PN-AAT-516
41587

1985 INTERNATIONAL ROUNDTABLE
ON RENEWABLE ENERGY

COUNTRY POLICY PAPER #4

The Interaction of Governmental and Free Market Forces in the Development of Renewable Sources in Cyprus

By
Kyriacos Hadjikyriacos
DKA Kittis Associates, Ltd.
Nicosia, Cyprus

© THE INTERNATIONAL INSTITUTE FOR ENVIRONMENT AND DEVELOPMENT

TABLE OF CONTENTS

I. INTRODUCTION

1.1 Objectives 1

1.2 General Overview 1

II. THE DEVELOPMENT OF RENEWABLE ENERGY SOURCES AND FUTURE PLANS IN CYPRUS 6

2.1 Highlights of the Application of Renewable Energy 6

2.2 Utilization and Prospects of Renewable Sources 6

2.2.1 Solar Energy Utilization and Prospects 6

2.2.2 Wind Energy Utilization and Prospects 17

2.2.3 Hydro Energy Utilization and Prospects 17

2.2.4 Biomass Energy Utilization and Prospects 18

2.2.5 Geothermal Energy Utilization and Prospects 18

III. SUMMARY AND CONCLUSIONS 19

3.1 Summary 19

3.2 Conclusions 19

I. INTRODUCTION

1.1 Objectives

This paper attempts to highlight the development of renewable energies in Cyprus and the role of governmental policies and free market forces in this framework. Renewable energy sources are defined to be:

- Solar Energy
- Wind Energy
- Hydro Energy
- Geothermal Energy
- Biomass Energy

Direct and indirect governmental policies are considered to be all fiscal, financial, legal/regulatory and promotional actions pursued by the government, whereas free market forces are defined to be all economic factors that influence manufacturers and end users.

In view of the high level of activity in the use of solar water heaters, the paper will focus most of its attention on the development of the market for that particular technology.

1.2 General Overview

Cyprus, with a population of 0.6 million and GNP of US $2.2 billion, is almost totally dependent on the import of crude oil for providing for its energy requirements.

The total energy requirements of the country are estimated to be 1,025,000 tons of oil equivalent (TOE). The contribution of domestic resources does not exceed 4.1 percent; this contribution is essentially in the form of solar energy (almost exclusively solar water heaters - SWH), wood (mainly for cooking purposes), and very little wind energy.

Thus, 96 percent of the total energy supply is imported, and these imports are exclusively oil and oil products. This is clearly shown by the energy balance for 1982 given in Table 1 and Figures 1 and 2, which demonstrate the evolution of oil imports in relation to economic indicators of the country, respectively.

Table 1. Overall energy balance of Cyprus.

Year 1982 — In Thousands of Tons Oil Equivalent (TTOE)

	Crude Oil	Oil Products	Hydro	Electr.	Other Renewable	TOTAL	Prima Equiv.
Indigenous Production	0	-	+0	-	+25	+25	-
Imports	+508.8	+406.8	-	-	-	+987.3	-
Exports	-0	0	-	-	-	0	-
Marine Bunkers	-	-12.6	-	-	-	-12.6	-
Stock Change ±	-2.3	-9.1	-	-	-	-11.4	-
TOTAL Energy Requirements	+506.5	+493.3	+0	-	+25	+1024.8	-
Electr. Generation	-	-346.3	-0	+96.2	0	-250.1	+346.3
Refinery	-506.5	+480.4	-	-0.84	0	-26.94	-3.0
Own Use by Energy Sector & Losses	0	0	0	-11.3	0	-11.36	-40.7
Unbilled Consumption	-	-6.2	-	-19.56	0	-25.76	-70.
TOTAL Final Consumption	-	+621.2	-	+64.50	+25	+710.7	+232.2
(Non Energy Uses)	-	0	-	-	0	0	-
Final Energy Consump.	-	+621.2	-	+64.50	+25	+710.7	+232.2
Agriculture	-	+62.0	-	+4.04	+ N/A	66	+14.5
Industry	-	+248.3	-	+19.99	+ N/A	268	+72.0
Domestic	-	+63.0	-	+17.36	+25	+126.8	+62.5
Commercial & Admin.	-		-	+21.45	0		+77.2
Transport	-	+247.9	-	0	0	+247.9	0
Other Sectors	-	0	-	+1.66	0	+1.66	+6.0
Electr. Generated SWH	-	-	+0	+1006.6	0	-	-
Efficiency in Elec. Generation	-	-	-	27.77	-	-	-

+Including jet fuel supply of foreign air companies.
N/A = Not Available

Table 1. Overall energy balance of Cyprus.

Year 1982 — In Thousands of Tons Oil Equivalent (TTOE)

	Crude Oil	Oil Products	Hydro	Electr.	Other Renewable	TOTAL	Primary Equiv.
Indigenous Production	0	-	+0	-	+25	+25	-
Imports	+508.8	+406.9	-	-	-	+987.3	-
Exports	-0	0	-	-	-	0	-
Marine Bunkers	-	-12.6	-	-	-	-12.6	-
Stock Change ±	-2.3	-9.1	-	-	-	-11.4	-
TOTAL Energy Requirements	+506.5	+493.3	+0	-	+25	+1024.8	-
Electr. Generation	-	-346.3	-0	+96.2	0	-250.1	+346.3
Refinery	-506.5	+480.4	-	-0.84	0	-26.94	-3.0
Own Use by Energy Sector & Losses	0	0	0	-11.3	0	-11.36	-40.7
Unbilled Consumption	-	-6.2	-	-19.56	0	-25.76	-70.4
TOTAL Final Consumption	-	+621.2	-	+64.50	+25	+710.7	+232.2
(Non Energy Uses)	-	0	-	-	0	0	-
Final Energy Consump.	-	+621.2	-	+64.50	+25	+710.7	+232.2
Agriculture	-	+62.0	-	+4.04	+ N/A	66	+14.5
Industry	-	+248.3	-	+19.99	+ N/A	268	+72.0
Domestic	-	+63.0	-	+17.36	+25	+126.8	+62.5
Commercial & Admin.	-		-	+21.45	0		+77.2
Transport	-	+247.9	-	0	0	+247.9	0
Other Sectors	-	0	-	+1.66	0	+1.66	+6.0
Electr. Generated SWH	-	-	+0	+1006.6	0	-	-
Efficiency in Elec. Generation	-	-	-	27.77	-	-	-

+Including jet fuel supply of foreign air companies.
N/A = Not Available

Figure 1 Evolution of total country requirements of imported energy

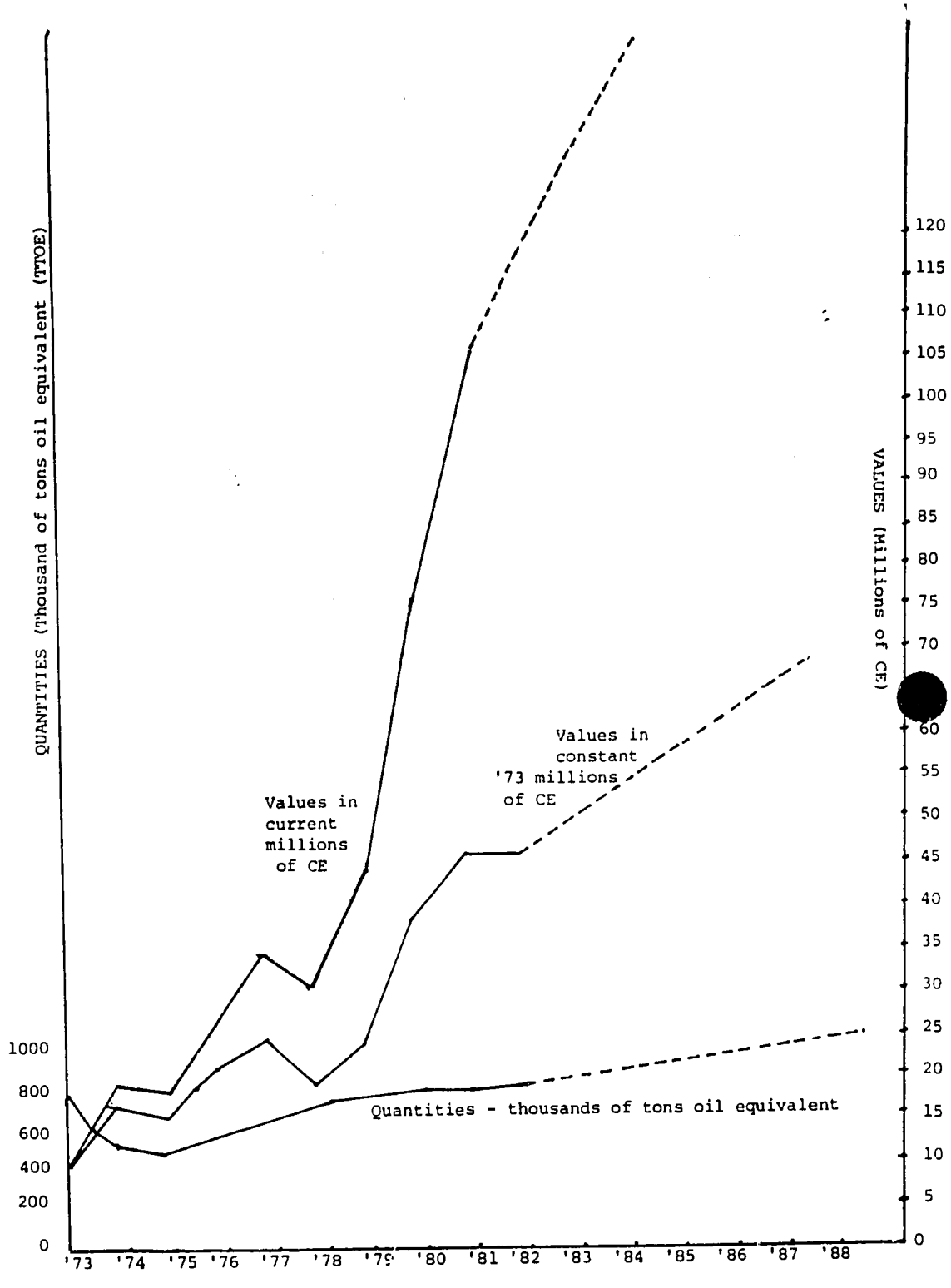
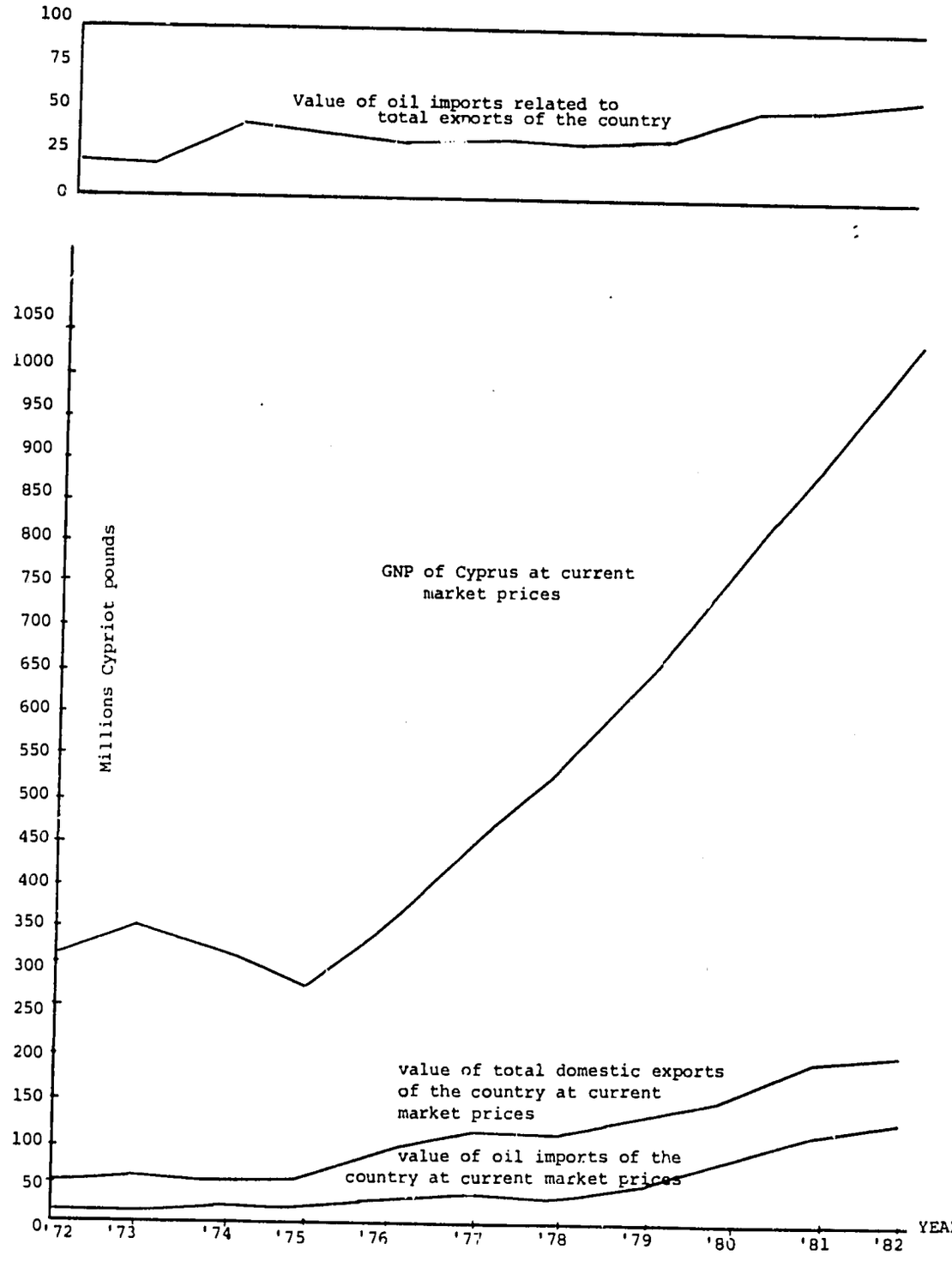


Figure 2 Evolution of oil imports compared to economic indicators of the country.



The importance of the energy problem in Cyprus is expressed by the fact that the cost of energy, essentially the cost of imported oil and oil products, is becoming a heavier and heavier burden on the economy, representing the following portions of important economic indicators:

1972	1982
7 %	20% of total imports
19 %	50% of total domestic exports of goods
6.5%	25% of foreign exchange earnings

These increases were largely due to the very high increases in the prices of imported energy, which consumers had to bear.

In view of these severe problems and constraints, Cyprus is prudently focussing its national energy objectives on:

- reducing oil imports;
- energy conservation;
- developing further its renewable energy sources - the subject matter of this paper.

The responsible body for planning, coordinating, and implementing the national energy policy and which has final responsibility for the energy sector is the Ministry of Commerce and Industry (MCI). Within the MCI, the Energy Section prepares and makes recommendations to the Minister, who formulates the energy policy; this section then implements the policy. Within the energy section an Energy Advisory Unit (EAU) has recently been established to act as the focal point for all non-power energy-related development, including conservation and renewables.

II. THE DEVELOPMENT OF RENEWABLE ENERGY SOURCES AND FUTURE PLANS IN CYPRUS

2.1 Highlights of the Application of Renewable Energy

Historically, the first application of renewable energy to be developed in Cyprus was the use of windmills for irrigation purposes. In the early 1930s, hundreds of windmills were set up in agricultural areas all over Cyprus to irrigate small plots of vegetables. This application grew quickly but began declining in the 1960s when diesel pumps, run on gas and oil, proliferated due to the very low price of oil.

A second extensive use of a renewable source of energy appeared in the early sixties, when Israel was developing, on a large scale, solar water heaters (SWH). Cypriot manufacturers initially copied some Israeli products and quickly created a national industry which is today the most successful in the world with regard to the number of square meters of collectors manufactured annual divided by the population.

Cyprus produces today more than 30,000 sq. m. of collectors per year and 9 percent of the total electricity consumption is replaced by the exploitation of solar energy.

The use of wood as a heat source for domestic purposes is common, mainly for space heating and to a lesser extent for cooking. This represents a significant part of the country's renewable energy consumption (approximately 7,000 TOE).

Other applications of renewables have been tested and/or implemented, but on an experimental scale. Most prominent are a hydro power station developed in the Troodos Mountains, and several technologies studied in research centers, including solar greenhouses and biogas units at the Agricultural Research Institute.

Lastly, additional new technologies are knocking at Cyprus' door: wind turbine generators and solar ponds would represent a partial response to year 2000 energy requirements, whereas solar photovoltaic generators could play a useful role in supplying electricity to remote equipment such as marine beacons, telecommunications, and telemetry.

A diagram of potential applications of renewable sources in Cyprus is given in Table 2.

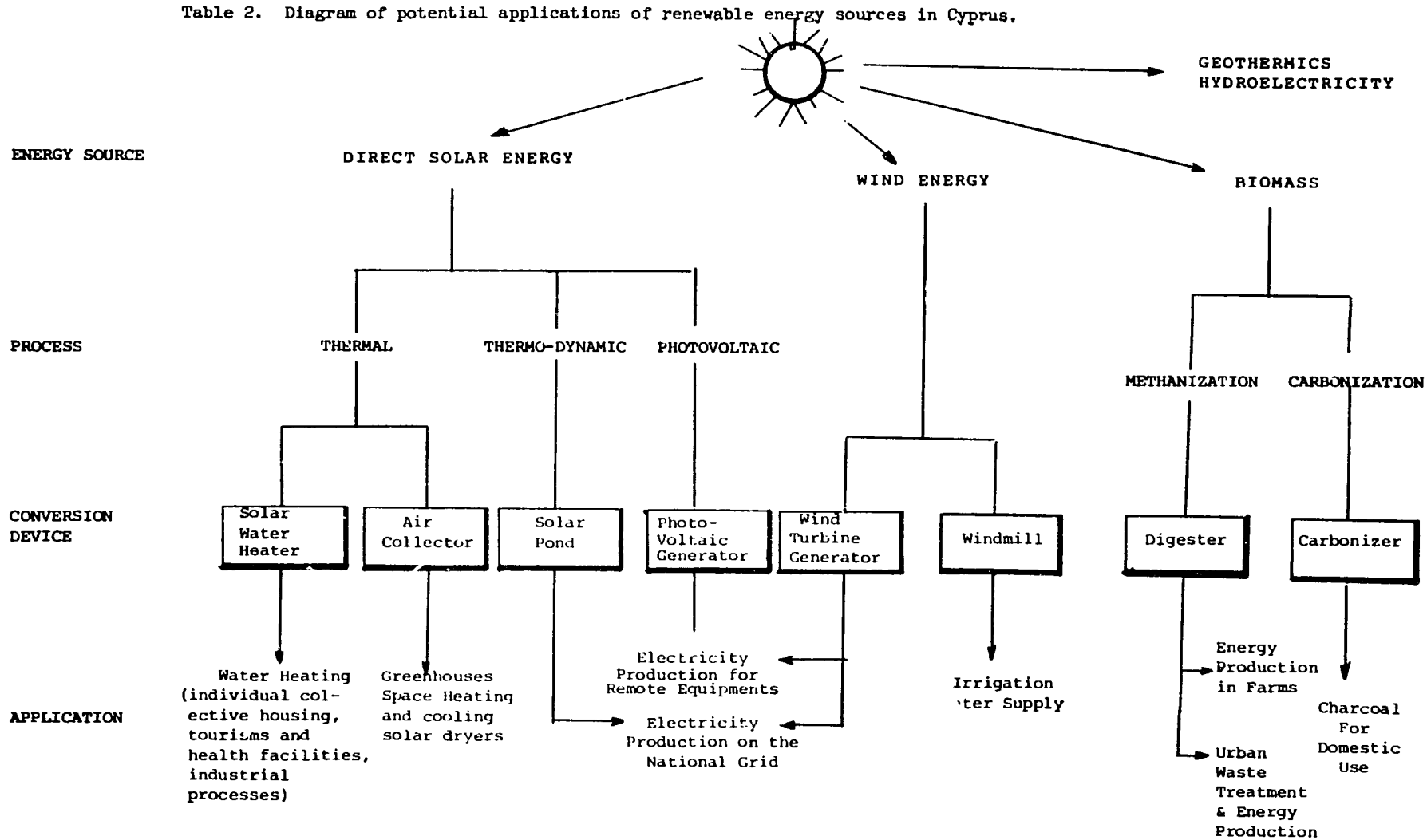
2.2 Utilization and Prospects of Renewable Energies

2.2.1 Solar Energy Utilization and Prospects

Solar Energy Resources

Cyprus enjoys a very sunny climate with an average annual solar radiation of 5.3 kwh/m^2/day (on a horizontal basis). Even in winter, the sun's radiation is sufficient for useful application.

Table 2. Diagram of potential applications of renewable energy sources in Cyprus.



Present Situation/Background

In Cyprus one is struck by the large number of solar heaters (of thermosyphon design) that tower over most of the flat roof-tops. With about 109,000 solar water heaters in January 1984, the island has the largest per capita diffusion of this technology in the world: 1 SWH for each 5 persons in Cyprus, compared to 1 SWH for each 8 persons in Israel.

Table 3 gives a breakdown of stocks as of January 1, 1983; 1983 sales; and stocks of SWH as of January 1, 1984, by sectors of utilization.

About 90 percent of the existing SWH stocks is in houses, 8 percent in flats and 2 percent in the tourism sector.

Cyprus begun to manufacture SWHs in the early sixties, when Israel was developing a large-scale industry in this field and when some Israeli products were copied by Cypriot manufacturers. Since then a remarkable expansion in the use of solar energy has been experienced. If one looks in the past twenty-five years of solar water heating experiences in Cyprus, an interesting success story emerges.

The progress in the first six years was rather slow. This is attributed to the rather faulty initial design and deficiencies in manufacture which in turn led to low efficiency, leakages, etc. and to the SWHs' rather high cost. With further developments in the construction of the collectors so that most technical problems were eliminated and with rationalization of production, costs have been, if not decreasing, at least remaining constant as more and more units were installed.

The next 6-7 years saw an impressive increase in manufacturing capacity, with the production rising from about 800 units a year in 1967 to an unprecedented 5,000 units in 1973.

This rapid development in the use of solar energy was abruptly interrupted in July 1974 as a result of the Turkish decision to occupy about 40 percent of the island. The displacement of some 200,000 people from their homes and the loss of total gross economic output led to a general dislocation of the economy, in the face of which the solar water heating industry could not remain unaffected.

Since then, however, production of solar water heaters has been reactivated and developed at a faster pace than before. Yearly sales of SWH during the 1976-82 period have more than doubled, reaching a level of 10,000 units ($3m^2$ each) per year, as can be seen in Figure 3.

Table 3 Estimation of existing SWH in Cyprus

SECTOR		STOCKS OF SWH AS OF 1/1/83		1983 SALES		STOCKS OF SWH AS OF 1/1/84	
		m^2	SWH (3)	m^2	SWH (3)	m^2	SWH (3)
Housing							
Existing	H	266,100	88,700	7,500	2,500	277,500	92,500
	F	28,800	9,600	7,500	2,500	38,700	12,900
New	H	-	-	11,400	3,800	-	-
	F	-	-	2,400	800	-	-
TOTAL		294,900	98,300	28,800	9,600	316,200	105,400
Tourism							
Existing H and HA		6,800	2,300	750	250	7,700	3,200
New H and HA		-	-	1,950	650	-	-
TOTAL		6,800	2,300	2,700	900	7,700	3,200
Health		700	200	300	100	1,000	300
TOTAL		302,400	100,800	31,800	10,600	324,900	108,900

H = House, F = Flat, HA = Hotel-Apartment

SWH (3) = Equivalent in domestic individual SWH (3 m^2 of collector)

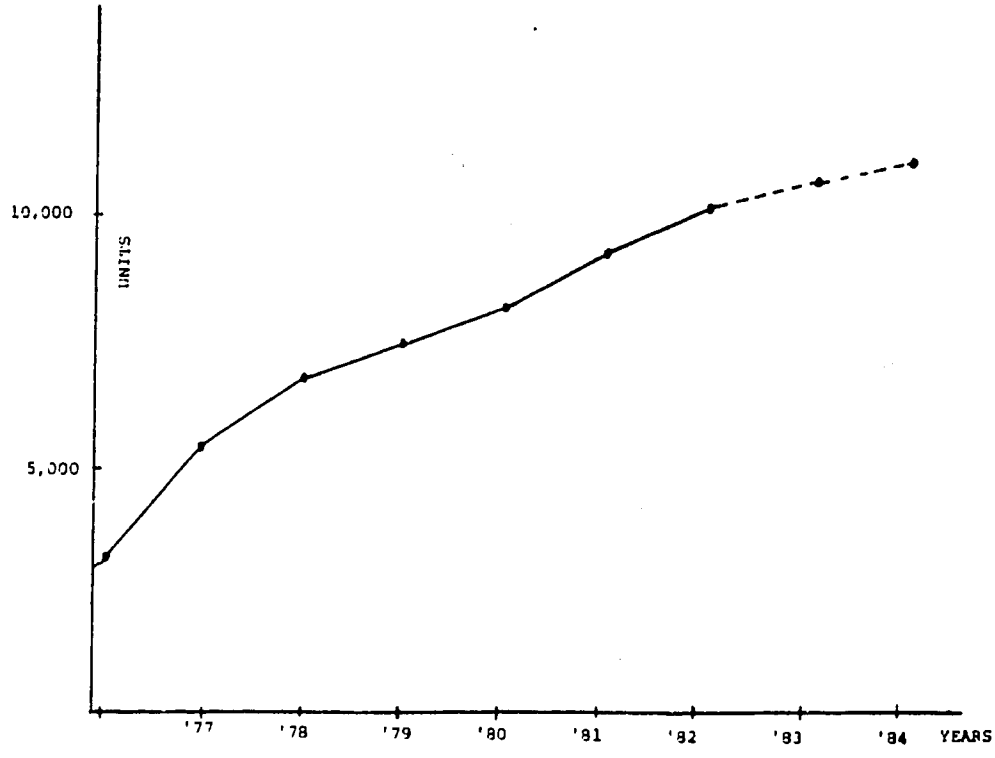


Figure 3. Annual sales of SWH during 1976 - 82.

Thus, the Cypriot industry for solar water heaters quickly expanded to reach 30,000 m^2 of collectors produced annually by more than 30 manufacturers. The dynamic quality of this industry, in fact, includes different aspects:

- on the one hand, 5 or 6 big manufacturers control half of the total production, offering SWH of good efficiency, high reliability and durable components (i.e. copper absorber, polyurethane insulator, selective coating, galvanized steel casing, etc.)

- on the other hand, a large number of small manufacturers produce low quality, inexpensive products. However, these manufacturers have played a positive role in the primary development of the SWH industry in Cyprus.

It is also important to mention that despite the widespread use of SWH, the technology and design used are fairly simple. This is a negative as well as a positive factor.

On the one hand, due to their unsophisticated design and technology they cannot be easily used in heavy duty applications such as hotels and large buildings. In addition, the passive acceptance of this technology by end users did not induce the manufacturers to invest in R&D for further development of their SWHs.

On the other hand, the simplicity of design, technology, installation, and maintenance have proved to have considerable advantages, because the costs remained fairly low and constant, new manufacturers could enter the market easily, and end-users were attracted due to the ease and low cost of installation and minimum maintenance expenses.

The considerable demand for individual SWHs from households has provided limited motivation for manufacturers to develop collective SWH systems for hotels, high rise buildings, hospitals, etc., despite the fact that the medium-term potential market lies in these sectors. The Government has attempted to induce such R&D by investing directly in R&D activities but this effort has had limited success.

Estimated Annual Energy Savings and Contribution to the National Energy Balance

The estimated energy saved by existing solar water heaters is about 32,000 tons of oil equivalent (TOE) per year. The electricity saved by SWH represents about 9 percent of national electricity consumption or about 3 percent of the total national energy consumption. These percentages are very likely the highest in the world.

The Role of the Private and Public Sector

The remarkable development of the SWH industry in Cyprus has been achieved mainly as a result of free market forces for both the manufacturers and the end users. In addition, Governmental policies and incentives have assisted this development during the 1973-84 period.

The successful experience of this industry and the factors that assisted its development should be reviewed chronologically in order to facilitate understanding.

As already mentioned, the manufacturing of SWHs began in the early sixties. During the 1960-66 period the production of SWH was about 500-900 units per year. This period could be considered a learning stage during which a very few manufacturers copied Israeli designs and marketed them locally. End users in this period were limited principally to households belonging to upper socioeconomic groups; these users were able to appreciate the benefits/savings achieved. Government involvement did not exist during 1960-66, and thus pure market forces assisted the development of this industry in its first years.

The 1967-73 period was fairly identical to the 1960-65 period. Some additional manufacturers entered this industry, production and sales volumes increased further, reaching a level of 800 to 1500 units per year. Once again free market forces alone were the determining factors, with no governmental involvement at all.

The 1973-84 period has witnessed substantial changes and developments in comparison with the previous periods. The 1973 energy crisis had considerable repercussions on all actors involved in this industry -- the manufacturers, the end-users and the government.

The end-users realized to the maximum extent the benefits/savings of installing SWHs; at the same time household economics for SWH were very positive since the payback period for existing houses was 3-4 years and 1 1/2 to 2 years for new houses.

Thus, with considerable household demand, mainly from houseowners, and considerable production capacity on behalf of the manufacturers, the 1984 stocks of SWHs have reached about 109,000 units from an estimated 30,000 to 40,000 SWHs in 1972.

Within this framework, in the 1973-84 period the government of Cyprus, with the assistance of the United Nations and the World Bank, has introduced a considerable number of direct and indirect incentives and measures that have assisted to a considerable extent the industry growth and the widespread use of SWH, mainly in households. The series of direct and indirect measures and incentives introduced by the government are given in Tables 4-7.

These governmental incentives have had a considerable impact on the industry and end-users. However, it would be unfair to suggest that the credit goes only to the efforts of the government, as these incentives were only introduced after 1978. The manufacturers and consumers, as already explained above, have been primarily responsible for paving the way that the industry has developed so far.

It is clear from the discussion above that market forces have determined to a great extent the SWH market success in the residential sector. However, the introduction of new products and technologies based on solar energy in market segments such as tourism, industry, and agriculture is not so extensive. The private sector has not managed to penetrate those segments on its own. The possible role of the government in these new technologies and market segments is given in the sub-section that follows, which explains the future potential and the actors in olved.

Future Prospects of the Industry

The industry encounters the following challenges:

- disengaging from the highly saturated market of individual SWHs and turning to collective housing systems, tourism and health facilities, and even industrial hot water processes.
- facing a presently non-expanding domestic market, after sales had increased regularly for over 15 years (for this reason, it appears necessary to promote export sales).
- strengthening local capabilities for collective SWH design, optimization, and implementation, avoiding inappropriate use of technology within the constraints of local capabilities.

Despite the fact that the SWH industry has grown and prospered with limited public intervention, relying mainly on the dynamism and the good management of private manufacturers, it is believed that the government should play a positive role at this point in the evolution of the market, without involving itself inside the private manufacturing structure.

Table 4

FINANCIAL INCENTIVES BY THE CYPRUS GOVERNMENT FOR THE DEVELOPMENT OF SOLAR ENERGY APPLICATIONS

FINANCIAL INCENTIVES	DESCRIPTION	ACTORS	ADVANTAGES	DISADVANTAGES	RESULTS
Funding of R&D	Support of basic research & product development aimed at commercialization.	Undertaken by the higher technical institute, a government-owned engineering college.	Government focusses R&D on products most economically promising for the country and not individual end-users or producers.	Theoretical R&D without parallel market incentives for commercial sales. Also does not use expertise from the industry itself but rather scholars.	No concrete findings so far and therefore no new applications by commercial firms.
Financial incentives in terms of loans & guarantees for the expansion of establishment of manufacturers with technology-oriented potential.	Backups new inv/ment in the industry through government guarantees & loan facilities through the Cyprus Development Bank.	Government & Cyprus Development Bank	Facilitates the expansion in the industry.	May drive out of the market small manufacturers.	A number of big SWH manufacturers has invested in new machinery and equipment financed by the Cyprus Development Bank and guaranteed by the government.
Export Promotion	Specialized exhibition for SWH & renewable energy-related products.	Cyprus State Fairs Authority, a governmental body.	Gives to the industry assistance to export trade.		Limited exports were affected*
Investment Allowance	Investment alliance in hotels, hotel apts & industry for installing SWH.	Private investors	Promotes widespread use of SWH & its applications.		This incentive is applicable to all SWH manufacturers but its effect can not be measured.

*Efforts by the Government did not result in any substantial contacts with the international market. In addition, SWH manufacturers undertake limited export-oriented activity and in fact their total annual sales are in the range of 100 to 150 units.

Table 5

FISCAL INCENTIVES BY THE CYPRUS GOVERNMENT FOR THE DEVELOPMENT OF SOLAR ENERGY APPLICATIONS

FINANCIAL INCENTIVES	DESCRIPTION	ACTORS	ADVANTAGES	DISADVANTAGES	RESULTS
R&D	Allows write-offs for purposes of of R&D expenses in specialized sectors of the economy.	Goverment, commercial sector	Offsets cost of development and minimizes risks to commercial firms.	Such facilities may be abused by commercial firms.	This incentive has been welcomed by SWH manufacturers.
Support purchase by end-users	The government through the central Bank has earmarked amount from the special reserves for the purchase of SWH and related equipment.	Central Bank, commercial banks	Facilitates the purchase of SWH	Commercial banks may channel the earmarked money to other type of loans.	This scheme has been widely accepted by end users. About 5,000 units have been financed through this scheme.
Taxation of conventional fuels	High prices for conventional fuel	Government, commercial banks	SWH becomes more competitive with conventional fuels	May discourage cost-cutting development. Politically questionable.	This incentive has a definitive impact on the decision of end-users to install a SWH.
Waived import duties for spare parts. Also direct import duty on SWH.	Duty free parts for SWH. 15% import duty for imported SWHs.	Government commercial firms	Inexpensive to produce and therefore enhances competitive stand. Also, gains in revenues to the economy offset tax losses, etc.	May hinder development of such parts locally. May use such imported parts for the uses which should be taxable.	Has been welcomed in the SWH industry.
Direct purchase by the Government of SWH	Installed SWH to refugee re-housing scheme.	Government, end-users	Assisted in the widespread use of SWH. Also assisted the industry after the 1974 invasion.		More than 10,000 SWH were purchased by the Government.

Table 6

REGULATORY AND LEGAL INCENTIVES BY THE CYPRUS GOVERNMENT FOR THE DEVELOPMENT OF SOLAR ENERGY APPLICATIONS

FINANCIAL INCENTIVES	DESCRIPTION	ACTORS	ADVANTAGES	DISADVANTAGES	RESULTS
Zoning Regulations	Allow access to sunlight.	Government courts & Governmental Civil Engineering Department.	Facilitates installment of SWH and other solar related technologies.	Such laws may create other developmental problems in big towns or cities.	Very helpful because it facilitates the installation of SWH.
Building Regulations	Maximum number of stores in buildings.	Government courts Civil Engineering Department.	Facilitates the installation of solar collective systems in in buildings.	Such laws may create other developmental problems in big towns or cities.	Very helpful because it facilitates the installation of SWH.
Consumer Protection	Creation of performance standards, certification, efficiency rating, etc.	Governmental Energy Unit	Develops consumer confidence in product and technology.	May drive out small producers possibly difficult to monitor.	This has been welcomed by the SWH industry and in fact more than 500 SWH were tested by the MCI.

Table 7

PROMOTIONAL INCENTIVES BY THE CYPRUS GOVERNMENT FOR THE DEVELOPMENT OF SOLAR ENERGY APPLICATIONS

FINANCIAL INCENTIVES	DESCRIPTION	ACTORS	ADVANTAGES	DISADVANTAGES	RESULTS
Extension services to producers, financiers and end-users*	Promotion of locally relevant applications such as collective panels for buildings.	Government, industrialists, federation, industrial authority.	Introduces new applications.	Requires coordinated policies.	It has been widely accepted among SWH manufacturers yet recommendations from MCI appear to be theoretical.
Advertising and campaigns*	PR programs to educate end-users.	Government	Easy to implement and inexpensive.	Government financing should be continuous to ensure effects.	Very useful. It has increased the awareness of end-users.

*Such government promotions aim at particular end-users in addition to the general promotional incentives which cover the whole spectrum of the potential end-users.

This positive role could include:

- development of a solar water heater label, allowing for a distinction between high quality products, which are good for exports sales, and medium quality products, which can continue to be sold on the domestic market. The Ministry of Commerce and Industry could also intervene in worldwide solar congresses presenting field test results that establish the quality of Cypriot SWHs.

- improvement in the engineering of collective SWH (design, optimization, choice of components), training of consultants, engineers, and architects, and promotion of microcomputer-assisted methods of systems design.

- testing of different solar configurations (i.e. multi-individual or collective SWHs in buildings) with measurement campaigns.

- improvement of general marketing of SWHs--market surveys inside and outside Cyprus, optimization of selling prices, improvement of the aesthetics of SWHs.

- reinforcement of the links between Cypriot SWH manufacturers and international technology, to help them to implement quickly new solar concepts (air collectors, concentration, thermovalve process, etc.).

2.2.2 Wind Energy Utilization and Prospects

The potential use of wind energy in Cyprus is important but the potential is not equally spread over the island.

On the one hand, water-pumping windmills have been used in Cyprus for many decades, reaching their peak in the 1930s, but their use declined as engine-driven pumps became used more widely -- these could provide power on demand. It is evident that it was the market forces that were behind the penetration and decline of windmills in Cyprus. The progressive decline in demand in the 1940s and '50s is not expected to change unless the government interacts to promote the use of windmills for irrigation purposes; this could be easily done since the economics of windmills are still very encouraging - with a windmill the farmer can reduce his diesel fuel costs by a factor of about 4.

In addition, Cyprus appears to offer good sites for the installation of large wind generators. However, the actual potential still has to be measured and evaluated by the government once the world market develops significantly.

2.2.3 Hydro Energy Utilization and Prospects

One of the most severe problems in Cyprus is the limited quantities of water available. With this constraint, Cyprus hydro potential is also very limited; its contribution, in the best case, will be less than 1 percent of electricity requirements by 2000.

Despite its very limited potential, it has been given attention by the government. In fact, a hydroelectric dam pilot project has been completed mainly because such small hydro projects might facilitate the Electricity Authority of Cyprus, which has a considerable problem in satisfying maximum power demand in winter.

2.2.4 Biogas Energy Utilization and Prospects

A conservative evaluation of the available biogas potential leads to an estaimate of 10,000 TOE per year, 30 percent of which would be from pig waste.

The only promising areas for development are biogas from pig wastes and biogas from urban wastes. These two areas are currently being studied by the government.

2.2.5 Geothermal Energy Utilization and its Potential

There have been no indications yet that Cyprus has geothermal resources. However, the geological characteristics of Cyprus should be favorable to the existence of such resources.

Thus, the government should at least conduct a preliminary study to evaluate the feasibility of further tasks.

III. SUMMARY AND CONCLUSIONS

3.1 Summary

- Cyprus is almost totally dependent on imports of crude oil for providing its energy requirements.
- Renewable energy is the only indigenous source of energy contributing currently about 4 percent of the total energy requirements of the country.
- Solar water heaters (SWH) represent by far the largest renewable energy activity; at present there are about 109,000 SWHs making Cyprus the first country in the world in terms of SWH per capita.
- The domestic sector is the single biggest user of SWH.
- The design and technology of SWH in Cyprus is fairly simple and unsophisticated.
- The most important actors in the development of the SWH industry in Cyprus are the manufacturers themselves, who managed to offer a fairly low priced product, of simple design and yet efficient with obvious economic benefits to end users; and to a lesser extent, the Government with its incentives that were mainly directives, oriented towards co-ordination and overlooking of the industry rather than drastic intervention in the SWH industry.

3.2 Conclusions

Cyprus has experienced a unique development of its SWH industry with a minimum of government intervention.

This success is mainly attributed to:

- the ample sunny climate enjoyed by Cyprus
- the energy and good management of Cypriot manufacturers
- the fairly simple design and technology used
- the ease of installing a solar water heater
- the low capital investment and operational and/or maintenance costs
- and the government inventives, mainly those directed toward the co-ordination, promotion, and technological support towards the industry rather than through direct intervention in the industry.