for the traditional wisdom which may encourage designers to derive lessons from our ancestors (Ref:1.1).

9. TRANSITION FROM TRADITIONAL TO CONTEMPORARY HOUSE

It is evident that the task of modern architect is considerably more complicated than that of indigenous builders. The demands of modern life introduced new factors and considerations into the design of buildings beyond the "basic" traditional ones. As technology advances and life becomes more demanding, the judicious and optimal organization of complex variables involving technical, social, utilitarian and cultural aspects, still converge on creating comfort and convenience to the user. The priority of architects in the design process alters; machines become more important in producing appropriate comfort standards. Moreover as the feeling of comfort is a subjective perception it varies from person to person from culture to culture and over time. So it is unfair and wrong to judge thermal comfort levels in traditional buildings by the same yardstick that we use for modern ones (Ref:1.8).

However the tools, materials and techniques available to the modern architect are more than the indigenous builder had access to. In addition the architect has the advantage of the accumulated knowledge of predecessors.

Through these two key areas, of viable traditional approach to house building on one hand, and the highly complex set of design criteria of conventional practice on the other the basic objective is to derive recommendations for the efficient utilisation of energy in contemporary architecture (Ref:1.2).

10. APPROACH

For the attainment of this aim, the comfort standards for single family detached houses in Cyprus, taken as a basis in the optimization study, through investigation of current thermostat settings, reviews of thermal comfort studies in Cyprus and internationally were established in the first stage. This is followed by an analysis of the prevailing climatic conditions in Cyprus to assess how energy demands for heating and cooling arise in domestic building and to evaluate the free energy systems available to contribute to these requirements.

Furthermore an evaluation of traditional, existing and new built houses, was carried out, to identify deficiencies in the regulatory systems inherent in the built form that result in heating and cooling demands.

In this respect influencing factors such as:

a) Building regulations and planning legislation
b) Architectural trends
c) Building construction
d) Energy source and usage
were reviewed.

Initially simplified thermal calculations were carried out using "Method 5000", a well established method adopted by the commission of the European Communities Handbook. These were followed by detailed hourly simulations of selected variants in order to compare the thermal performance of the traditional and the contemporary house, using dynamic simulations of selected variants in order to compare the thermal performance of the traditional and the contemporary house, using dynamic simualtion models such as SERI-RES.

The main tested variables are:

— Shape
— Mass
— Fenestration
— Insulation

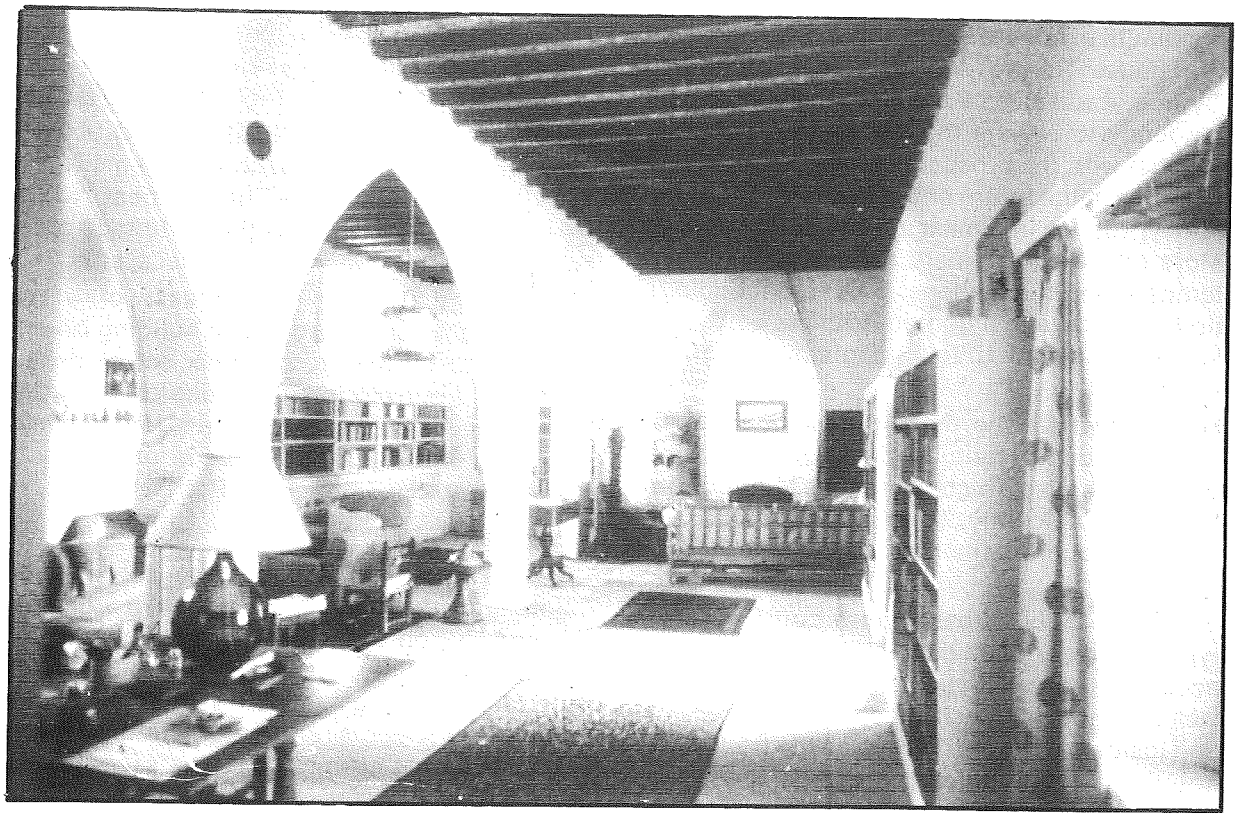


Fig. 1.4.4: Solarium as Internal Space

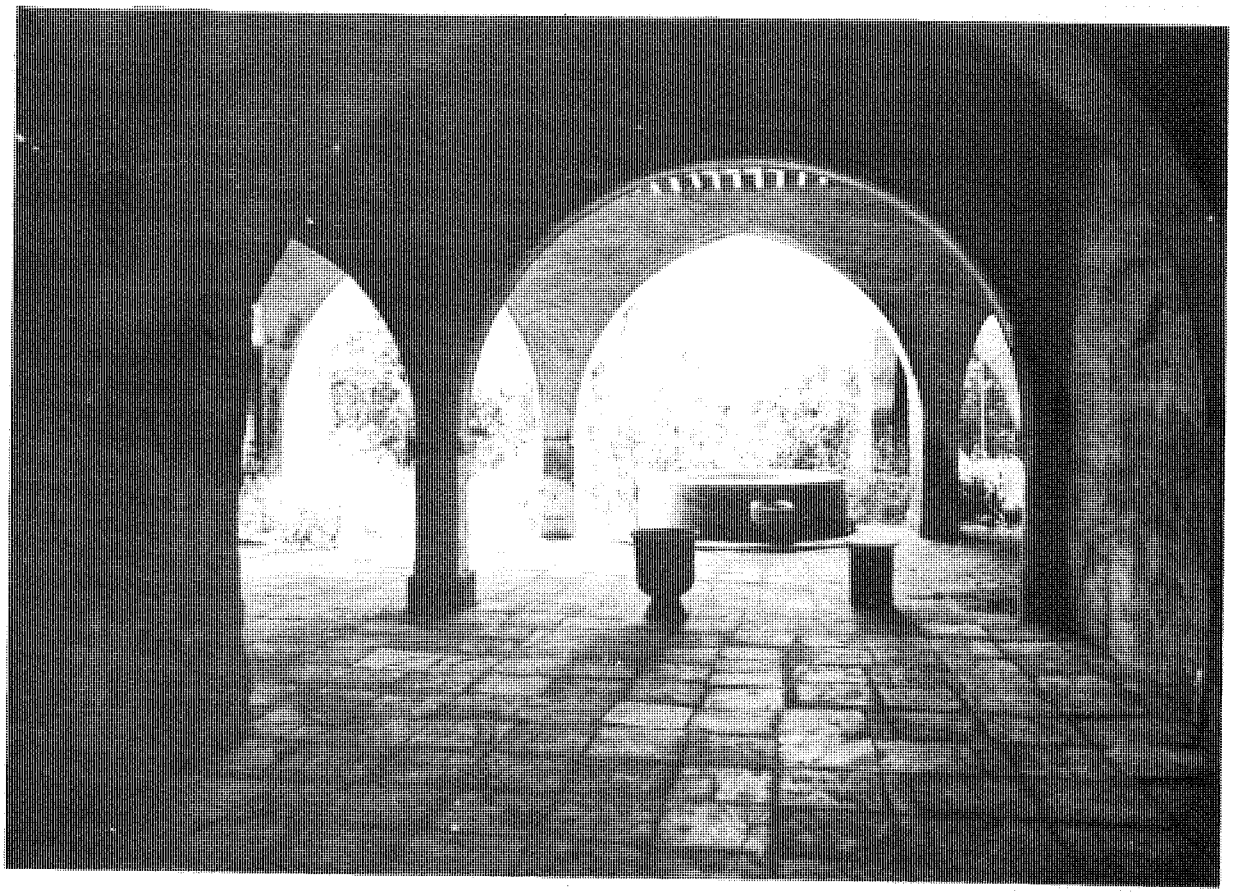


Fig. 1.4.5: Solarium as External Space

In the final stage, recommendations for new houses are made, through comparative assessment of obtained results.

11. CONCLUSIONS FOR ENERGY EFFICIENT HOUSES

It is concluded that successful climatic design in Cyprus should not ignore the accumulated experience and wisdom of our forbears but rather it should develop after a deep understanding, through scientific comprehension, rather than an emotional appraisal of traditional architecture.

On the other hand, the mass knowledge and technology coming from the West should not be ignored either. The architecture must be a synthesis of both aspects so that it is in harmony with the traditional values suitable for the contemporary Cypriot society, its cultural identity and human scale and based on the appropriate technology.

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Managing Systems Quality Improvement

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Improvement for the sake of improvement has value striving for improvement offers challenge, which people who like having their abilities tested and stretched enjoy. Striving to improve quality brings out the best in both individuals and organizations. The means is the end. Quality is not a destination but a journey, and it is the journey that is valuable.

Unfortunately, this view of quality improvement does not by itself convince IS (Information Systems) managers to embark on a quality improvement program. A convincing argument can be made by looking at the IS department's bottom line and seeing the effect poor quality has on it.

In his book Software Engineering Economics, Barry Boehm concludes that systems development organizations typically spend approximately 30% of their budget on verifying and validating (i.e. ensuring the quality) of new systems. The total spent on quality related activities, however, is probably more when the following factors are considered:

- Specification errors found during the design phase.
- Design errors made during the programming phase.
- The time a programmer spends coding and compling — Then testing, debugging and fixing.
- Parallel and conversion testing and correcting.

It has been said that people are always trying to get something for nothing. The same can be said of software development managers, who are looking for technological breakthroughs that will significantly and effortlessly improve systems quality. There have already been such technological breakthroughs as higher-level languages and CASE, but even these breakthroughs have made demands on systems developers.

Although CASE tools can improve productivity, these tools cannot remove the complexity of software applications, which systems developments managers often overlook. Software applications are designed to model human activity and whether word processing, paying invoices, or steering a missile is modeled, the activity is always complex.

CASE tools, do provide a significant advantage over traditional development tools. Much of the improvement realized with CASE tools lies in the elimination of higly detailed development activities. In these instances, CASE tools, improve productivity as well as quality.

CASE tools can help improve quality, but the current tool set does not have the ability to manage the complexity of large software systems. Until tools evolve to the point that they can reduce this complexity, improving systems development quality will remain a tremendous challenge that requires large investment and commitment on the part of IS management.

Systems quality is not easily achieved; dedication, commitment, and persistence are required by all involved in systems development.

How can a systems development manager improve quality? A systems development manager can affect the level of quality only indirectly. The people with direct control over quality are those actually developing the system if the manager is directly involved in development activities, greater control over the level of quality can be exerted, but what can a manager not directly involved in the activities do?

Some managers resort to frequently exhorting staff members to improve quality.

Exhortations, however, do not always work. There are more effective methods for ensuring a high level of quality. With proper focus, all development staff members are capable, with or without the aid of CASE tools, of delivering reliable, high-quality systems. The necessary focus can be achieved by:

- Making quality tangible
- Correcting areas in the development prone to errors
- Leveraging the investment in quality by incorporating quality improvement into the early phase of the development process
- Making all development personnel responsible for quality and quality improvement.

Systems development managers use three basic criteria for judging the success of a

software project, cost, schedule, and quality. Cost and schedule are easily judged; they are made tangible because they are tracked, counted, measured, and reported. Quality, however, is rarely made tangible because systems development managers fail to measure it.

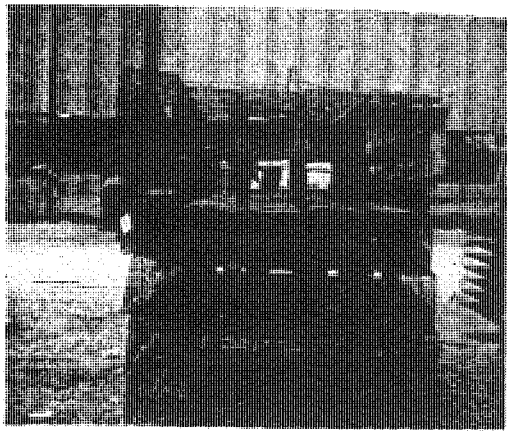
Most judge quality by the number of user complaints about the system. If there are not too many complaints, the system is considered to be of sufficient quality.

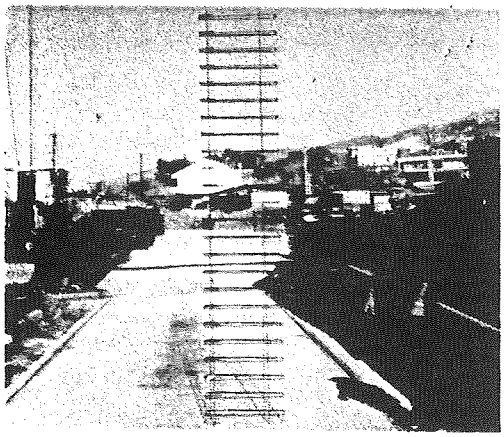
The first step in improving quality, therefore, is to measure it. It is not important how quality is measured, but that it is measured.

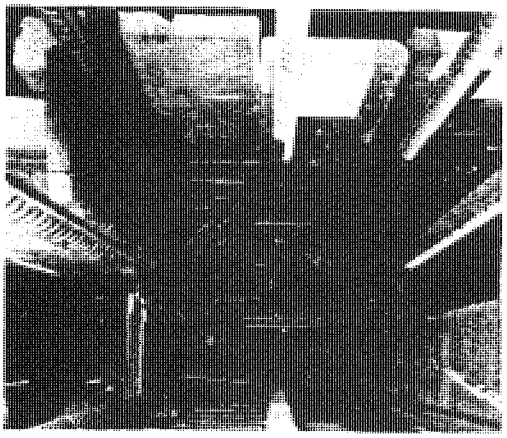
If systems development personnel are to focus on improving quality, there must be a procedure to measure it. Almost any measurement is more effective than no measurement. To be effective, however, the measurement must be based on reasonable criteria and the measurement process must be visible.

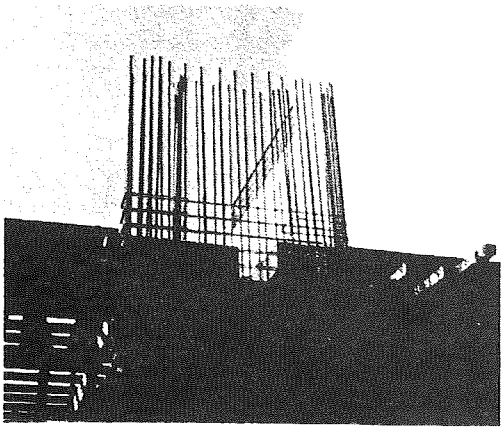
Measuring quality and making the measurement process visible accomplishes two goals. First, the organization's performance is objectively assessed. Second, and more important, organizations and individuals are encouraged to focus on quality because the measurement process has made quality tangible, as well as more precisely defined and understood.

Improving quality for the sake of improvement has its own value. In addition to this value, improving systems quality can substantially save IS organizations money. CASE tools can help improve the quality of systems development but only IS management can significantly improve systems quality. One step towards improving quality is making quality tangible by measuring it. Subsequent steps involve ensuring quality in the first phase of systems development, and making all IS staff members, especially management, take the responsibility for improving systems quality.



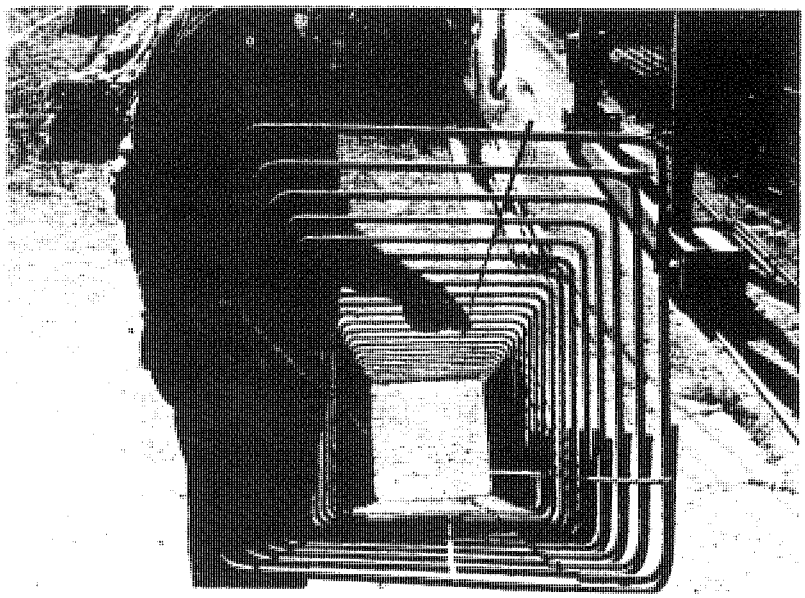






ΜΑΝΔΥΑΣ

ΣΥΓΚΟΛΛΗΜΕΝΟΣ ΚΛΩΒΟΣ ΣΥΝΔΕΤΗΡΩΝ ΓΙΑ ΚΟΛΩΝΕΣ & ΔΟΚΟΥΣ



- Ομοιομορφία και ακρίβεια στον οπλισμό συνδετήρων.
- Λειτουργία «μανδύα» - αύξηση της θλιπτικής αντοχής και πλαστιμότητας.
- Οικονομία χρόνου, εργατικών και υλικών.
- Ευκολία ελέγχου και επίβλεψης.
- Αποφυγή του κινδύνου μετατόπισης των συνδετήρων κολώνων.
- Εξασφαλισμένη πύκνωση συνδετήρων στους κόμβους - αντισεισμικότητα της κατασκευής.
- Ευκολία, ταχύτητα και οικονομία.

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Explosive Welding and its Practical Applications

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This article describes the theory of explosive welding with particular emphasis on its key parameters. Practical applications are then described and the article is concluded with some metallurgical observations on this interesting welding process which is a particularly effective technique for joining dissimilar metals.

It has long been realised that metals could bond as a result of high velocity oblique impact. It was well known during the First World War that a bullet or shrapnel could adhere to the metal surfaces they impacted[1]. The occurrence of this scientific phenomenon was not appreciated as a welding process at that time and it was only in 1944 that Carl[2] recognised it as a solid phase welding process. This chance observation was then developed during the next 45 years to what has today become a well established industrial process.

Although explosive welding (like any other process) suffers some limitations it is however one of the most effective techniques for welding dissimilar metals. It is generally used for the production of composite metal sheets and for lining tubular shapes with thin layers of alloy materials for corrosion protection.

EXPLOSIVE WELDING THEORY

Explosive welding is achieved when a metal plate is accelerated by an explosive charge to a high velocity oblique collision with another metal plate. Figure 1 demonstrates the basic configuration of explosive welding where a flyer plate is accelerated under the influence of the detonation gas to impinge obliquely onto a base plate. In doing so a jet of metal (from both plates) in the form of a 'spray' is ejected ahead of the collision point cleaning the weld surfaces of any oxide films or surface impurities. The pressure at the collision point is estimated at 250 Kbars which is well in excess of the yield strength of any metal. Thus, under these conditions the interfaces of the two metals are subjected to an interatomic contact where the cohesive energy, or more simply the balance of the interatomic forces between the metal atoms, results in a solid phase weld.

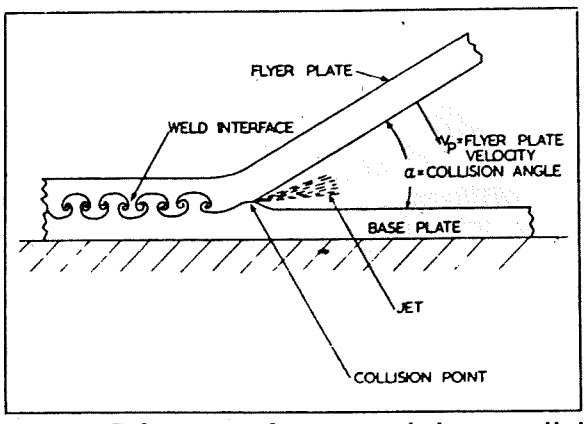


Fig 1. Schematic diagram of the parallel plate welding configuration.

Extensive experimental work indicates that the following important conditions govern the jet formation:

- At all times (whether or not the collision point moves with a subsonic, sonic or supersonic velocity) the pressure at the collision point must exceed the dynamic elastic limit of the material to ensure plastic deformation of the metal surfaces and the formation of a jet.
- If the collision point velocity is subsonic, theoretically jetting will occur at any collision angle. In practice, however, a minimum collision angle is required to satisfy the collision pressure requirements mentioned above.
- If the collision point velocity is supersonic, jetting will only occur above some critical angle. This critical angle is strongly dependent on the welding configuration used and it must again satisfy the collision point pressure requirements mentioned above.

The sonic plate velocity discussed above is defined as the velocity of sound in the metal plate and is described by the following equation:

$$C = \sqrt{\frac{E}{\rho}}$$

Where C is the sonic velocity
E is material elastic modulus
ρ is the material density

Explosive welding can be achieved through a range of collision angles 4^0-45^0, however, the explosive and geometrical parameters must be controlled in such a manner as to give the

correct collision angle and collision point velocity for a good quality weld between a particular metal combination.

EXPLOSIVE WELDING PARAMETERS

The explosive welding parameters have been mainly derived from empirical data and the relation between explosive variables and impact phenomena is confined to commonly used metals. Some of the metal alloys used in industry today require individual assessment with regard to their behaviour under impact loading. However in general terms the following parameters have been suggested[3,4] as guidelines to successful explosive welds.

1. In general the detonation velocity of the explosive used must be less than the sonic velocity of one of the metals, whichever is the lowest.
2. The limiting conditions for jetting (mentioned in the previous section) must be avoided.
3. The collision angle, α, should exceed a limiting value below which welding will not occur regardless of Vp. This value of α may be related to the thickness of the contaminant surface film.
4. A minimum value of impact pressure, which is related to Vp, must be achieved to produce extensive plastic deformation at the interface.
5. Above this minimum impact velocity the conditions for an acceptable weld appear to be associated with the kinetic energy imparted to the flyer plate by the explosive charge. The kinetic energy for a satisfactory weld may be related to the strain energy to cause dynamic yield of the stronger of the two materials.
6. For metal combinations where a brittle intermetallic can be formed there is an upper limit of the impact energy beyond which the weld is weakened by the formation of excessive intermetallic compound. Even where brittle intermetallic compounds are not a problem there will still be an upper limit. If there is excessive melting at the weld interface then the weld created may be torn apart by the reflected tension wave from one of the free surfaces before the metal at the weld interface has developed sufficient strength.
7. The stand-off or space between the flyer and base plate in a parallel welding configuartion should exceed half the flyer plate thickness to allow the flyer plate to reach its maximum velocity.
8. There appears to be no effect of anvil characteristics on the weld quality but in practice this could well affect the damage done to the product and in particular the amount of distrortion of the product.

Although these parameters may satisfy a number of limitations found by experience it is always advisable to carry out prequalifying trials before any serious weiding is carried out on any metal combination.

PRACTICAL APPLICATIONS

The main applications of explosive welding are in flat plate cladding and the welding or cladding of cylindrical geometries.

Flat plate cladding (a well established industrial process) is used for the production of thick

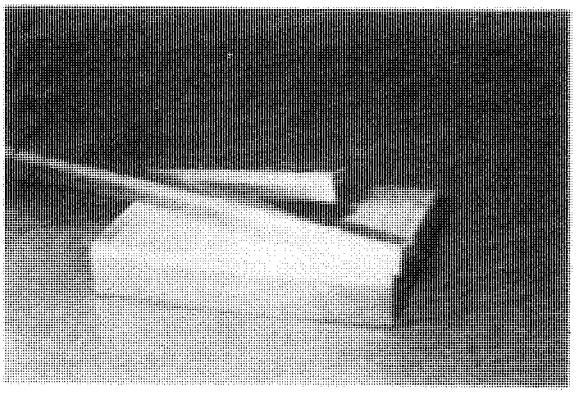


Fig 2. Aluminium/steel transition joints used in the ship building industry.

slabs which can be hot rolled to the required thicknesses. These are frequently used for electrical connections to aluminium anodising baths and to bus bars in aluminium and magnesium reduction cells. Explosively welded transition joints, fig 2, and clad plates are widely used in the following sectors of industry:

- Aluminium/steel transition joints are used in the ship building industry for conventionally welded aluminium super-structures onto steel decks.
- Attaching devices between aluminium tanks

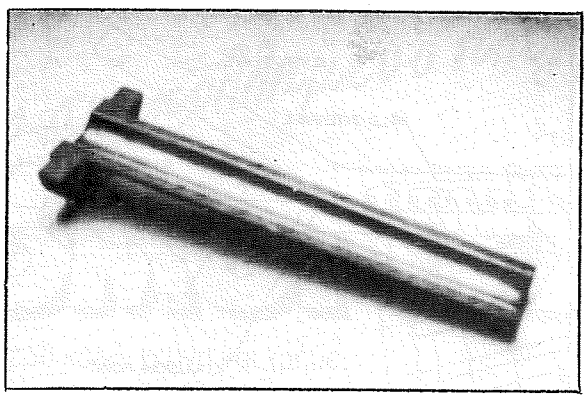


Fig 3. Long-Weld-Neck flange cladded with 3mm of nickel alloy 400.

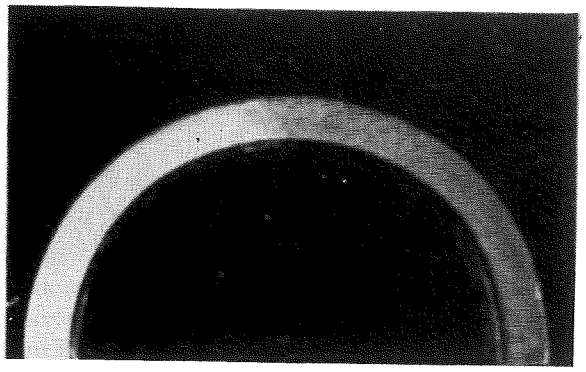


Fig 4. Section of API 5L Grade X52 pipe, 6in OD, cladded in 3 metre lengths with 3mm of nickel alloy 625.

and the hull on board LNG tankers.

- Transition joints between aluminium and steel in building structures.
- Stainless steel/aluminium composites used in the production of freezer trays for the 'fast freeze' food industry.
- Thick steel plates are clad with a thin layer of corrosion protection materials such as titanium, monel and nickel alloys. These plates are used for the fabrication of storage tanks for processing plants.

Explosive cladding of cylindrical surfaces was an early development in the field of explosive welding. Initially it was applied in particular to nozzles in steam power plants for corrosion protection. Tube to tube-plate welding has been extensively used for the fabrication of heat exchangers.

Similar techniques have been used in the past for plugging leaking tubes on heat exchangers for the nuclear industry.

Various attempts have been made in the past to explosively weld pipes, without any commercial success (see Reference 3 for details on various configurations). Recent developments on new explosive compositions and production clamp designs have produced commercially viable components. Such products are long-weld-neck flanges clad with nickel alloy materials, fig 3, spool pieces and flowlines clad with nickel alloy 625, fig 4, for subsea production systems. Also elbows or T-connectors may be produced from straight clad pipe by induction bending or forging respectively. A major contribution to the pipeline welding industry is the explosive welding of stainless steel duplex pipe, fig 5, with both practical and commercial advantage in the J-laying of pipelines for the offshore oil industry.

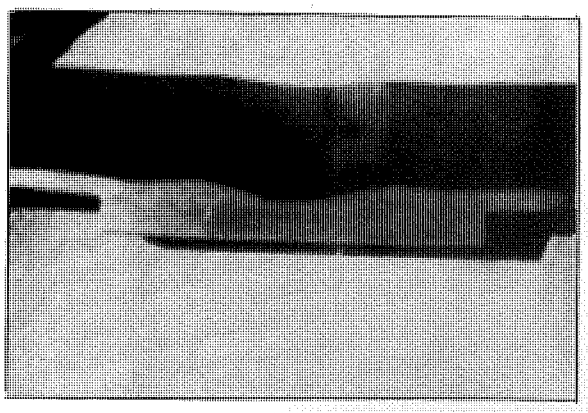


Fig 5. Section of a duplex stainless steel pipe joint, explosively welded in a single shot.

Another development of the explosive welding process is the spot welding of similar or dissimilar metals for the attachment of brackets or fittings and for making cost effective low resistance electrical connections. A portable hand held spot welding gun has been developed capable of welding metals up to 3mm in thickness and by using only 1 gram of explosive, fig 6. Some examples of spot welds are shown in fig 7a and 7b where electrical connections can be made in one shot without the need for any power supply or costly power packs.

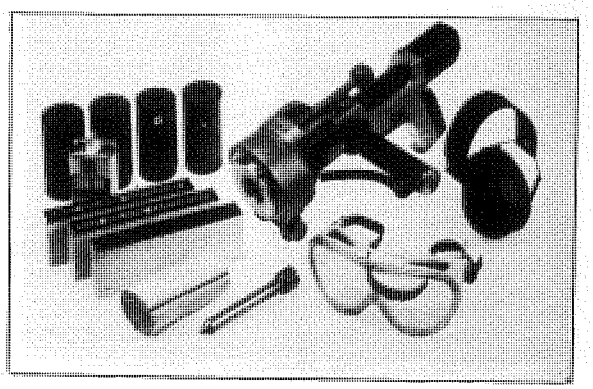


Fig 6. Hand held, portable explosive spot welding gun.

For joining thin sheets of metal, forming cylinders from thin metal sheet or sealing metal containers with sheet metal, the explosive seam welding process is ideal as it utilises only 10 grams/metre of explosive and can produce a double metal to metal seal/weld without any distortion on the components which often occurs when conventional welding processes are used. A section of a seam weld is shown in fig 8 where a lap weld was produced between two titanium sheets, each 2 mm in thickness. Further, the explosive welding process can be controlled to the extent that it can be applied to the production of micro-welds between metal foils as thin as 11μ metres. Examples of these welds are the coating of titanium sheets with

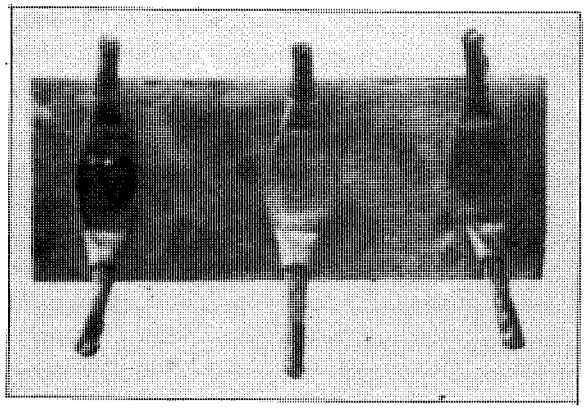
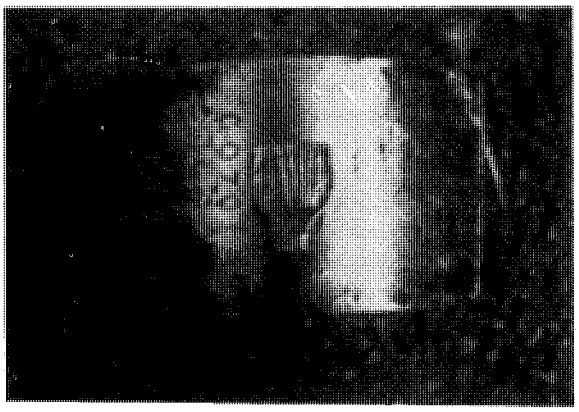


Fig 7. Explosive spot welds between dissimilar metals:
(a) Copper electrical connections onto steel flat plate (above).
(b) Copper earth connections on steel pipe (below).



platinum or the welding of electrical connections between galvanised aluminium chassis and circuit boards.

Explosive welding has, and can be, used in other areas of industry but the practicality and

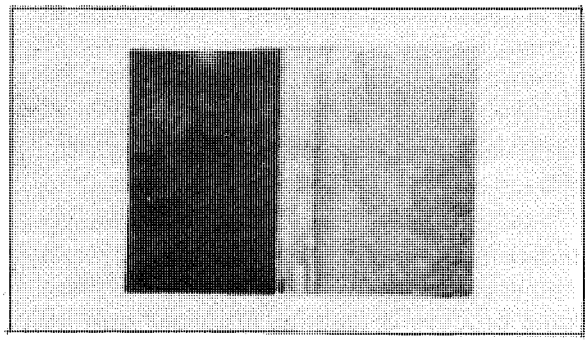


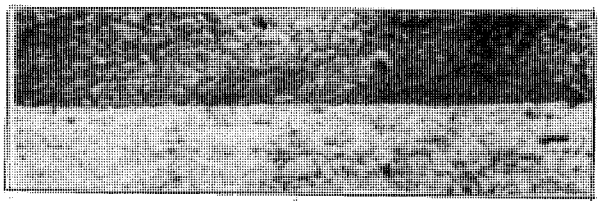
Fig 8. Seam weld between two titanium sheets.

the commercial viability of each system must be assessed on its own merits.

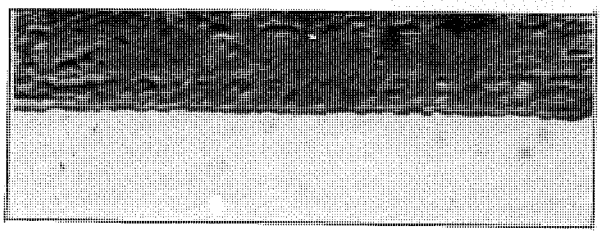
METALLURGICAL OBSERVATIONS

When two metal plates collide obliquely the pressure at the collision point exceeds 1 Million lb/in^2 which is well above the yield strength of associated fluid flow instabilities as a result of an oscillating pressure gradient ahead and behind the collision point. These interface flow instabilities appear at the welded interface as a wavy pattern which is a characteristic of explosive welding. The size and shape of these interface waves depend mainly on the quantity and type of explosive used (see Figure 9 for details).

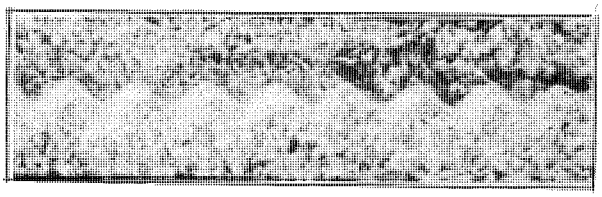
Fig. 9. Various wave-forms indicating the dependence of the wave size on the explosive loading.



Plane Interface.

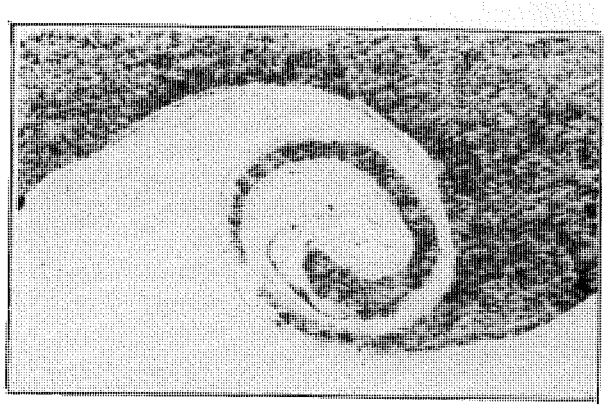


Onset of Wave Formation,
Transition to Plastic Flow.



Symmetric Interface Waves,
Plastic Flow.

Symmetric Curly Waves,
Onset of Fluid Flow.



Highly Distorted Waves,
Vortex Fluid Flow.

It is possible, and sometimes advantageous, to have a straight weld interface by reducing the amount of explosive and thus the plastic deformation between the two metals. This situation is particularly applicable to titanium/steel or aluminium/steel welds where brittle intermetallics are likely to form when severe plastic deformation with consequential melting takes place. It can be observed from fig 9 that the size of the waves increases with explosive loading to a point where a real vortex stream may be formed dragging material from both plates resulting in the formation of melting pockets with intermetallic inclusions. In most metals it is desirable to have a symmetric wave interface which is a measure of the plastic deformation and work hardening of the metal interfaces.

Hardness tests taken across the interface of an explosively spot-welded brass/steel

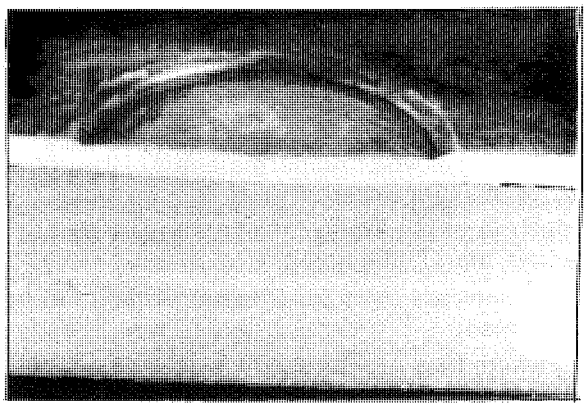


Fig 10. Section of an explosively spot welded brass/steel combination.

combination, fig 10, have shown an increase in hardness of less than 10%. Mechanical tests were also carried out on sections cut from 2.5m lengths, 6in pipe, cladded with 3mm of nickel alloy 625. The hardness across the weld interface was varying from 25RC at the nickel alloy 625 to 30RC at the interface and to 18RC at the API 5L X 52 pipe. The weld strength of these clad pipes was found to be twice that generally required by the oil industry.

Due to the fact that there is no significant rise in temperature during an explosive weld, the problems of carbon dilution (which occurs with conventional weld overlay techniques) is confined to the weld interface which may extend to 100 μm. It is therefore possible to explosively clad a pipe with 1-1.5 mm thicknesses required by conventional weld overlay techniques and still maintain superior corrosion resistance properties.

As the chemical and oil industries increasingly demand the use of nickel alloy clad materials (plate or pipe) the explosive welding process is becoming more popular than ever as it can offer metallurgically and mechanically sound welds with real commercial advantages.

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New Labelling Requirements for Footwear

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INTRODUCTION

The HTI Footwear and Leather Centre has recently acted as technical consultants to the Footwear and Leather Standards Committee, TC6, of the Cyprus Organisation for Standards and Control of Quality CYS in its work for the preparation of a Cyprus Standard/Specification for the labelling of footwear.

This specification is based on BS5833 and numbered as CYS 200 and it specifies the requirements for brand name or other means of identification and those parts of the footwear for which the material is to be stated and the terms to be used. A summary of CYS 200 follows:

1. INFORMATION TO BE MADE AVAILABLE AT THE TIME OF SALE

1.1 SIZE

The shoe size and, where available, the width fitting shall be clearly marked on the footwear by the methods specified in 2.1.

1.2 BRAND NAME

The brand name, or other means of identification, shall be clearly marked on the footwear by the methods specified in 2.1. The brand name shall be traceable to a Cyprus source.

1.3 MATERIALS OF MANUFACTURE

1.3.1 Materials of the upper and lining

The material of manufacture, or the materials of the upper and lining shall be indicated using the terms in 1.3.3 by one of the methods specified in 2.2.

Where the upper and lining are made from materials of the same generic type, then the material shall be indicated without making a distinction between the outer upper and lining. The appropriate label shall take the form:

"leather upper"

Where "coated leather" or "laminated leather" or "man-made", or "rubber", or "textile" can be substituted for "leather".

If the upper and the lining are made from a variety of materials, the appropiate label shall indicate the two principal materials of each, in decreasing order of predominance, based on the surface area of the materials in question (e.g. "leather/man-made upper, coated leather lining").

If the upper and lining are of different materials but each is made from one type of material exclusively, then the materials shall be labelled separately (e.g. "leather upper, man-made lining; man-made upper, leather lining").

If the upper is of one generic type and the lining is of a variety of materials, then the label shall indicate the material of the upper and the two principal materials of the lining in decreasing order of predominance (e.g. "coated leather upper, leather/man-made lining").

If the upper is of several materials and the lining is of one generic type then the label shall indicate the two principal materials of the upper in decreasing order of predominance and the material of the lining (e.g. "man-made/leather upper, man-made lining").

The materials used for trimmings need not be indicated:

a) where they are purely decorative, or

b) where their total surface area is less than 15% of the total area of the upper.

1.3.2 Materials of the sole

The material of manufacture, or the two principal materials of the sole, based on thickness, determined on samples in accordance with the method in CYS 201, shall be indicated in decreasing order, using the terms in 1.3.3, by one of the methods specified in 2.2.

NOTE. The terms "ethylene-vinyl acetate" or "EVA" "polyurethane" or "PU", "polyvinyl chloride" or "PVC" and "resin rubber" used in relation to soles may be used singly or in combination in place of the generic term "man-made".

1.3.3 Terms used for labelling

The following generic terms for materials of manufacture shall be used in labelling of footwear, either singly or severally in accordance with 1.3.1 and 1.3.2:

a) leather, or

b) coated leather, or

c) laminated leather, or
d) man-made, or
e) rubber, or
f) textile.

NOTE. Additional terms may be used in conjuction with these generic terms. Provision is made in 1.3.2 for certain soling materials to be included on the label in place of the generic term "man-made".

1.4 CLEANING AND CARE

If footwear requires special cleaning or care, a leaflet giving advice on this shall be provided.

NOTE. It is recognized that it is not possible to include advice on cleaning and care on a label with each pair of shoes, but retailers are encouraged to make such information available.

2. METHOD OF LABELLING

2.1 The brand name or other means of identification, size and, where appropriate, the width fitting, shall be labelled on each item of footwear by one or more of the following methods:

a) engraving;
b) stamped markings;
c) adhesive label;
d) stitched label.

The information shall be clearly visible and legible.

NOTE. Within practical limitations, the information should be positioned so that the effects of wear on its legibility are minimized.

2.2 Information on the materials of manufacture and, where appropriate, end use recommendations shall be made available either by one of methods (a), (b), (c) or (d) in 2.1 or by some other appropriate written method attached to the footwear, such as a swing ticket.

SUMMARY

The decision to draw up CYS 200 was taken in the light of the Government's policy for greater consumer protection through increased information on consumer products.

This is all the more relevant in view of the technical advances made in the manufacture of man-made materials for the footwear and leather industries which make it increasingly more difficult to differentiate between natural materials, (leather), and synthetic materials.

It is expected that CYS 200 will contribute to greater confidence in locally produced footwear and add impetus to Cyprus footwear exports to countries where labelling is required.

The decision also reflects government policy on the adoption of E.E.C. practices wherever possible.

HTI Computerized Information System

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INTRODUCTION

Information Technology has penetrated all aspects of our lives. Many are the advantages of this technology and it is generally accepted now that the areas of economy that correctly utilize Information Technology benefit a lot. The Higher Technical Institute (HTI) management acknowledged these benefits and realized that through the use of Information Technology the overall performance of the people (management, staff, lecturers, students) of the organization could be improved. It decided therefore to promote the utilization of Information Technology at the HTI. Within this framework the HTI Information System was initiated.

HISTORY

Since the beginning of 1988 all HTI departments have been equipped with personal computers and the secretarial staff started using word processors for all typing operations. Some specialized, stand alone systems were also developed by Computer Studies students and various HTI lecturers. Some of these systems were implemented temporarily while others were not implemented at all. In spite of their present state, all of these efforts have significantly contributed to the definition and understanding of the needs of the Institute and have influenced the manner with which these needs are presently being met. One of these systems, the Entrance Examinations System was implemented and is used until now.

The major computerization face started in Autumn 1989 when the author and a team of Computer Studies students undertook to develope an integrated student information system for the whole of the Institute.

THE DESIGN

Objective

The main objective of the system is to build and implement a computerized system that will meet the needs of the Institute as far as Student Information is concerned.

The objective is to be accomplished by the development of a computer software system which will "monitor and retrieve data from the HTI environment; capture data from transactions and operations within the organization; filter, organize, select and present data as information to managers; and provide the means for managers to generate information".

The designed system is not to be looked upon only as a support activity for the staff and the management of HTI. It is designed, like all modern information systems, in order to have an impact on the organization's environment, both internal and external, formal and informal.

Global design

The HTI Information System has been designed as a real-time, online, integrated system which is divided up into various subsystems (fig.1). The subsystems are connected to a central database while some of the systems interface also between each other. Depending on the implementation method selected, the HTI Information System may operate purely at a departmental level or at an organizational level.

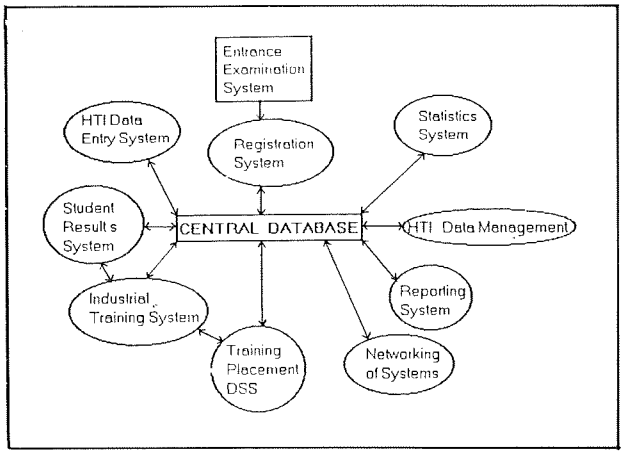

Fig. 1: System Global Design.

TOOLS AND RESOURCES

The system has been developed and supported until now mainly by the author, on her own free time, and a team of Computer Studies students.

The language used for developing the system is Clipper. This is a Dbase type language which allows for easy and flexible retrieval of information. Due to its availability, facilities and simplicity as well as its capability to create executable coding and to support networks it was considered the most appropriate language to be used at the time of selection.

The system is being developed using 286 and

386 personal computers and has been installed on Pcs which operate under a DOS 3.3 operating system.

DETAILED DESCRIPTION AND PROGRESS

During the two and a half years that passed since the beginning of the HTI information system a lot has been done. Until now a significant part of the system has been delivered and is operating at the personal computers of the four academic departments of HTI. A lot remain though to be done. A detailed description and a progress statement of each subsystem making up the HTI Information System is given below in historical order:

1. HTI DATA ENTRY SYSTEM

The HTI Data Entry system was developed in order to facilitate the departments to record the marks of the HTI students who attended HTI courses during the years 1986-1990, as well as for the purpose of producing student results for the academic year 1989/90.

This system was a short-life system that was developed and implemented in all HTI departments during the academic year 1989/90 only. Through this system, all HTI subjects were standardized and given codes, students' marks were recorded for four years and the most needed student year-end results were produced. The system was replaced and ceazed to operate when other subsystems were finalized at the end of the academic year 1990/91.

2. REGISTRATION SYSTEM

The Registration System is a subsystem for registering existing and new HTI students. The registration of students can be done either automatically or manually by the user.

The subsystem is composed of three parts. The "Automatic Registration", the "Manual Registration" and "The Entrance Examinations Interface". The "Automatic Registration" is a facility through which the computer itself enrolls students to their appropriate courses, classes and subjects. The "Manual Registration" on the other hand allows the user to have full control over the registration process. Through this module the operator itself registers students to the appropriate courses, classes and subjects. The third part is a module that automatically obtains first year student information from the Entrance Examinations system and correctly registers students to the selected courses and classes.

This subsystem has been operational for the last two years and has proved to be very beneficial.

3. STUDENT RESULTS SYSTEM

The Student Results is a subsystem for gathering and issuing student marks. It is composed of a number of separate programs which either gather marks in a flexible manner or report student results based on the Institute's regulations and shemes again in a multiple number of ways. Figure 2 presents one of the menus through which the user records student marks.

This subsystem has been installed in all departments of HTI and has successfully produced information regarding student academic results during the academic year 1990/91.

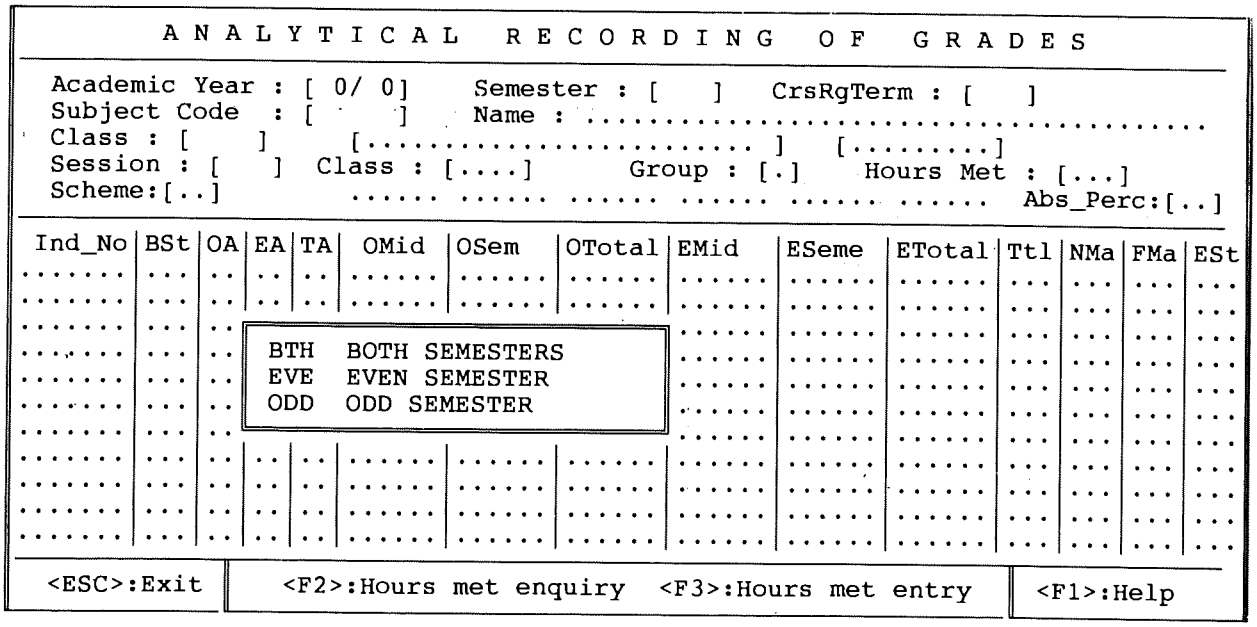

Fig. 2: Marks Recording by Class and Selected Period.

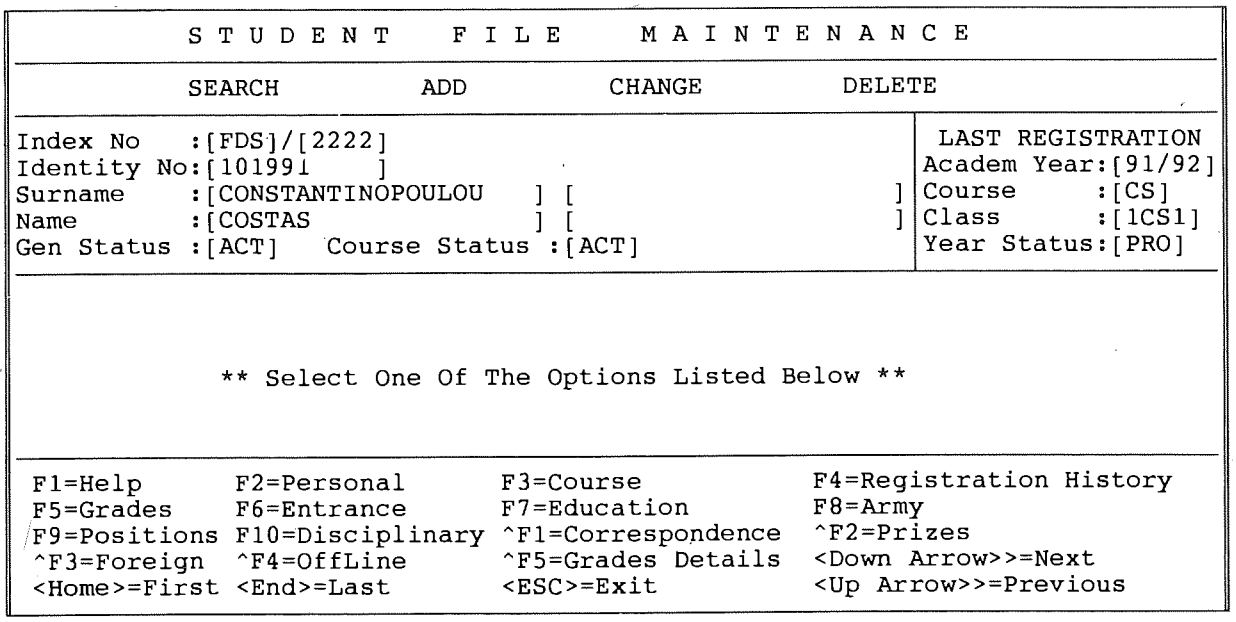

Fig. 3: Student Information Control Menu.

4. HTI DATA MANAGEMENT SYSTEM

The HTI Data Management subsystem is the main software system that builds and maintains the greatest part of the central database. The central database is made up of about 70 different tables and is composed mainly of information relating either to students or to other necessary data handled by the Institute. It is composed of two major parts: the "Student" and the "Other" The "Student" part allows the user to maintain personal and academic information for the graduated and current HTI students while the "Other" option deals with other basic type of data relating for example to entities like: subjects, courses, curriculum, marking schemes, student nationalities, projects undertaken at the Institute. A summary of the data maintained for students is presented under figure 3.

Its installation and implementation took place during the academic year 1990/91 and it is presently operating in all departments of HTI. This subsystem, together with the Students Results subsystem, substituted the Data Entry System (item 1 above)

5. INDUSTRIAL TRAINING SYSTEM

The Industrial Training subsystem (ITS) is designed for supporting the HTI Industrial Trainers. This system can operate independently or in association with the central database. It is composed of a multiple number of programs which function as an assistant to the HTI Industrial Training officer (ITO).

Its main scope is to maintain data relating to the following three different entities: the students' industrial training, the specific industries that participate in the scheme and the lecturers who act as supervisors to the students. A dedicated reporting module provides also functional reports and information, on the students' training, to the ITO and the Industrial Training Authority. In addition, another facility automatically interfaces the system with the Student Results subsystem for the purpose of summarizing and transferring the student industrial marks to the Students Results subsystem. Figure 4 is a picture of one of the menus of the system through which details about the places attended by a student is recorded.

Although developed and tested since the end of the academic year 1990/91 it is yet to be installed at the Institute's departments.

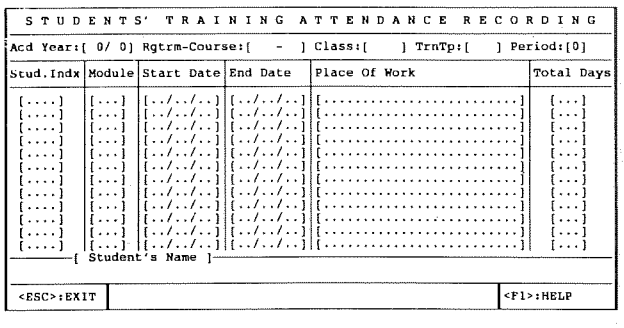

Fig. 4: Industries Visited by Student.

6. TRAINING PLACEMENT DECISION SUPPORT SYSTEM

One of the major, most significant and complicated functions of the Industrial

Training Officer is the placement of students to the appropriate industry. This subsystem, which is to be developed in the near future, will attempt to become the right hand or even, up to a point, substitute the Indrustrial Training Officer as far as this function is concerned.
The system that has been designed ensures that this will be a very beneficial tool for the ITO.
This software system will have a graphics user interface (GUI) and will use the data and information created by the Industrial Training System. Initially the computer will apply intelligence and expert rules so as to come up with a plan which will specify how the students may be placed at the various Industries. Once the plan is proposed the ITO will then be free to modify, reproduce and execute the plan as desired. On the execution stage, all the files and necessary reports will be produced automatically.

7. REPORTING SYSTEM

The purpose of the Reporting subsystem is to provide information on paper or on screen. The designed Reporting system is composed of three main parts. The first part is a series of tailor made reports designed for providing external, future-oriented, performance, progress and system reports to the HTI management and to the departments. The second part is a report generating module whose goal is to allow the users to create easily their own reports whenever they need them. Finally, the third part is a graphical database query processor. Through this facility the users will be able to retrieve flexibly information by using the powerful SQL method.

It is believed that this subsystem will give great flexibility to the whole information system and the users will be able to obtain the requested information whenever and as soon as they need it. A significant amount of tailor made reports have already been created but a lot have yet to be developed. The report generation module and the query processor are also planned to be developed in the near future.

8. STATISTICS

Another very significant subsystem which will make an additional impact on the organization is the Statistics subsystem. This system will maintain and report all kind of statistical data and results about students and other entities (i.e. institute, lecturers, class results, course results) and will present the results both in text as well as in graphical form. It is believed that very significant and important information will be produced by this system which will be of great value both to the HTI Management as well as to the Government of Cyprus. The subsystem is planned to be developed along with the Reporting subsystem.

9. NETWORKING OF SYSTEMS

Presently the implemented subsystems of the HTI Information System have been installed at each department and they operate in a decentralized manner. This has proved quite efficient as far as the departmental level is concerned. Management needs though to view information globally as well as departmentally therefore the Systems Networking is necessary. The major goal of this subsystem is to combine the databases of each department into one database through which top management information is to be derived.

A set of programs have already been developed and installed which combine all departmental databases into one database. This method solves the immediate needs of the institute but it has a lot of different disadvantages one of which is the duplication of information. These problems will only be permanently solved when the system hardware configuration is converted from stand alone computers to a local area network configuration and the software system is operated under such an environment.

CONCLUSION

It can be realized from the detailed progress report given above that the HTI Student Information System has significantly progressed. It is believed that when all the subsystems are completed and the whole of the system becomes fully operational it "will be a powerful method for aiding managers in solving problems" and "the improvement of the performance of people in the organization through the use of information technology" will have a positive effect on the whole of the Institute.

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Gender Differences within the System of Education in Cyprus

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INTRODUCTION

In Cyprus, similar to the practice followed in all other countries, until the end of the 19th century, girls were given different education to boys. Girls were taught to be good wives and mothers while boys were prepared for their role of family-breadwinners. The main subjects taught to girls were literature, foreign languages and domestic economy while science and mathematics were considered as incompatible to their female nature.

In recent years a considerable improvement has been achieved with the unification of "male" and "female" studies, the abolition of separate schools for the two sexes, and the revision of reading books so as to eliminate sexist ideology.

Research studies in Europe and the United States revealed that though all written sex discriminatory regulations have been eliminated, there is a hidden curriculum for gender[1] based in teachers expectations and behaviour, as well as social organisation of school.

Meighan[2] defines the hidden curriculum as "those aspects of learning in schools that are unofficial, or unintentional, or undeclared consequences of the way teaching and learning are organised and performed". Ann Oakley[3] mentions in her book titled **Subject Women:** "The hidden curriculum is important both because of its obvious capacity to shape pupils' attitudes and progress, and because, being implicit and often unconsciously implemented, it is peculiarly resistant to change".

Through family and schools adolescents are socialized and conditioned to their gender role expectations. The effects of gender role socialization in the family and in primary education can be seen in the routes followed by boys and girls in secondary education.

The aim of this research is to demonstrate and account for gender differences in the system of education in Cyprus. In this respect it was considered essential to present first a brief outline of the current system of education and then to investigate more closely gender differences within the operation of the system.

1. SYSTEM OF EDUCATION

In 1960, when Cyprus was declared independent according to the Zurich agreement, the Greek and the Turkish Community Councils were responsible for the education of each ethnic group. After the events of 1963-64, which separated the two communities, the House of Representatives in 1965 entrusted the newly formed Ministry of Education with matters relevant to education.

This research is confined to the study of the educational system of Cyprus republic and do not cover Turkish Cypriot minority, since the political events of 1963-64 have kept the Turkish minority inaccessible.

In Cyprus education is provided through:

(i) pre-primary and primary schools
(ii) secondary general and secondary technical/vocational schools
(iii) special schools and non formal institutions and
(iv) third level institutions.

1.1 PRE-PRIMARY AND PRIMARY EDUCATION

Pre-primary education is offered through Public, Community and Private Kindergartens and Day Nurseries. Primary education is mainly confined in the public sector. It aims for children aged 5.5 years old and provides a six-year course; it has always been free in the Cyprus republic and was made compulsory in 1962.

1.2 SECONDARY EDUCATION

It is pursued mostly at public schools but there are also a few private ones. There are two types of secondary shools:

(i) Secondary General which consists of two stages:

Stage I comprises the first three grades and Stage II the last three grades. As from 1977/78 the Lyceums of Optional Subjects (LEM) were introduced.

(ii) Technical and Vocational:

They aim at providing local industry with technicians and craftsmen.

Free education in the public sector was first introduced in 1972/73 for grade I and by 1985/86 it was extended to all six grades. In

TABLE 1: INTERNATIONAL COMPARISON OF EDUCATION IN SOME SELECTED COUNTRIES, 1986

	GROSS ENROLLMENT RATIOS (4)		THIRD LEVEL STUDENTS FOR 100,000 INHABITANTS
	PRIMARY	SECONDARY	
CYPRUS	106	91	2,272 (3)
EGYPT	87 (1)	66 (1)	1,918 (1)
GREECE	106 (2)	88 (2)	1,709 (2)
ISRAEL	99	79	2, 746
U.S.S.R	106	99	1,814
UNITED KINGDOM	106 (1)	85 (1)	1,806 (1)
UNITED STATES	102	100	5,167
TURKEY	117	44	1,003

Source: Statistics of Education 1989/90, Nicosia, 1990, P.59.

NOTES

(1) Data refer to 1985.

(2) Data refer to 1984.

(3) Excluding foreign students in local institutions and those in preparatory courses abroad.

(4) The gross enrollment ratio for a given level of education is derived by dividing the total number of pupils at this level regardless of age, by the population of the age-group which according to national regulations should be enrolled at this level.

1985/86 the first stage [up to the third grade] was made compulsory.

1.3 SPECIAL EDUCATION AND NON-FORMAL EDUCATION

Special education for children and persons with special needs at all ages, is provided in special schools of primary and secondary level and vocational training.

Non-formal education consists of various public and private part-time institutions which provide miscellaneous courses at various levels.

1.4 THIRD LEVEL EDUCATION

According to the Statistics of Education 1989/90, there are six public and twenty private educational institutions, which have been recently established; they are affiliated with British and American Polytechnics and Universitites and provide training towards a degree.

i) The six public educational institutions are:

a. The Paedagogical Academy of the Ministry of Education offering a three-year course for teachers of primary schools and kindergartens.

b. The Higher Technical Institute, providing a three-year course in Mechanical, Electrical, Civil and Marine Engineering. There is also a three-year course in Computer studies, which was established in 1985.

c. The Hotel and Catering Institute provides education and training for hotel and catering.

d. The Mediterranean Institute of Management provides one-year course in management for University Graduates. (The above three public institutions belong to the Ministry of Labour).

e. The Forestry College of the Ministry of Agriculture which offers two-years training in Forestry and six-months postgraduate.

f. The School of Nursing and Midwifery of the Ministry of Health, running a one, two or three year courses in general and psychiatric nursing and midwifery.

ii) Private institutions offer one to four year courses in such fields as Business Administration, Secretarial Studies, Electrical, Mechanical and Civil Engineering, Wireless Communications, Hotel and Catering, Banking, Accountancy and recently in Computer Programming.

Cypriots can attend third level education in local institutions or abroad. Cypriot students, attending tertiary and university education abroad, mainly study in Greece, the United Kingdom, the United States of America and other European countries. The newly established University of Cyprus is intended to operate in the next academic year 1992/93.

Education in Cyprus in highly appreciated and the figures of education attendance at all levels can be favourably compared to relevant figures in developed countries. Table 1 shows the figures of education attendance in Cyprus in comparison to some selected countries.

2. GENDER DIFFERENCES WITHIN THE OPERATION OF THE SYSTEM

In order to show gender differences in the

system of education in Cyprus first the figures of male and female attendance are to be presented. Then the sex distribution in the different fields of studies is to be examined and finally some of the striking gender differences which appear in the curriculum and the books are to be outlined.

2.1 MALE - FEMALE ATTENDANCE

In Cyprus education was traditionally considered as of no value to women, since their destiny was to become good housewives and mothers. Illiteracy was higher among females than males and the figures of women in education showed a sharp rise during the last fifty years.

From the decennial censuses it can be seen that the percentage number of literate women increased from 12.7% in 1911 to 42.6% in 1946 while the corresponding increase in the male figures was from 38.6% to 65.4% for the above mentioned years. Furthermore, in the Census of 1960 it is mentioned that the most remarkable increase in the number of literate persons took place among females.

From the Statistics of Education 1989/90 it can be seen that after 1970/71 a similar percentage of boys and girls proceeded to secondary schools, while the number of girls in third level education showed a steady increase and tended to catch up with the number of boys.

In 1989 the gross enrolment ratio of males in third level education was 37 per cent while the corresponding female ratio was 32 per cent. Though in 1988/89 equal numbers of students attended studies in Cyprus and overseas the number of females in local institutions was higher than that of males, coming to 54.6 per cent of local students while their participation abroad was lower constituting 39.3 per cent of the total.

The higher number of girls in local institutions can be attributed to the lower costs compared to overseas universities and to the availability of short duration courses in specialisations which are mainly followed by girls, like Secretarial training and Nursing. Parents taking these factors into consideration and the fact that their daughters will be under their protection and control seem to prefer the local institutions.

Despite the lower female participation compared to males in overseas institutions, the increase in their number is nevertheless significant, considering that in 1971/72 they constituted only 24.4 per cent of students abroad. Concerning the continuation of postgraduate studies, though there is an increase in the number of women their figure is still much smaller than that of males. In 1988/89, 212 women were attending postgraduate study courses as against 539 men.

The lower participation by women in third level education is a clear example of the double standard still existing in Cyprus as far as the education of the two sexes is concerned. Parents are not so willing to invest in their daughter's education, while they consider their son's education as a first priority. In Eleni Nikita's words[4]: "They een suffer privations in order to send their son to the gymnasium or the university even if he does not excel as a student".

2.2 SEX DISTRIBUTION IN THE STREAMS OF EDUCATION OFFERED

In Cyprus there is a well defined segregation of the sexes in the different streams of education.

In secondary education the participation of girls in the Technical and Vocational courses is insignificant, while they are concentrated in the Commercial and Secretarial courses. From the statistics of education it was found that in 1989/90, only 5.3 per cent of the girls were in the Technical and Vocational stream compared to 28.5 per cent of boys, while 29.3 per cent of the girls in secondary education followed the Commercial and Secretarial course as against 13.7 of the boys. Their participation in all the streams of secondary education can be seen in Table 2.

TABLE 2: PUPILS IN SECONDARY EDUCATION IN THE SECOND CYCLE OF STUDIES BY STREAM AND SEX, SCHOOL YEAR 1989/90

STREAM	MALES %	FEMALES %
General	10.3	7.8
Technical and Vocational	28.5	5.3
Classical (Lem S_1)	3.0	11.0
Science (Lem S_2)	20.0	12.5
Economics (Lem S_3)	23.0	26.1
Commercial and Secretarial (Lem S_4)	13.7	29.3
Foreign languages (Lem S_5)	1.5	8.0
Total	100.0	100.0

Source: Statistics of Education 1989/90, p.47.

Different streams of education are also followed by students of the two sexes in tertiary education, locally and abroad. From the Statistics of Education 1989/90, it can be seen that:

i) In local tertiary education only females attended Teacher Training for Kindergartens and Secretarial, while only

males attended Marine Engineering and Forestry. A considerable number of males (27% of all male attendance) followed Engineering courses as against 2% of females; the female participation constituted 9% of all students attending Engineering courses. It is worth noting that 80% of females attending Engineering courses were enrolled in Civil Engineering and they constituted 34% of total male and female attendance in this field. Female participation in certain fields of study comprises more than 70% of the total attendance. For example in Nursing 78% and Teacher Training for Primary Schools 73%.

ii) Female participation in the fields of study followed by students abroad, is also typical of the preference of women towards certain fields, as it has been dictated by their gender socialization. A detailed analysis of female figures in the main fields of study in 1988/89 is a clear example. The participation of women in Mathematics and Computer Science is quite low (28%) and even lower in Engineering- Technology (11%). They constituted 35% of the attendance in Commercial and Business Administration, 40% of Social Science and 47% of Medical and Paramedical. Their attendance in Law rose to 55% and their biggest share is in Humanitites (78%).

2.3 GENDER DIFFERENCES

In the Ministry of Education of Cyprus, though there are thoughts, there is not yet established a committee which will undertake matters of gender differences in education similar to the practice followed by most European countries.

As there is no research on gender inequalities in the education of Cyprus, firstly overt differences in the curriculum are to be outlined and then a reference is to be made on the reading books used in elementary education.

2.3.1 Overt Differences in the Curriculum of Cyprus system of education

Public elementary schools were always mixed and during the 1970s all secondary public education schools were turned from single sex to mixed schools except for certain private elementary and secondary schools.

The syllabus is common for both sexes at all levels of education; the only exception is the subject of Domestic Economy which is taught only to the girls while Craft Design and Technology is taught to the boys. The Ministry of Education has decided to make available both subjects to both sexes on a trial basis for the current academic year (1991-92).

The role of the teacher is instrumental in the preservation of the gender role system. Every teacher is a former pupil. Every teacher has already been through the process of learning the roles for each sex. Therefore each reflects consciously and unconsciously their own attitudes and expectations in their treatment of their pupils.

Research carried in other countries revealed that adults in the home and school treat children differently. Sue Sharpe stated that "Teachers ultimately expect less from girls than from boys, and less from working class than from middle class children[5]. In addition Diane Bush mentioned that "Teachers' behaviour expectations are sex stereotyped, even though teachers may believe that they are gender neutral[6]. In the European countries, special seminars are organised, aiming to the elimination of gender discrimination practices, followed by teachers.

Another factor contributing to the structuring of inequality is the staff structure of schools which provides examples of sexist ideology at work. Despite the high participation of women in education, especially in elementary schools, there are very few women holding administrative posts. Thus, as observed by Sue Sharpe men are identified as figures of authority and "this image is often endorsed by the figure of the headmaster who rules over a primary school largely staffed by women".

In Cyprus in 1989-90, there were 210 men headmasters in primary education as against 61 women out of a total of 1,229 males and 1,617 females. In secondary education there were 92 men headmasters compared to 12 women out of a total of 1,972 males and 1,638 females.

2.3.2 Elementary reading books

The reading books used in the elementary education of Cyprus are the same as the reading books used in Greece. A revision of these books was carried out in Greece in 1981 in order to eliminate sexist messages.

In 1979, Anna Frangoudaki made an analysis of the reading books which were used in Greece before the revision of 1981. The main findings of the analysis can be summed up as follows:

1) The model of a human being, formed by the values entailed in the books, was obedient, overzealous in religion, superstitious and one who identifies patriotism with the acceptance of any political authority.
2) The family pattern described in the books was traditional and patriarchal; authority was determined firstly by the sex and secondly by the age of its members. Thus the grandfather occupied the first place,

followed by the father, the grandmother and then the mother. The only natural role of the woman was that of the mother-housewife and the child of the working mother tended to see its mother as being different from the one described in the books.

3) A distinct sexism was promoted in the reading books. The destiny of the boy was to become man-father while a girl should become mother-housewife. This was the only female role which a girl could identify All other role-models in the books belonged to the male sex; the good student, the teacher, the father, the hero.

Though in the recent revision of books (in 1981) care was taken to avoid any overt discrimination through gender roles, a detailed analysis may still reveal examples of sexist ideology. The following differences were located by the researcher by going quickly through the book "Us and the World", which is now used by first grade elementary pupils

> Out of 115 pictures illustrating people at work, 82 pictures were depicting only men, 26 pictures only women and 7 pictures men and women together. In 10 out of the 26 pictures referring to women workers, only school teachers were depicted. In the rest of the pictures women were mainly portrayed in their traditional professions, like office employee, agricultural labourer and cleaner. The pictures referring to men covered a wider variety of professions and most of them were male dominated ones, like builder, crafstman, machine operator or driver.

CONCLUSION

A considerable improvement has been achieved in the education of Cyprus, especially after 1960, when it was declared as an independent republic.

Education in Cyprus is highly appreciated and the figures of education attendance at all levels can be favourably compared to relevant figures in developed countries.

Illiteracy was higher among females and there has been a remarkable increase in the number of women attending education during the last fifty years. After 1970 a similar percentage of boys and girls proceeded to secondary schools while the number of girls in tertiary education is still lower to that of boys despite its considerable and steady increase.

Education played a decisive role in the change of women's social status and position in society. It offered to women not only the means for their personal, cultural and professional improvement, but also opportunities of employment in its ranks since the profession of a teacher was the first high status job occupied by women.

Though there are no written regulations implying gender differences in the System of Education there is still a hidden curriculum for gender which permeates the entire system: i.e. the structuring of schools and teachers gender expectations.

The higher number of girls in local institutions compared to their lower number in third level education abroad is a clear example of the double standard still existing in Cyprus as far as the education of the two sexes is concerned.

Socialization at home and schools are responsible for the different streams followed by the two sexes in secondary education. The participation of girls in the Technical and Vocational courses is insignificant while they are concentrated in the Commercial and Secretarial courses. Different streams of education are also followed by students of the two sexes in tertiary education, locally and abroad.

Despite the contribution of education towards the equality of the two sexes and the improvement of their status in society the inherent hidden curriculum maintains the perpetuation of the gender behavioural expectations. The male and female images implied by education are identical to the prevailing gender images of everyday life.

As Huston-Stein and Higgins-Trenk stated[7]:

> "The development of nontraditional gender role expectation in adolescence requires at least one "unusaul" influence, be it a parent, a school program or a particular potent peer or adult model".

Since in Cyprus any such intervention is still limited, the culture breeds a traditional male or female.

NOTES

1. "Gender" implies the social influences which amplify the biological division (sex) and assign specific personality traits and behavioural expectations as appropriate to a person of that sex.
2. Ann Oakley, **Subject Women,** London, 1986, p.102.
3. Ann Oakley, op. cit. pp. 129-130.
4. Eleni S. Nikita, **Cypriot Woman Rise and Downfall,** Nicosia, 1975, p.8.
5. Sue Sharpe, **Just Like a Girl,** London, 1985, p.151.
6. Diane Mitch Bush, "Social Rights: Education" in **The Traped Woman,** ed. Josefina Figueira-Mc Donough and Rosemary Sarri, London, 1987, pp.271-276.
7. Huston-Stein, A and A. Higgins-Trenk, **Development and Behaviour,** New York, 1978, pp.282-283.

Lasers in Medicine

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Savvas Pyrgos M.D.

INTRODUCTION

Lasers are used more and more in Medicine and the results are, so far, encouraging. Through further experimentation and research it is envisaged that lasers will find a wider application in Medicine as the mechanisms of pain control, biophysics and biostimulation are more clearly understood. This article attempts to give a brief overview of the uses of Lasers in Medicine.

A HISTORICAL BACKGROUND OF LASERS:

Einstein's conception and announcement in 1917 of the principle of the Stimulated Emission of Radiation was the beginning of a series of research projects. In 1950 the MASER, (Microwave Amplification of Stimulated Emission of Radiation), was developed based on the applications of Einstein's theories in this field of Physics. In 1951, Towns and Schawlow proved that it was possible to construct a LASER, (acronym derived from Light Amplification of Stimulated Emission of Radiation). At about the same time the Soviet Scientists Basov and Projorov carried out relevant research work for which they received the Nobel prize in 1964.

It would have been an omission not to mention the work of Theodoro Maiman who used a ruby crystal which emitted light in the red part of the visible spectrum.

After the production of the first lasers, there followed biophysical and medical research which aimed in the understanding of the therapeutic effects but also on the possible risks and dangers which may arise from the use of lasers. Various research centres have, therefore, been set up for the study of the above mentioned objectives. One famous centre was that of the Medical School of the University of Cincinatti in the USA, under the direction of Leon Goldman a dermatologist, honoured all over the world as the father of Lasers in Medicine and Surgery.

The pioneer of clinical applications of LLLT, (Low Level Laser Therapy), was Professor Endre Mester who has investigated various parameters of wound healing under controlled conditions.

SUMMARY OF THE BASIC PHYSICS OF LASERS

When atoms of a material are exposed to an external force such as an elctromagnetic field, these atoms may absorb or emit photons.

Photons are considered as packages of energy, (or quanta), associated with electromagnetic radiation.

The energy of the emitted photons is given by the relationship:

$E = hv$ Joules.

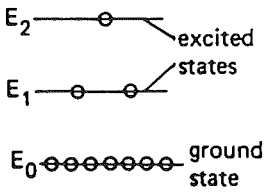
Where h = Plank's Constant = $6.63 * 10^{-34}$ J.s

v = Frequency of the emitted Photons.

When the number of photons absorbed per second equals the number of photons emitted per second, THERMAL EQUILIBRIUM is said to have occured.

At the condition of Thermal equilibrium there are more atoms at the GROUND Energy level than in the excited higher energy levels E_1 and E_2.

This is called Normal Distribution. (See fig. 1 below).

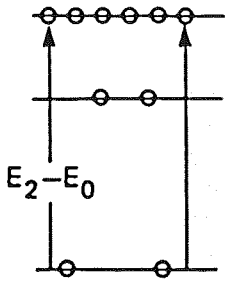


Normal population

Fig.1

By optically or electrically exciting the atoms and then by "optical pumping", population inversion takes place in certain active materials as may be used in lasers.

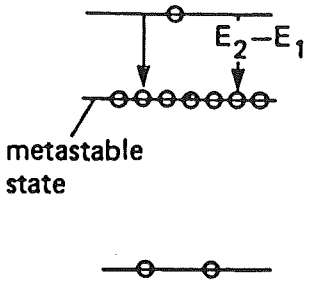
By optical pumping atoms are raised to higher energy levels so that the majority of atoms are found in E_2 or E_1 energy levels than in the ground level. (See fig. 2 below).



Optical pumping

Fig. 2

Immediately these atoms are raised to a higher energy level they re-emit energy and reach a state from E_2 to E_1. This state is called METASTABLE STATE. The accumulation of atoms is now in energy level E_1 (Population Inversion is said to have occurred). See fig.3.

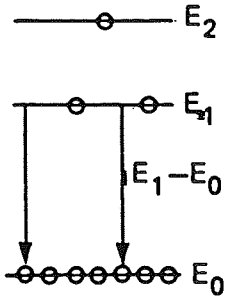


Population inversion Fig.3

There is then a change in the energy levels. The energy difference, ΔE, of the two energy levels ($E_2 - E_1$) is expressed as a quantum value.

$$\Delta E = (E_2 - E_1) = h.v$$

Now Population Inversion is what is needed for Laser action. If a photon of energy ($E_2 - E_0$) is now introduced into the system the excited atoms are STIMULATED to return to the ground state by emitting photons of **precisely** this energy of ($E_2 - E_0$) See fig. 4 below.



(d) Stimulated emission Fig. 4

In this "STIMULATED EMISSION" condition all the photons are in phase resulting in a coherent Monochromatic beam of light of very high intensity. By using parallel mirrors, (one half silvered), amplification is greatly increased with the result that photons undergo multiple reflections, thereby stimulating the emission of more and more photons during their passage.

It was shown by Einstein that the number of atoms, N_2, (population), required to change the energy state from E_1 to E_2 is given by the relationship:

$$N_2 = N_1 e^{-(E_2 - E_1)/KT}$$

That is $N_2 = N_1 e^{-(\Delta E/KT)}$

K = Boltzman's constant = $1.38 * 10^{-23}$ JK^{-1}

T = Absolute Temperature in degrees Kelvin.

Now $\Delta E = hv$ and $v = \frac{c}{\lambda}$

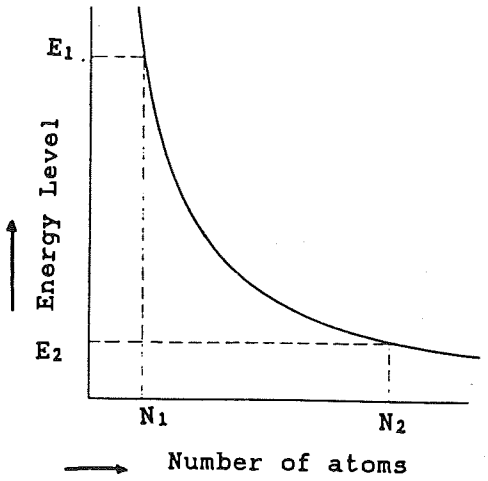
Where c= the speed of light = speed of electromagnetic waves,

λ = Wavelength of emitted photons.

Therefore:

$$N_2 = N_1 e^{-hv/KT}$$

$$N_2 = N_1 e^{-hc/KT\lambda}$$



The overall power absorption rate is given by the relationship:

$$P_{abs} = hv_{21} (W_{12} \cdot N_1 - W_{21} \cdot N_2)$$

where: W_{12} and W_{21} are Propability of Transition occurring per unit time which is proportional to the intensity, I, of the radiation applied.

N_1 = Number of atoms in energy level 1.

N_2 = Number of atoms in energy level 2.

CLASSIFICATION OF LASERS

Class 1 Lasers: These lasers are said to be inherently safe either because of their lower power or because of their engineering design so that the maximum permissible exposure (MPE) level cannot be exceeded.

Class 2 Laser products are low power devices emitting visible radiation, (i.e. in the wavelength range of 400 nm to 700nm). These lasers are not inherently safe but eye protection is normally afforded by aversion responses including the blink reflex. For continuous wave lasers, the output power in this class is limited to 1 mW.

Class 3A Lasers:

These are lasers which emit visible radiation (i.e. in the wavelength range 400 nm to 700 nm), but their output power does not exceed 5 mW of continuous wave operation.

The irradiance at any accessible point of the beam must not exceed 25 Wm^{-2} Protection for the unaided eye is afforded by aversion responses, including the blink reflex but direct intrabeam viewing with optical aids may be hazardous.

Class 3B Lasers:

Laser products of this class may emit visible and/or invisible radiation at levels not exceeding specified accessible emission levels (AELs): Emission shall not exceed 0.5W for continuous wave lasers and 10^5 Jm^{-2} for pulsed lasers.

Another method by means of which lasers may be classified is according to their parameters.

So we have lasers classified:

a) According to their wavelength (such as HeNe - 632.8 nm, or IR-904nm etc.).

b) According to the emitting mode (i.e. continuous mode, modulated continuous mode or pulsed mode).

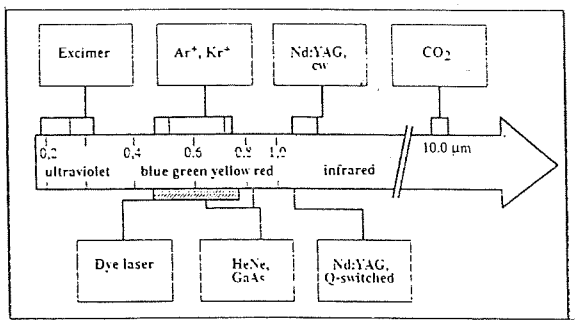
c) According to their power (i.e. High, Medium and Low power lasers, the latter ranging from fractions of a milli-watt to about 50 mW).

d) According to the active medium used in lasers, (i.e. liquid, gas, mixture of gases, semiconductor lasers etc).

Among the solid-state lasers the best known are those with a neodyne-impregnated host material.

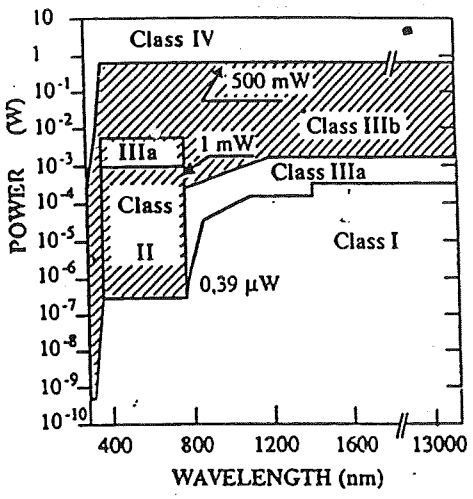
Neodyne is a rare earth element whose ion Nd*** can be "fixed" with various compounds: Crystal (YAG) liquids or amorphous compounds such as glass. It's emitting frequency lies in the infra-red range at wavelength 1060 nm. Among gas lasers the best known is the Helium-Neon laser. In this gaseous mixture (85% helium and 15% Neon), neon is the active element while the helium serves as a catalyst for excitation by stabilizing neon atoms in their excited state. Excimer lasers make use of gases like Krypton and Xenon. These lasers radiate in the Ultra-Violet spectrum. Figs 6a and 6b are relevant.

Diode lasers, based on semi-conductors, emit beams in the 900 nm range. The best known contain gallium arsenide as a host material.



Laser systems and their different emission wavelengths.

Fig. 6a



Classification of lasers according to their wavelength and power.

Fig. 6b

CHARACTERISTICS OF LASER RADIATION

The characteristics of laser radiation can be classified into the following two groups.

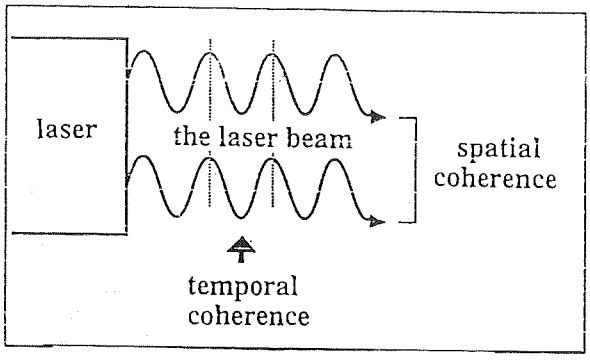
— General Characteristics, which are common to all laser beams, and

— Specific characteristics, which are particular to the type of laser used.

GENERAL CHARACTERISTICS

These are:

1. Coherence. All the photons in the beam are emitted in an orderly fashion and have identical phase pattern as shown in Fig. 7



Schematic illustration of the coherence.

Fig.7

2. Directivity. While ordinary light rays scatter in all directions, laser light is unidirectional. Its component beams are virtually parallel and hardly separate from their point of emission to infinity. Divergence, if any, is usually caused by diffraction.

3. Monochromaticity. Lasers oscillate within a narrow range of frequencies determined by the type of active medium and resonating cavity used.

4. Luminance Emittance. Luminous emittance is a measure of the concentration of the energy of photonic radiation per unit time and unit area. In laser radiation, luminous emittance is very high. It is measured in Stilb units. Where as an incandescent light bulb might emit 10^3 stilb a 10mW laser in continuous mode might reach 10^9 stilb.

SPECIFIC CHARACTERISTICS

Specific Chararacteristics are useful in determining the practical applications and the operating mode of the specific laser as follows:

1. Frequency, f, in Hertz.

(In practice the wavelength, λ, rather than the frequency is used to characterise laser radiation. Frequency and wavelength of course are related:

$f^*\lambda = c =$ speed of light.

2. The Power

The power of a laser is a function of the amount of energy of photons emitted. It is expressed in watts or fraction of watts.

3. Emission Modes.

Depending on the active medium used, the emission can be in a pulsed or continuous mode.

BIOLOGICAL EFFECTS OF SOFT LASERS

The biological effects of laser radiation are:

1. The analgesic effect.

Laser radiation can act on two levels namely:

a) The moderation of the pain message, and
b) The stimulation of morphino-mimetic production. The hyperstimulation induced by low level laser emission on a nerve ending hyperpolarises the neuron membrane by raising its activation threshold.

2. The anti-inflamatory effect.

This occurs by reducing secretions of PGE_2 prostaglandins, which are known for their pro-inflammatory effect. (Mester, 1976).

3. Anti-oedematic effect.

4. Healing effect, (wounds, ulcers etc).

5. Stimulation of the immunity system.

6. Improvement in cell respiration. (Increases the enzyme activity).

An important step in the study of laser radiation is the discovery of the biophotons, an ultra-weak form of cell radiation. It has been shown that the DNA is the primary source of this radiation. (Ratternmeyer, Nagl 1981). The biophoton radiation is a feature of all living beings and is a measure of the state of health of the organism. Biophotons regulate the behaviour of the cells and determine all the biochemical functions. There are many indications that the IR radiation promotes intracellular communication and that visible UV radiation serves the intracellular communication.

At the ionic level the absorption rate in the light spectrum for different ions, (especially those of sodium and potassium), lies in the region of wavelengths produced by low-energy lasers, particularly those radiating at 632.8 nm wavelength. Making use of differences in concentration, these ion pools produce the polarisation effect on membranes of cells through differential ion distribution on either side of the membrane.

In cases where this polarisation is disturbed by cellular imbalance, lasers can restore membrane potential difference through the specific application of energy.

It has been found that the normal potential difference across the cell's membrane is about -90 millivolt, as proved mathematically by Nerst-Hodgkin-Katz, which was also measured using micro-electrodes and suitable voltmeters. The Hodgkin-Katz equation is:

Membrane Equilibrium Potential, E = :

$$E = \frac{RT}{F} \ln \left\{ \frac{P_K[K]_o + P_{Na}[Na]_o + P_{Cl}[Cl]_i}{P_K[K]_i + P_{Na}[Na]_i + P_{Cl}[Cl]_o} \right\}$$

Where R = Universal Gas Constant = 8.31 J/(mol.k)

T = Absolute temperature in degrees Kelvin
F = Faraday Constant = 96500 c/equivalent
$[K]_i$ and $[K]_o$ are the intra and extracellular concetrations of potassium ions in moles per litre.

P_k = Membrane permeability to potassium ions.
(Na)i and (Na)o are the intra and extra cellular concentrations of sodium ions.
[cl]i and [cl]o are the intra and extra cellular concentrations of chloride ions.
In diseased cells then, it was found that $(K)_1$ $(K)_0$. $(Na)_1$ and $(Na)_0$ are upset, and the potential difference of such "ill" cells is reduced to a value less than -90 mv, say to —60, —40, —30 mV.

It is said that cancerous cells have a potential difference of only —5 mV or even slightly positive.

APPLICATIONS OF LASERS IN MEDICINE

LOW AND MEDIUM POWER LASERS (SOFT LASERS)

1. Sports Medicine - Orthopaedics.

Sports medicine is a field where laser therapy is applied with particularly good results and has been used extensively abroad. Laser therapy could be used for the treatment of: Tennis elbow, Tendonitis, Strains, Cramps, Low back pain, neuralgia, cervical syndrome, arthritis etc.

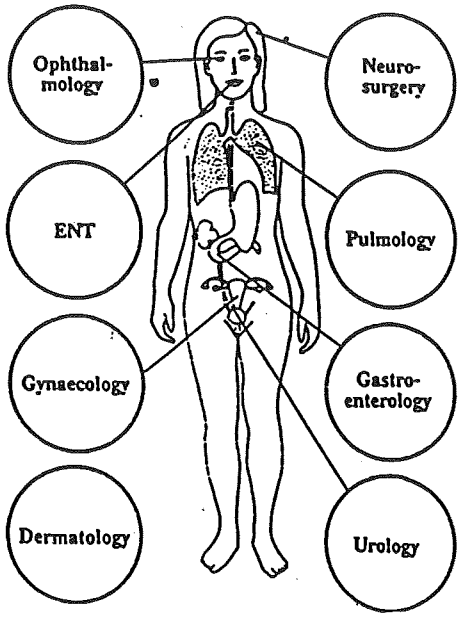
2. Neurology.
— Migraine
— Trigeminal Neuralgia
— Post-herpetic neuralgia.

3. Dermatology
— Eczema
— Bed sores
— Acne
— Burns
— Ulcers
— Aphtae

HIGH POWER LASERS (HARD LASERS).

1. Dermatology: Capillary Hemangiomas, Telangiectasia.
2. Opthalmology:
   Treatment of diabetic proliferate retinopathy, glaucoma etc.
3. Gynaecology:
   Treatment of Cervical intra epithelial Neoplasia (C.I.N.), endometriosis, etc.
4. Surgury, Neurosurgery
5. ENT (Vocal Cord nodules, polyps, granulomas, Laryngeal stenosis etc.)
6. Pulmology
7. Gastroenterology
8. Urology

The picture below shows some of the applications in medicine



POSSIBLE FUTURE USE OF LASERS

Because cancerous cells are said to absorb laser radiation more strongly than healthy tissue, research is focussed in the possible treatment of tumors. Using lasers for the treatment of tumors is not likely to cause any undue damage to the surrounding healthy tissue. In the treatment of cancer the parameters of wavelength, power density and energy dosage as well as the rate of pulses are closely chosen to suit the absorption properties of the particular tumor.

According to some reports "dark" tumours which absorb more light are readily destroyed. Red-reflecting vascular tumours are not so well affected by red radiation from ruby lasers, whilst "white" tumours are not successfully treated as yet.

It is hoped however that through further research and experimentation, the Laser will prove a very valuable and useful tool in the hands of doctors according to their specialisation, for the treatment of many ailments, disorders abnormalities and illnesses.

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Industrial Research and Consultancy at the HTI

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1. ABSTRACT

The staff and equipment resources of the Higher Technical Institute are considered an important asset not only for their primary objective, the provision of sound technical training to its students, but also for their capabilities to support new technology in the Cyprus industry. At the HTI there is a unique group of technically oriented engineers and scientists who are backed up by semi-professionals and supported by well equipped laboratories.

The management and the staff of the HTI have recognised the capabilities of the Institute to provide technical research and consultancy services to the industry and have always encouraged and welcome such activities. For this purpose the Research and the Consultancy Committees have been set up to regulate and promote these services. It is however recognised that the Cypriot industrialists are not fully aware of the available potentials and consequently are not seeking their use.

This article aims at describing the possible areas for which the HTI can undertake industrial applied research and consultancy especially those related to the introduction of new technology. This is nowdays considered necessary due to the relationships of Cyprus with the European Community and the available budgets to upgrade technologically the local industry.

2. THE EXISTING WORK

The staff of the Higher Technical Institute have been involved with industry related activities almost since the establishment of the Institute. This involvement has been realised in the form of applied research, consultancy services and testing facilities. The main areas of work in these fields are outlined below.

2.1 APPLIED RESEARCH

A limited amount of expenditure for industrial research purposes is allocated in the HTI budget and covers expenses towards the purchase of necessary equipment as well as the partial replacement of staff performing such work. The majority of the project ideas, which have been dealt with up to now, were proposed by members of staff and consequently reflected the staff interests in certain areas. Some of these projects were run in collaboration with British Universities or Polytechnics and certain members of staff have been awarded postgraduate MSc/PhD degrees based on their research work.

Other important research work has also been completed in areas related to new technological issues or investigation of certain industrial problems. Typical areas in which research work has been completed or it is in progress are outlined below:

— Solar energy and solar reflectors design and performance evaluation
— Solar desalination
— Evaluation of Total Quality Management for the Cyprus Manufacturing Industry
— Material properties and structural behaviour of steel fiber reinforced cement composites
— Cost effectiveness of thermal insulation in buildings
— Reinforced concrete repair techniques and materials
— Solar X-Ray Unit and solar power facilities
— Electrical energy conservation measures for electric motors
— Digital signal processing
— Programmable logic controllers
— Computer assisted applications

2.2. CONSULTANCY SERVICES

On many occasions the staff of the HTI have undertaken consultancy services for the local industry as well as for international agencies such as the World Health Organisation (WHO), the Commonwealth Fund for Technical Cooperation (CFTC), UNESCO and the International Labour Office (ILO).

Typical assignments for the local industry under this activity were the following:-

— Electrical Building Services
— Testifying a leakage in a concrete tank
— Failure of a fibre-glass container
— Measurement of vibration for the Cyprus Grain Commission.
— Use of grape marc as a source of energy
— Investigation of malfunction of a detector for the Cyprus Forest Industries.
— Checking of a petrol meter
— Test on concrete additive retarder
— Measurement of noise level
— Mechanical and hydrostatic pipe test

— Leaf-spring failure of a bus
— Repair of silos for Cyprus Cement Company
— Domestic hot water and space heating/ cooling using solar energy.
— Microexamination of an immersion heater flange
— Design of an oil tank
— G.R.P Tank Testing
— Tests for Calorific Value of Fuels.
— Efficiency curve of a 15 HP electric motor
— Implementation of a Quality Control system in Footwear Industry
— Organisation of a footwear factory

2.3. TESTING/TREATMENT LABORATORY SERVICES

The engineering laboratories of the Institute are well equipped and often have been used to test specimens for industrial projects. The available testing facilities are:

— Metrology and Quality Control Laboratory
— Heat treatment Laboratory
— Tensile tests for reinforcement steel
— Compressive strength tests for concrete cubes
— Electrical instruments calibration laboratory
— Footwear Testing Laboratory

3. FURTHER POSSIBILITIES FOR INDUSTRIAL SUPPORT

The above research, consultancy and testing activities of the HTI can also be utilised in other related fields which are suitable to the available staff expertise and laboratory apparatus as follows:-

3.1. AVAILABLE RESOURCES

The staff and the laboratory equipment of the Higher Technical Institute spreads in the following major disciplines:-

— Civil Engineering Design and Construction
— Highway engineering and testing
— Mechanical Engineering including Production, Plant and Marine Engineering.
— Electrical, Electronic and Software Engineering
— Mathematics, Statistics, Management and Computer Sciences.

Based on the multidiscipline capabilities of the staff, industrial projects requiring the involvement of a wide variety of expertise can be succesfully undertaken by the HTI. This is considered as a unique opportunity because it is not possible to be provided by any other organisation. It is also anticipated that problems arising from the introduction of new technology in industry require the collaboration of a group of persons of various disciplines.

3.2. INDUSTRY SUPPORT CENTRES

In order to encourage industry to benefit from its available resources the HTI has already established industry support centres in the following areas:-

— Software Engineering
— Industrial Electronics
— Concrete and Steel Reinforcement
— Highway Engineering
— CAD Centre
— Metrology and Quality Control
— Energy
— Footwear Quality Control and Testing

These centres concentrate a specialised group of staff together with suitable laboratory equipment and are capable of undertaking work either individually or in collaboration with other groups.

3.3. MECHANISMS OF COLLABORATION WITH INDUSTRY

The HTI welcomes proposals from industries to undertake work in the form of applied research, consultancy services or specimen testing. For the consultancy and the testing services there are approved rates of payment which can be provided to any interested organisation. The applied research work may be agreed on an individual basis depending on the project to be undertaken.

The work is regulated by the Testing and Consultancy Committee which receives the requests from industry and decides whether the proposal is within the staff capabilities as well as the policies of the Institute. It examines the applications and proposes the fee to be paid. If agreement is reached with the interested part the project is undertaken. It is also important to indicate the possibility to cover major parts of such expenses through budgets available from the European Community and other International bodies.

4. CONCLUSIONS

The resources of the Higher Technical Institute are available for the benefit of the industry of Cyprus and can undoubtely contribute in the solution of the problems encountered with their technological upgrading.

It is also anticipated that the involvement of the HTI staff in real life projects provides opportunities for useful indrustrial experiences which result in a closer understanding of the needs of the Cyprus industry. Consequently this enables the development of a more realistic training course with syllabus content which brings technical education nearer to industry and its problems.

Southern Conveyor Project

Panicos Pelekanos
Instructor In Civil Eng. Workshop, HTI

1.0 INTRODUCTION

In Cyprus during the past 10 years there has been a serious and growing concern about the shortage of water for Agricultural and Domestic consumption.

The water shortage has been caused by the increase in the demand and the reduction in the supply of water available, due to the low precipitation during the recent years.

The problem has been most serious in the Kokkinokhoria area, where overpumping by the local farmers has caused a disasterous fall of the ground water table. This has resulted in the intrusion of sea water in some areas and a raise of salinity to unacceptable levels for domestic or agricultural use.

On the demand side the increase is greater in the capital Nicosia where the rising of industrial and commercial requirements as well as the increasing population have necessiated cutting off water supplies to consumers. The increase is also considerable in seaside towns and holiday resorts, since about 1.5 millions tourists visit Cyprus each year, mainly during the summer period.

Additional water supplies are therefore needed for reasons of social welfare, health and hygiene and there is little question that in agriculture this water can be productively and economically used. The resources of good land and skilled labour are available, as are the crop markets and marketing systems, especially so in the case of Kokkinokhoria where the replacement of ground water is clearly the factor which will most limit continued agricultural production.

Solutions with disalination of sea water have been rejected since at present they are relatively costly operations.

In order to solve the problem of water at least for the near future, the surplus water in the mountains of the island is to be used, since no other sources are available. For this, the Government of Cyprus gave instructions to Sir William Halcrow and Partners of United Kingdom, to prepare a feasibility study. The Project was named "SOUTHERN CONVEYOR PROJECT".

The author of this report was working as Civil Engineer and Chief Quantity Surveyor for China International Water and Electric Co, the International Contractors of the Pumping Stations of the Southern Conveyor Project.

2.0 THE SOUTHERN CONEYOR PROJECT OBJECTIVES

The basic objective of the Southern Conveyor Project (SCP) is to collect and store surplus water currently flowing to the sea in the mountainous and relatively wetter part of the island and convey it by means of a regional water carrier for use in areas to the East where the water is most needed.

In aiming to devise a socially and financially acceptable and economically viable scheme the SCP recommended the irrigated farming development in the South coastal region between Limassol and Famagusta that would benefit most from the Project. In addition the SCP had to meet the future domestic and industrial water demands, for the towns of Limassol, Larnaca, Famagusta and Nicosia and numerous village communities and also supply the needs of touristic development along the southern and eastern coastline.

The SCP was decided to be constructed in two phases because of its large size and its high financial cost.

Phase 1: includes the construction of Kourris Dam, the main Conveyor, the Akhna Dam and the Kokkinokhoria Irrigation Systen.

Phase 2: includes the Dhiarizos Diversion, Irrigation Distribution Networks for Akrotiri, Parekklisha, Mazotos and Kiti and Domestic Water Supply works for Limassol, Nicosia, Larnaca and rural water supply schemes.

3.0 FIRST PHASE

Phase 1 is expected to cover the irrigation requirements of Kokkinokhoria and domestic water demands until 1993, when phase 2 is expected to come in to operation.

The main works of the 1st Phase are as follows:

3.1 KOURRIS DAM

The objective of the Kourris dam is to provide seasonal and interannual storage of the flows of Kourris river and its tributaries. Such storage, by balancing the variable inflows will permit a steady and reliable supply to the Project benefited areas via the Southern Conveyor.

The capacity of the Kouris dam reservoir is 115

million cubic metres of water, the biggest upto date in Cyprus.

The embankment construction is of zoned earthfill about 110 m high. The reservoir is 5km long and it has a surface area of 3.6Km2.

The contract for the construction was awarded in July 1984 to the joint venture Impegrilo (Italy) with J&P (Cyprus) at a contract value of £19,954,512 and was completed late in 1988.

3.2 MAIN CONVEYOR

The objective of the Main Conveyor is to convey the stored water from Kourris dam, along the Southern coast, to Akhna reservoir. A branch-off will recharge Yermasoyia river bed boreholes downstream of Yermasoyia dam. A second branch-off will supplement Vasilikos-Pendaskinos Project through a Balancing reservoir.

The Main Conveyor is a 110 km long pipeline and it consists of ductile iron pipes and fittings of diameter ranging from 1400mm down to 800mm. Supply of these pipes and fittings has been awarded to Pont A Mousson of France for the tender sum of £19,944,927 and delivery was completed in mid 1987.

The construction of this contract was awarded in October 1985 to joint venture Cybarco (Cyprus) and Shand (UK) at a total contract value of £6,157,031. Installation of the main conveyor started late in 1985 and was completed at the beginning of 1988.

3.3 AKHNA RESERVOIR

The objective of Akhna reservoir is to provide balancing storage in the Kokkinokhoria area. Water can be pumped to the nearby irrigation area at times of peak irrigation demand to supplement flows in the main conveyor and thus reduce the size of pipeline otherwise required.

The capacity of Akhna reservoir is 5.8 million cubic metres of water.

The construction of the embankment is of zoned earthfill and it is 16m high.

The construction of this contract has been awarded to Iacovou Brothers of Cyprus at a contract value of £1,312,980. It started in mid 1986 and was completed in the end of 1987.

3.4 KOKKINOKHORIA IRRIGATION NETWORK

The objective of the Kokkinokhoria Irrigation Network is to irrigate an area of approx. 9000 ha. through the 1st Phase of SCP in the Kokkinokhoria region.

The Kokkinokhoria Irrigation network consists of:

3.4.1 Main Conveyors

The objective of the Main Conveyors is to convey water to the 4 balancing reservoirs. It consists of AC pipes which were supplied by Amiantid SA (Greece) and Cyprus Pipes Industries. The main conveyor is 30km long, the laying of the pipes was done by direct labour of WDD and was completed in June 1987.

3.4.2 Balancing Reservoirs

The objective of the Balancing Reservoirs is to balance the water quantities around the area to be irrigated. Their total number is 4 and they were constructed of reinforced concrete retaining walls and floor slabs. The construction was awarded in April 1987 to G.P. Zachariades of Cyprus. Works were completed in early 1989.

3.4.3 Central Distribution Points.

Water from the Balancing Reservoirs is stored in the Central Distribution Points, 15 in number and from there is pumped in the Distribution Network. The CDP's are made of reinforced concrete walls and floor slabs. The construction was awarded in April 1987 to Cybarco of Cyprus for a contract value of £2,179,600 and was completed in May 1989.

3.4.4 Pumping Stations

There are 15 CDP pumping stations and 4 other main pumping stations. Using electrically operated pumps the pressure in the Network is maintained at a certain level thus enabling the farmers to use water directly without any extra cost and allows the use of latest technology irrigation systems. There is a Control Panel in each station which automatically initiates the start or stop of a pump according to the demand for water. The construction of the Pumping Stations was awarded in March 1987 to China International Water & Electric Corporation of China at a contract value of £1,649,000. Works were completed in June 1990. The pumping plant and ancillary equipment was supplied by SPP Projects (UK) for the tender sum of £664,454.

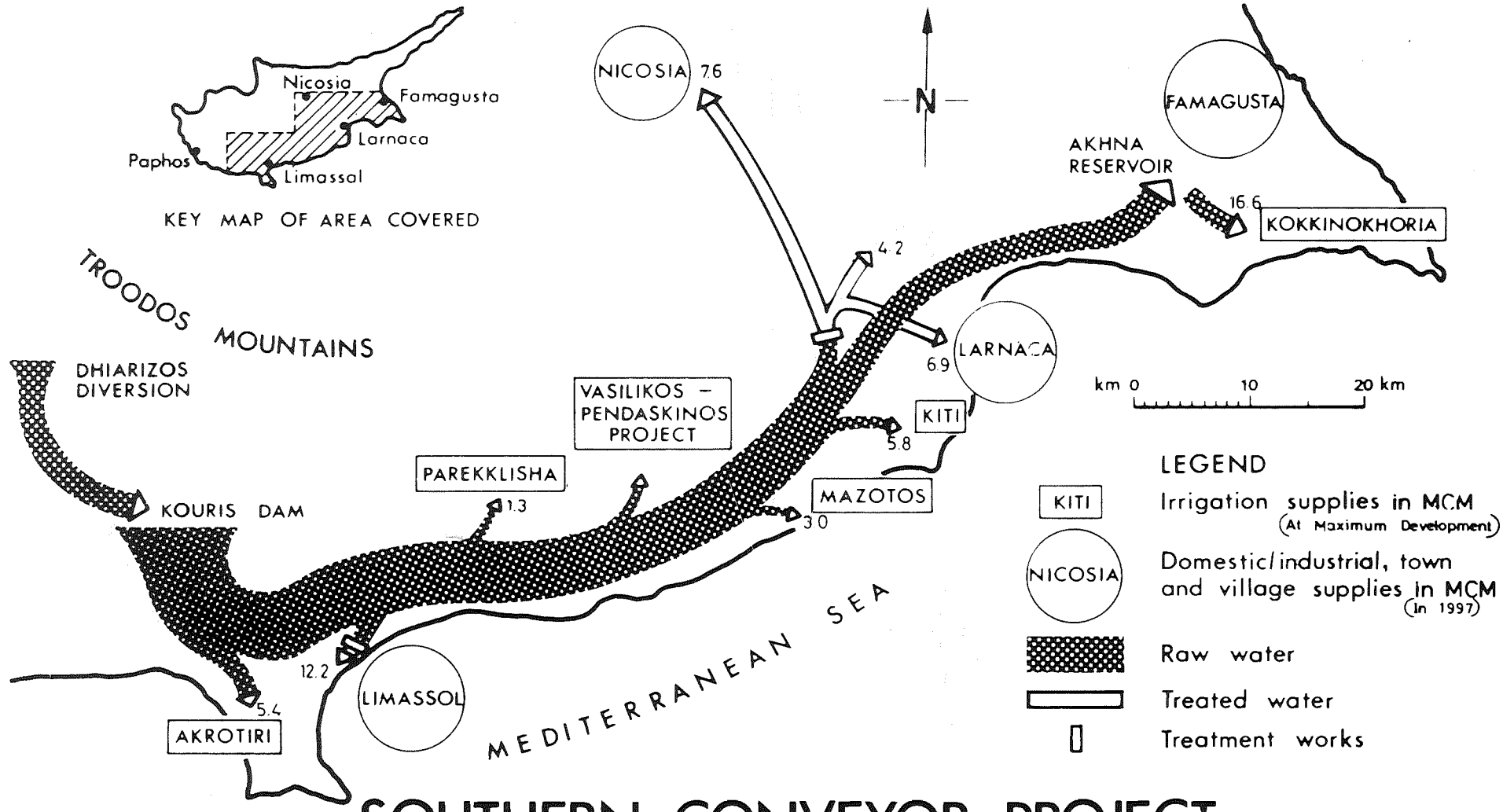
3.4.5 Secondary Distribution System

The secondary distribution system is of a total length of 300 km AC and plastic pipes. The valves, flow meters, irrigation hydrants, plastic pipes, fittings etc, were supplied by EEC and Cypriot manufacturers. The construction of the secondary distribution system was undertaken by WDD direct labour, works commenced in Jan. 1987 and completed in 1991.

4.0 SECOND PHASE

4.1 DHIARIZOS DIVERSION

The objective of the Dhiarizos Diversion is to convey the surplus water from Dhiarizos river



SOUTHERN CONVEYOR PROJECT

Diagrammatic Representation of Water Distribution

1st and 2nd Phase

and store it to Kourris dam for the Southern Conveyor requirements.

A 14 km long tunnel, 2.8 m diameter, is constructed through the mountains. The lining of the tunnel is made of precast concrete slabs with the backside voids filled with concrete.

A total quantity of 21 millions cubic metres of water per year is estimated to be carried through the tunnel.

The project was undertaken by joint venture of Mayreder of Austria and G.P. Zachariades of Cyprus for a contract value of around £16,000,000. Work commenced in June 1990 and is scheduled to be completed in January 1993.

4.2 IRRIGATION DISTRIBUTION SYSTEMS

The objective is to construct irrigation distribution networks for four irrigation areas totalling some 4300 ha - Akrotiri (1755ha), Parekklisha (320ha) Mazotos (660ha) and Kiti (1600ha).

This component will include all connecting and distribution pipes and regulating tanks between the SCP main conveyor and hydrants at farm level. About 2,300 ha of the total area will be consolidated and new farm roads will be constructed there in.

4.3 DOMESTIC WATER SUPPLY

Domestic water supply works will include:

(i) for Limassol:

untreated water main from Southern Conveyor to treatment plant, water treatment works (Limassol plant) and conveyors from treatment plant to service reservoir.

(ii) for Nicosia and Larnaca:

untreated water from Southern Conveyor to site of treatment plant, water treatment works (Tersephanou plant) and main conveyor from Tersephanou to Nicosia service reservoir at Lakatamia including pumping stations and balancing reservoirs.

(iii) for Larnaca:

storage tank including necessary pipeline connections.

(iv) two rural water supply schemes, in the Limassol area and along the route of the Stavrovouni - Nicosia main pipeline.

5.0 CONCLUSIONS

Water in Cyprus is limited and all necessary measures should be taken in order not to waste it and not to allow any surplus surface water to flow in to the sea.

The Southern Conveyor Project is estimated to have an overall cost of about £200,000,000 for Phases 1 and 2. However one has to bear in mind that this solution gives only a temporary relief to the problem.

Studies by experts should be carried out on a longterm basis and the Government should apply a longterm program in order to minimise the results of a dry season or a series of dry seasons. Maybe the construction of a disalination plant is a solution, in case of emergency.

All concerned, inhabitants and visitors, should have in mind that the quantities of this valuable God given gift are limited. Every time one uses water either in the house or in the fields, should think twice so that the waste of water is reduced to the MINIMUM.

HTI Calendar of Activities Academic Year 1991-92

D Charalambidou-Solomi, DES,BA,MA
Lecturer, HTI

SEPTEMBER

- Two hundred and forty (240) students were envolled on the regular courses of HTI: 62 for Electrical Engineering, 60 for Civil Engineering, 60 for Mechanical Engineering, 28 for Marine Engineering and 30 for Computer Studies.
- Fifteen (15) students enrolled on the RTC Medical Electronics Specialised Technician Course.
- Regular lectures commenced on Monday, 16 September.
- Mr G. Iordanou, Head of Mechanical Engineering Department, and Mr M. Pattichis, Senior Lecturer, attended a seminar on "Industrial Robotics Applications" in Belgrade between 2-6 September.
- Mr C. Neocleous, Lecturer, attended a Conference on "Robot Control Systems" in Vienna between 16-20 September.
- Mr G. Iordanou, Head of Mechanical Engineering Department, participated in the Conference on "Maritime Cyprus 91" which was held in Nicosia between 22-26 September.
- Mr Sp. Spyrou, Head of RTC, visited Damascus in his capacity as a WHO consultant where he prepared and submitted a report to the Syrian Government on the prospects of setting up an Arabic Regional Centre for the repair and maintenance of medical equipment where the medium of instruction would be Arabic.
- Mr D. Lazarides, HTI Director, participated in the World Student Conference in Moscow on an invitation from the State University of Moscow, M.B. Lomonosov.

OCTOBER

- HTI staff and students donated blood on 16 October for the needs of the Blood Bank of the Nicosia General Hospital.
- Mrs Despina Sergidou, Senior Lecturer, attended the Meeting of the Presidents of the European National Sections of the International Solar Energy Society (ISES) which was held in Rome between 28-29 October on "Europe — ISES".
- Mr Klitos Anastasiades, Lecturer, attended a course on "LOTUS" organised by CPC between 14 October — 11 November.

NOVEMBER

- HTI in collaboration with IEE Cyprus Centre organised three courses on:

(a) "Advanced Programming of Programmable Logic Controllers and their Applications" between 2-9 November.

(b) "X-25 Pocket Switching Network" between 4-8 November. This course was of 20-hour duration and was sponsored by the Industrial Training Authority.

(c) "Fire Alarm and Intruder Systems" of 20-hour duration between 4-8 November.

- The First Mid-Semester Exams were held 4-8 November.
- HTI in collaboration with the Public Works Department organised a 10 week course on "Prestressed Concrete". The course started on 5 November and was delivered by Dr. Chr. Chrysostomou, HTI Lecturer.
- Mr Engr. Dieter Horneber, Technical Adviser of the German GTZ-PAS, working for the Department of Health in Manilla, visited HTI-RTC from 6-7 November. The obsective of his visit was the co-operation of RTC and the Department of Health of Manilla in the field of training technicians on hospital equipment.
- HTI in collaboration with IEE Cyprus Centre organised a course on "The IBM PC for Technical Staff and Managers" between 11-15 November.
- HTI Students Union participated in the three-day "Fight Against Leukemia" which was organised between 12-14 November by Cyprus Airways and Cyprus Anti-Leukemia Association. On 12 November HTI staff and students gathered at 9.25 am in the main court-yard of HTI to cheer the cyclist, Mr Michalis Agrotis, who set off from Makarios III Hospital in Nicosia on his way to Larnaca in his effort to raise money to support the fight against Leukemia. Mr Agrotis' efforts were praised by the HTI Director, Mr D. Lazarides, and money was collected for the same course among students and staff.

• Mr Udo Staack, Hospital Engineer, and Mr Emil Dietrch, Engineer, both Technical Advisors of the German GTZ-PAS at the National Medical Institution of Amman, Jordan, visited HTI-RTC on 19 November. The objective of their visit was the co-operation between HTI-RTC and the National Medical Institution of Amman in the field of training students.

• Mr A. Taylor from the Polytechnic of Wales visited HTI between 11-29 November on a staff-exchange visit. Mr N. Kathijotes, Lecturer, visited the Polytechnic of Wales between 25 November — 16 December.

• Professor Stricker from Switzerland, and on secondment to the Swiss Foundation for Technical Co-operation, in charge for the Development of Technical Programs in various countries in Africa visited RTC on 25 November. The objective of his visit was to evaluate RTC courses and to examine the possibilities of sending African students to RTC for training.

• Mr C. Everiss, Senior Lecturer of the Polytechnic of Central London, visited HTI on a staff exchange programme in November. During the same period Mr C. Neocleous, HTI Lecturer, went to PCL.

• In November the Head of Electrical Department, Mr St. Anastasiou, and Mr Char. Chrysafiades, Lecturer, attended the "International Conference 91" which was held in Athens. The Conference was organised by the Greek National Committee for C.I.G. R.E.

• Mr Gerald Musgrarne, Pro Vice-Chancellor of the University of Brunnel, visited HTI on an ecxhange programme in November. Mr E. Michael, Lecturer, visited the University of Brunnel for the same period.

• UNESCO Day was celebrated on 26 November. Students and staff visited the Church of Sotiros and the Monument of the Cypriot Mother in Palechori village. Mr Panicos Lambitsis, a member of the Palechori Improvement Board, gave a short talk on the historical and cultural value of the Church and the national significance of the Monument of the Cypriot Mother.

DECEMBER

• Lectures stopped on 23 December for the annual two-week Christmas break.

JANUARY

• Lectures commenced on Tuesday, 7 January.

• Mr J. Economides, Lecturer, attended the "First Pan-Hellenic Conference" on Asphalt — Concrete and Flexible Road Pavements which was held in Salonika between 16-17 January.

• The Annual General Conference of the International Association for the Exchange of Students for Technical Experience (IAESTE) was held in the town Bad Newenahr in Germany from 17-25 January. Sixty countries participated. The Conference was attended by Mr D. Lazarides, Chairman of the National Committee of IAESTE, Cyprus and Mr Ch. Chrysafiades, National Secretary. IAESTE Cyprus offered 33 training positions to various countries and secured 38 offers for Cypriot students to receive training abroad during the current academic year.

• Mr Nicos Hadjigeorgiou, Lab Assistant, attended a seminar on "Aggregate Testing Methods" held at the City University of London between 27-30 January.

• The IEE Cyprus Centre in collaboration with HTI and the Industrial Training Authority organised a 20-hour course on "MS DOS Interfacing to DOS and the BIOS". The course was delivered by Mr J. Craddock of the Euromanagement and Technology Bureau, London, from 27-29 January. The course was attended by 22 participants for industry and 3 members of HTI staff.

• The First Semester Exams were held 20-31 January.

FEBRUARY

• Classes for Second Semester began on 3 February.

• The HTI in collaboration with IEE Cyprus Branch and the Industrial Training Authority of Cyprus organised two 20-hour courses on:

(a) "Networking with Novell Netware" which was held from 3-5 February and was attended by 27 participants.

(b) "Troubleshooting Novell Netware" which was held between 5-7 February and was attended by 23 participants. Both courses were aimed at personnel working in industry and were developed by the Euro Management and Technology Bureau, London. Mr A. Freeman, authorised instructor of the Euro Management and Technology Bureau, presented both courses.

• The Head of the Civil Engineering Department, Dr H. Stavrides, visited the Polytechnic of Wales within the framework of the exchange staff programme between 24 February — 6 March.

● Mr J. Economides, Lecturer, presented a course to Public Work Department personnel on "Soil Stabilization" in February.

● The HTI Workshops in collaboration with IEE Cyprus Centre and the Industrial Training Authority organised a course of 24-hour duration on "Fire Alarm and Intruder Systems" from 18 February — 5 March.

MARCH

● Mr G. Iordanou, Head of Mechanical Department, and Mr M. Pattichis, Senior Lecturer, attended the Conference "Robot 92" which was held Brno CSFR from 1-7 March.

● Mrs D. Sergidou, Senior Lecturer, participated in the UN pre committee and the New York Roundtable of the International Solar Energy Society (ISES) as a panel speaker between 2-10 March. This meeting was a follow-up of the ISES Rome roundtable where Mrs Sergidou actively participated. The ISES recommendations were forwarded to the United Nations for the United Nations Conference on Environment and Development (UNCED).

● The IEE Cyprus Centre in collaboration with HTI and the Industrial Training Authority organised a 20-hour course on "The IBM PC for Technical Staff and Managers" from 30 March — 4 April. This course was aimed at engineers working in industry, and was developed by the Euro Management Bureau, London. It was presented by Mr. Ch. Theopemptou, Lecturer. The course included theoretical and practical sessions and was attended by 12 participants.

● Second Mid-Semester examinations were held between 30 March — 6 April.

APRIL

● Mrs D. Sergidou, Senior Lecturer, presented a paper as a guest speaker during the "International Conference of Renewable Energy Resources" which was held in Cairo between 19-23 April. She also chaired a session of the conference.

● Dr M. Kassinopoulos, Lecturer, participated in the "Pan-Commonwealth Workshop on Mathematical Modelling in Circuit Design" which was held in Kandy, Sri-Lanka between 27 April — 15 May.

● HTI Staff and Students donated blood on 9 April, 16 April and 7 May thus bringing the total blood donation to 391 bottles for the current academic year.

MAY

● Mrs D. Sergidou was one of the speakers at the roundtable on "Environment and the Health of the Earth" on 19 May organised by the United Nations, Cyprus Section, to celebrate the International Day of Environment.

● The presentation of the awards to all winners individuals and teams of all the intramural sport events of the academic year 1991/92 took place at the Students' Canteen on Wednesday 27 May., KEO LTD, which sponsored the intramural sport events, offered free beer.

● The Formal Dinner of the HTI third year students was held on Thursday, 28 May at the Philoxenia Hotel. The Dinner was honoured by H.E. the Minister of Labour and Social Insurance, Dr I. Aristidou, the Director General of the Ministry of Labour and Social Insurance, Mr George Anastasiades, the Director of the Industrial Training Authority, Mr Panos Koutouroushis, and representatives from the local industry.

● Mr J. Economides, Lecturer, delivered a short course to Public Works Department Technician Engineers on "Laboratory Testing of Soils" in May.

Final Exams for third year students were held 11-15 May.

JUNE

● The End-Semester Exams for first and second year students were held 1-12 June.

● Diploma Projects were submitted on 5 June and Diploma Project Oral Exams were held between 16-18 June.

JULY

● Mr Sp. Spyrou, Lecturer, participated in the "VI Mediterranean Conference on Medical and Biological Engineering" which was held in Capri, Italy, from 5-10 July. The Conference was organised by the AIIMB of Italy and was sponsored by the International Federation for Medical and Biological Engineering (IFMBE) Mr Spyrou presented a paper entitled "Repair & Maintenance of Medical & Hospital Equipment: Courses & Training at WHO/EMR Regional Training Centre (1978-1992).

● The HTI Graduation Ceremony was held on Monday, 6 July, at the Cyprus International Conference Centre. H.E. The President of the Republic, Mr George Vasiliou, attended the ceremony and awarded the Presidential Prize. The HTI Director, Mr D. Lazarides, delivered the Graduation Speech and the President of the

HTI Students Union, Mr C. Konnaris, addressed the gathering as well. The Diplomas to the Graduates of the Civil, Electrical, Mechanical and Computer Specialisations were awarded by the Hon Minister of Labour and Social Insurance, Dr I. Aristidou. The Diplomas to the Graduates of the Marine Specialization were awarded by the Hon Minister of Communication and Works, Mr Renos Stavrakis. The Diplomas to the Graduates of the WHO-Sponsored courses were awarded by the Hon Minister of Health, Dr Panicos Papageorgiou.

- Mrs D. Sergidou, Senior Lecturer, addressed the Conference on "The Environment Natural & Man-Made" which was held in Spetse, Greece, between 16-19 July.
- Dr Chr. Chysostomou, Lecturer, was one of the speakers at the "10th World Conference on Earthquake Engineering" which was held in Madrid, Spain from 19-25 July.
- Dr H. Stavrides, Head of Civil Department, participated in the "4th RILEM International Symposium on Fibre Reinforced Cement and Concrete" which was held in Sheffield, UK, from 20-23 July.

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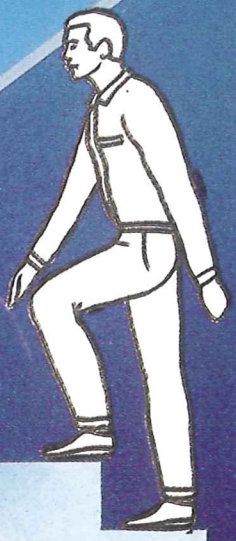

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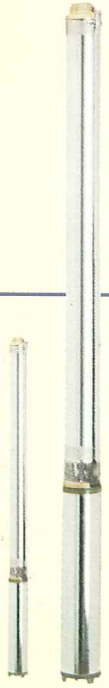

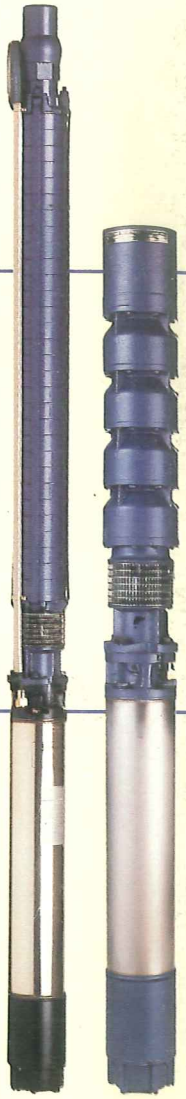

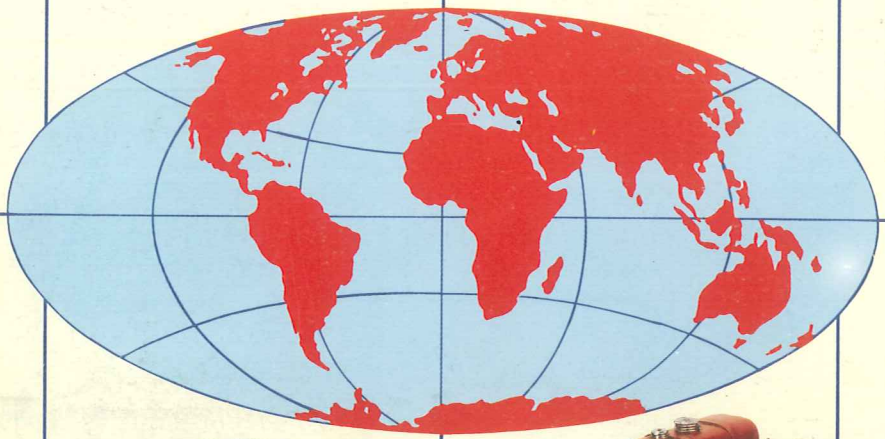

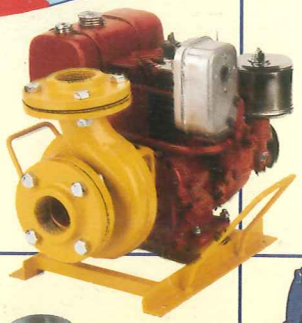

Total Commitment to High Quality & Service

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