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Intergovernmental Review Meeting of  
Mediterranean Coastal States and  
First Meeting of the Contracting Parties  
to the Convention for the Protection of  
the Mediterranean Sea against Pollution  
and its related protocols

Geneva, 5 - 10 February 1979

DRAFT PROJECT PROPOSAL FOR THE  
FUNCTIONING OF MARMARIS SOLAR ENERGY RESEARCH CENTRE AS  
A SPECIFIC REGIONAL R + D CENTRE FOR THE  
PRACTICAL UTILISATION OF SOLAR ENERGY  
IN THE MEDITERRANEAN REGION

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TICAL UTILISATION OF SOLAR ENERGY  
IN THE MEDITERRANEAN REGION

Submitted by the Government of the Republic of  
Turkey

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## I. INTRODUCTION

The history of the initial activities undertaken in the field of solar energy in the Mediterranean Region which might be considered as the cradle of a very substantial civilization goes back to the first half of the 19 th cēntury. Nevertheless, so called activities were mainly of academicy oriented which eminently supports the fact that solar water heating constitutes the only commercial application realized up to present time, and the progressive endeavours from the standpoint of widespread accumulation of the general knowledge and experience is merely accomplished in relatively recent times.

As a consequence of the dramatic increase in the price of petroleum in 1970's , many countries throughout the world whether, importers or exporters of oil, industrialized or developing, really started to assign much relative importance to the depletable nature of oil and in the general context to all forms of conventional fossil fuels, and in this regard, a comprehensive examination of all means of generating energy have been instigated throughout the world.

In point of fact, various forecasts made with a view to determining the potential reserves of conventional energy sources and the serunity of those methodological scenarios, though quite distinctive as viewed within

their context, stresses strongly the fact that conventional energy sources being commercially used at present are limited in nature and would be depleted by the turn of the century unless present energy policies are strengthened in a way to extend the utilisation of our present depletable sources.

Thus, major efforts and acceleration are attached to the development of new techniques and technologies in the energy field throughout the world, so as to make the full appraisal of the fossil fuels in conjunction with the particular attention concentrated upon the most favourable utilisation of renewable energy sources in national energy strategies in meeting, part or whole, of the present and future indigenous energy demand.

Amongst the main renewable sources of energy currently examined (solar, wind, geothermal, biogas, tidal and ocean thermal gradients) solar energy seems to be interpreted as the only source totally independent from local conditions and be harnessable on a world-wide basis. It should be underlined that solar energy could play a significant role particularly in meeting the low grade heat needs mainly for heating and hot water supply in not-too-distant future.

In this regard, almost every country has a national programme underway or at least planned. Moreover, on such a subject having many unknowns,

and at the same time falling into line with the general philosophy of our century having regard to international cooperation, collaborative assessment of all national facilities and the current consolidated up-to-date information, and elaboration of necessary measures for securing the short term results constitute the main aspiration of all nations in the world.

Regional cooperation, on scientific and personnel level, in the field of solar energy has already been commenced in 1960's in the Mediterranean Region. To this effect, COMPLES has been established among the researchers of the Mediterranean Coastal States and many Turkish researchers, mostly from the universities were taken active role in the course of establishment and have been the initial members of the so-called organisation.

It is worth stressing that Turkey can not be regarded as lagged behind in creating the necessary course of action for enabling the assessment of the indigenous solar energy potential.

At present, several commercial firms are engaged in manufacturing and marketing solar water heaters and sales are raising quite rapidly. In the public sector, relevant administrative and institutional arrangements have been attained under the coordinative responsibility of the Ministry of Energy and Natural Resources. In 1975, a national R + D programme has been put forward and with due consideration of the realization of the

envisaged targets, a national solar energy research centre was established near Marmaris under the administration of MTA Institute.

The research centre, being open to international cooperation, and at the same time as an institutional member of COMPLES is engaged in several bilateral and international agreements with various Mediterranean coastal states.

Moreover, the MTA Institute, on behalf of the representative of the Ministry of Energy and Natural Resources, officially participated in the NATO-CCMS Solar Energy Pilot Study with sole regard to solar heating and cooling of buildings. In this respect, active participation has been foreseen while an effective role has been taken in forming the special sub-group related to Mediterranean climatic conditions.

#### THE SIGNIFICANCE OF THE LOCATION OF MAM AND THE MEDITERRANEAN REGION

The Mediterranean Region, constituting the border of Europe, Asia and Africa, lies between the 35 th and 46 th Northern latitudes and 6 th Eastern and 36th Western longitudes which renders the region a highly appropriate zone for the harnessing of all kinds of solar energy applications.

The southern part of the region is flat and low while the northern part is generally steep and high. From the climatological viewpoint it can be stated that winters are generally mild and rainy while summers are hot and dry with occasional rainy days.

Moreover, it might be felt appropriate to emphasize the different social and economical levels of development among the Mediterranean coastal states.

In this regard, a clear distinction can be made between the southern and northern Mediterranean countries with due consideration of the order of priority assigned to various applications of solar energy which are influenced by climatological, geographic and socio-economic parameters prevailing in the locations of intended use.

Most of the countries in the northern part of the Mediterranean Region are industrially developed, but having substantial dependence on oil imports. Domestic space heating comprises a significant portion in their energy balances, however, no impediments are encountered with respect to water and irrigation issues due to adequate amount of rainfall in the region.

In comparison with the former, the corresponding situation in the South part of the region is just the reverse. Most of the Southern Mediterranean countries are not sufficiently technically equipped, but are endowed with an abundance of oil reserves. Need for space heating is not stressed while severe bottlenecks are impeded with respect to water and irrigation problems.

In this respect, the geographical location of Turkey, constituting a bridge between the northern (European) and southern (African) parts of the Mediterranean region, would be of significant value. Such a state of affairs is typical of the situation prevailing in Turkey where, with due allowance made



for regional differences, similar problems of respective relevance to northern and southern parts of the Mediterranean region are encountered with the order of equal emphasis. The Marmaris Solar Energy Research Centre is under establishment in an endeavour to provide satisfactory solutions to the above-mentioned issues.

#### CONSEQUENCES OF MALTA MEETING

At the meeting of Government Experts, convened by UNDP and UNEP in Malta 9-13 October 1978, for developing a co-operative programme on the practical applications of renewable sources of energy in the Mediterranean Region, Turkey has made a proposal for placing MAM and its established facilities at the service of the Mediterranean States so as to perform the functions of the centre as a regional R + D centre in the field of solar energy. The proposal of Malta, on the other hand, was directed to the establishment of a Mediterranean Regional Centre for the practical utilisation of renewable energy sources.

As a result of the deliberations made at the meeting, foremost, the priority elements of a regional collaborative programme has been formulated, and according to the adopted cooperation programme, the concrete proposals of Malta and Turkey, to act as regional centres for certain envisaged activities, was agreed with appreciation and, subject to further consideration and approved by today's intergovernmental meeting of Mediterranean Coastal States, it was decided that

- i) the centre to be established in Malta should perform functions of regional relevance in the areas of exchange of information, technical assistance and training
- ii) the existing national centre in Turkey should be considered as a centre for specific regional activities related to R + D of solar energy utilization.

Some of the Mediterranean States participating at the Meeting, especially those located in the Southern zone of the Mediterranean Region, have, several times, stressed on their specific problems waiting for immediate action. Similar impediments are also faced with Turkey.

Consequently, in order to elaborate the ways and means for identifying the satisfactory solutions to the problems raised in those priority areas, immediate action should be undertaken for realization of the practical applications in the shortest time interval. In this regard, the existing facilities and related services which might be offered by MAM deserves special attention and considerable advantages might be realized by more appropriate execution of the relevant R + D activities and/or applications in near future.

## II. CURRENT STATUS AND FACILITIES OF THE MARMARIS SOLAR ENERGY NATIONAL RESEARCH CENTRE (MAM)

(For more details please refer to document UNEP/WG.20/INF 3/ADD

### A. Basic Infrastructure and Installations.

MAM, started to be established in 1975, is located at Datça Peninsula

on the south-west coast of Turkey (latitude:  $36^{\circ} 37'N$ , longitude:  $28^{\circ} 02'E$ ) which is one of the most favourable domestic sites with regard to solar insolation. The Centre, covering a very vast area was, as a start, provided with adequate transportational infrastructure through construction of internal roads and link to the Marmaris-Datça highway. Then, installation of basic infrastructure such as water, electricity and sewerage water have been completed. Subsequently, preparation of four platforms upon a bare hill of 30 m altitude lying at the bottom of a small bay were performed.

In this instance, the related platforms, facing South, are provided with the following establishments:

i) First Platform :

Altitude : 30 m

Observation park (10m x 10m) and a shelter for observers (2mx2m) - total area :  $200 \text{ m}^2$

ii) Second Platform :

Altitude : 23 m

Main testing platform (10m x 5m) at an altitude of 1.5 m from the ground, a shed for instruments (5m x 4m) - total area :  $200 \text{ m}^2$  -

A 118 canal DORIC recorder is installed in addition to various other instruments.

iii) Third Platform

Altitude : 18 m

A mechanical workshop ( $200 \text{ m}^2$ ), a measurement laboratory ( $200 \text{ m}^2$ ) and a workshop for general purposes ( $400 \text{ m}^2$ )

iv) Fourth Platform

Altitude : 13 m

Electronics laboratory ( $200 \text{ m}^2$ ) and a galvanoplasty laboratory ( $200 \text{ m}^2$ )

v) A carpentry workshop (100 m<sup>2</sup>) and a workshop for iron works have been built on another part of the centre.

Furthermore, several buildings constructed at various sites of the centre are illustrated hereunder :

- Near to the entrance, a dormitory for workers (50 m<sup>2</sup>), a ware-house (100 m<sup>2</sup>) and a reception-room (10 m<sup>2</sup>)
- An administration office (400 m<sup>2</sup>)
- Refectory and dormitory (400 m<sup>2</sup>)
- Three residence-halls (50 m<sup>2</sup> each)

A schematic diagram of the site and its establishments can be seen in Annex 3 (MAM Location Plan)

#### B. Working Programme :

At the present stage of development, the main features of the R + D activities in progress at the research centre are concentrated at following applications of solar energy :

##### i) Water heating

Construction and performance testing of various solar collectors (natural and forced circulation, air or water heated, small : 100 - 200 liter - or large : 1 tonnes or over , capacity systems)

##### ii) House heating (Passive methods)

Activities related to solar heating of village houses in rural areas by means of natural thermocirculation of air are being pursued.

At present, a Michael-Trombe wall has been incorporated to a standard pre-fabricated earthquake house and a similar house built for

reference purpose at the experimentation platform , and related activities are in progress for determining the energy balance of the solar heating system as a means to test the reliability of the Trombe-wall system under Mediterranean climatic conditions.

iii) Drying

Activities are devoted to dehydration of various agricultural products. The current project is concerned with the design and testing of various models of air collectors and different drying chambers as appropriate for the characteristics of vegetables and fruits to be dried.

iv) Heating of greenhouses

Related work is aimed at construction of various greenhouses under Mediterranean climatological conditions.

In addition to the above - mentioned activities, such relevant measurements (data) as outlined below are being monitored at the observation park:

- total solar radiation
- direct solar radiation
- humidity
- wind velocity and direction
- ambient temperatures
- maximum and minimum air temperatures
- amount of rainfall
- evaporation

Moreover, following R + D activities are performed for developing the different collectors used in various solar energy applications :

- i) preparation of selective surfaces by electrolysis and measurement of their optical characteristics
- ii) construction and performance testing of flat-plate and concentrated collectors (air or water heated)

C. INVESTMENT (in 1979 prices)

1<sup>o</sup>. Land<sup>x)</sup> : 9,360,000 \$

2<sup>o</sup>. Buildings : 800,000 \$

a) Installations for technical services : 600 000 \$

(electronics laboratory, selective surface laboratory, measurement lab., general workshop, mechanical workshop, workshop for iron works, carpentry workshop, warehouse, observation park, experiment platform)

b) Installations for social purposes : 200 000 \$

(administration office, refectory and dormitory, workers dormitory, guest-houses, reception room)

c) Infra-structure : 2 660 000 \$

(roads, water, electricity, sewerage water and platforms )

d) Equipment : 600 000 \$

(measurement devices used at the observation park, experiment

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x) About 80 % of the land can be utilized while the rest is maintained as forestry area.

platform and measurement lab., related apparatus in selective surface and electronics lab., equipment of mechanical and carpentry workshops).

The main infrastructure and cited buildings of MAM have all become operational at the beginning of 1979.

Detailed presentation of relevant investments are given in Table I (Annex 1).

#### D. ORGANIZATION

The relevant organization diagram (National Status) is given in Annex 4.

#### E. TIME SCHEDULE OF THE NATIONAL R + D PROGRAMME

The programme is outlined schematically in Table II. on the next page.

TABLE II

Years

Activities	1977	1978	1979	1980	1981	1982	1983
Basic Infra-structure							
Buildings Construction							
Workshops-laboratories equipment							
Water heating							
Passive house heating							
Drying							
Heating of greenhouses							



## F. RESULTS

The necessary infrastructure required for attainment of the relevant applied programme planned to be carried out in the short-time has fully been realized with the exception of communication facilities. As an initial course of action, the nucleus of a research team has been formed whilst laboratories and workshops are equipped by means of domestic facilities in addition to the financial support provided under the UNDP fund (No. TUR/75/064/C/01/01). The objective of the so-called project entitled "Establishment of a Solar Energy R + D Center " is mainly to help with the training programmes and key items of equipment. In this respect, a total of 60 man-months training, 6 man-months of consultant's work and 44 k \$ worth of equipment brings the related project total to over 150k\$ including MTA's cost-sharing portion. The project is due for completion the end of 1980.

On the basis of the above-mentioned programme, 18 months training has already been utilized and two young scientists have been given training abroad. A third one is expected to be granted a fellowship to U.S.A. in near future. As far as equipment support is concerned, only 14 k \$ has been utilized for providing such delicate instruments as flowmeters, thermocouples, read-out meters and digital recorders. By means of the remaining part of equipment support, such requirements as transducers and spectrophotometers are envisaged to be supplied.

For realization of the national R + D programme, envisaged personnel requirements amount to 51. (15 for technical, 12 for technical support, 24 for administrative and internal services). In this instance, full recruitment of technical support, administrative and internal services personnel have been realized. However, 9 posts are needed for execution of the technical R + D work in addition to the 6 technical staff available. Seven of the technical staff needed will be provided with domestic facilities while for recruitment of the remaining two, to be entrusted as scientific projects manager and deputy-manager respectively, primary negotiations were made with such well-known Turkish scientists in abroad and relevant cooperation is envisaged to be undertaken.

### III. PROPOSED STATUS OF MAM IN PERFORMING ITS FUNCTIONS AS A REGIONAL R + D CENTRE FOR PRACTICAL APPLICATIONS OF SOLAR ENERGY

Turkey has already made an offer, at the Malta meeting, to place MAM at the service of regional collaboration among Mediterranean Coastal States. The proposal of Turkey has been adopted so as to strengthen MAM as a regional R + D centre in the field of solar energy in a way to serve properly to the envisaged cooperation programme in the execution of specific regional activities. With a view to make optimum use of the existing facilities of MAM, and at the same time within the framework of the collaborative programme adopted at the Malta meeting, the

proposed status of MAM with respect to its reinforcement so as to function its performance as a regional R + D centre on various practical applications of solar energy is outlined hereunder. Such a proposed programme, it is hoped, could serve as an appropriate basis for formulation of relevant deliberations.

## I. PROPOSED COURSE OF ACTIONS

### A. Working Programme

MAM, in case to be strengthened as a regional R + D centre, could pursue its functions with due attention to be focussed on the following issues in addition to the already executed activities under the scope of the national working programme :

- i) House heating (active methods )
- ii) Water distillation and desalination
- iii) Generation of electrical energy (by low-temperature thermodynamic conversion)
- iv) Cooling
- v) Storage of thermal energy
- vi) Water pumping

It should be stressed that special emphasis is assigned to personnel training and related work will be carried out under the scope of the envisaged working programme for appropriate execution of the above mentioned activities.

An outline of the required installations and related financial implications are illustrated in subsequent sections :

## B. Infrastructure and Buildings

In performing the above-stated activities, merely, such technical installations as,

- a sea-water pumping station (50 m<sup>2</sup>)
- a cooling storage unit (50 m<sup>2</sup>)
- water pumping station (50 m<sup>2</sup>)
- an observation tower (100 m<sup>2</sup>)

will be adequate for meeting the required purposes.

On the other hand, further establishment of the following installations, mainly for social needs, should be taken into account :

- i) A meeting room for multi-purposes, for serving also as a library (500 m<sup>2</sup>)
- ii) An administration building (400 m<sup>2</sup>)
- iii) Buildings for social needs (1000 m<sup>2</sup>)

In this regard, it was envisaged as conceivable that the single apartment type residences should merely be provided to certain senior experts to be recruited for a relatively long term at the centre, and should constitute at most 10 % of the total social installations. For accommodation needs of the experts, researchers or training personnel (national or international) single rooms will be provided.

Moreover, further expansion of the basic infrastructure should be undertaken in accordance with the related establishments to be constructed.

#### C. INVESTMENTS (in 1979 prices)

1. Buildings (2150 m<sup>2</sup>, 650 000 \$)
  - a. Technical services (2500 m<sup>2</sup> 75 000 \$)
  - b. Social services (1900 m<sup>2</sup> 575 000 \$)
2. Infrastructure : 200 000 \$
3. Equipment : 1 000 000 \$
4. Operational costs : 1 100 000 \$

In case MAM to function as a regional R + D centre, the personnel requirements will amount to 120 of which 25 envisaged for technical, 39 for technical support, 36 for administrative and internal services, and 22 for civil works.

More details for each component of investments can be seen in Table I (Annex 2)

#### D. ORGANIZATION

The suggested organization diagram (Regional Status) is given in Annex 5.

#### E. TIME SCHEDULE OF THE REGIONAL R + D PROGRAMME

The programme is outlined schematically in Table IV on the following page.

TABLE IV

Years

Activities	1977	1978	1979	1980	1981	1982	1983
Infrastructure	—	—	—	—	—	—	—
Buildings construction	—	—	—	—	—	—	—
Workshops and laboratories equipment	—	—	—	—	—	—	—
Water heating	—	—	—	—	—	—	—
Passive heating	—	—	—	—	—	—	—
Drying	—	—	—	—	—	—	—
Heating of greenhouses	—	—	—	—	—	—	—
House heating (active methods)	—	—	—	—	—	—	—
Water distillation and desalination	—	—	—	—	—	—	—
Electricity generation	—	—	—	—	—	—	—
Cooling	—	—	—	—	—	—	—
Thermal energy storage	—	—	—	—	—	—	—
Water pumping	—	—	—	—	—	—	—
_____ National programme							
----- Regional programme							

#### IV . CONCLUSION

The significant advantages of MAM which could be derived from its performance as a regional R + D centre in the field of solar energy in the Mediterranean Region could be outlined as below :

- i) Ready availability of certain technical and other facilities deserve special attention and render MAM as an eminently suitable Centre for implementation and execution of the proposed regional activities in a shorter period of time
- ii ) It is worth to mention that many Turkish scientists reknowned in the field of solar energy are taken active role in significant projects in abroad and should the case arise they could certainly provide considerable contribution in promoting the regional R + D activities as to be envisaged at the MAM
- iii) Various R + D activities are currently pursued in several universities and/or governmental research institutions and within the framework of the present administrative status of MAM, close cooperation might be organized and maintained with these institutions
- iv) In this respect, no major impediments will be encountered at MAM from the standpoint of establishment of the required research groups for carrying out the envisaged regional R + D programmes
- v) MAM is planned on an ambitious scale which occupies a very attractive site with main infrastructure completed. It should be specified that the centre is developed as a comprehensive, self-contained installations with the required support facilities such as workshops etc. on the same

site so that all the phases from the concept to the experimentation and implementation can be accomplished at the Centre.

v1) The Centre's being on the sea-shore is important for work on desalination and also the sea-water provides a cold source for thermodynamic conversions. Moreover, Datça Peninsula is a very quite and peaceful area which makes the site highly appropriate for scientific and applied research, and at the same time vast territory makes it ideal for the conduction of field trials

In the light of the above-mentioned information, MAM, when strengthened with needed equipment and experienced personnel, could doubtless be organised as a regional solar R + D centre for implementing the proposed collaboration programme, in line with the proposed order of priority. In the case of an adequate external contribution, MAM could materialize much quicker since it would provide much needed foreign currency for equipment and training. Thus, in increasing the effectiveness of already existing or planned R + D activities, due attention should be accorded to the vital aspect of foreign support.

As it can be deduced from the presented study, the total investments allocated for the national research centre amounts to 4,060 k \$ which is based on costs prevailing in 1979. (Excluding the value of the land which is nearly 9,360 k \$). About 94 % of the related investments have been realized by the end of 1978, and in accordance with the proposed scope of activities, merely a supplementary investment amounting to 1,250 k \$



is necessitated in case of functioning MAM as a regional R + D centre.

It should be underlined that the significant advantage which stems from the placement of MAM with its such ready availability of facilities at the service of the Mediterranean Coastal States, with due consideration of the beneficial <sup>n/</sup>traslation of related R + D activities into practical utilisation in relatively short period of time deserves particular attention.

Thus, it might be felt as a realistic approach that Turkey could be exempted from the consequent expenditures of direct relevance to proposed collaborative services at least over an appropriate period so as to permit the compensation of the already made investments having regard to the national facilities (4, 060 K \$ ) to be offered at the service of regional cooperation.

## ANNEX I

TABLE I

## INVESTMENTS FOR THE NATIONAL PROGRAMME (1976-1979)

	(thousands of dollars) (in 1979 prices)			
	1976	1977	1978	1979
Land	9360	-	-	-
Electronics Lab.	-	-	75	-
Selective Surface Lab.	-	-	75	-
Measurement Lab.	-	-	75	-
General Workshop	-	-	146.25	-
Mechanical Workshop	-	-	75	-
Workshop for iron works	-	3.75	-	-
Carpentary workshop	-	-	37.5	-
Warehouse	-	-	37.5	-
Observation Park	-	-	37.5	-
Experiment Platform	-	-	37.5	-
Administration Office	-	80	-	-
Refectory and Dormitory	-	-	80	-
Residence hall	-	-	30	-
Workers dormitory	-	8	-	-
Reception room	-	-	2	-
Infrastructure	660	1000	1000	-
Equipment	-	-	300	300
<b>TOTAL</b>	<b>10.020</b>	<b>1091.75</b>	<b>2008.25</b>	<b>300</b>

GRAND TOTAL : 13.420

Amount Expended : 13.120

Amount Required : 300

## ANNEX 2

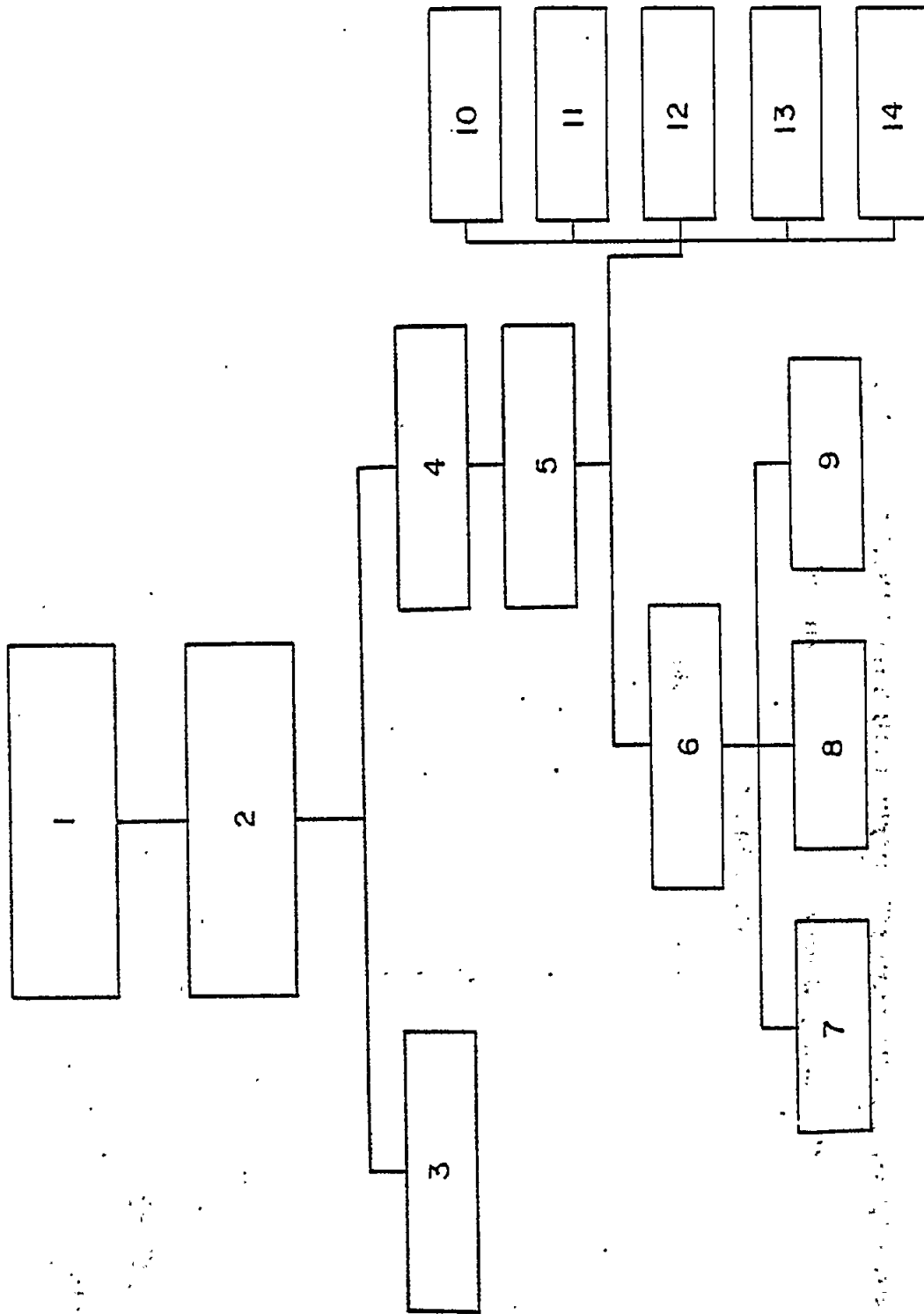
## TABLE III

## SUPPLEMENTARY INVESTMENTS FOR THE REGIONAL PROGRAMME (1980-1983)

	(in 1979 prices)			
	(thousands of dollars)			
	By Subject			
	1980	1981	1982	1983
Sea water pumping station	15	-	-	-
Cooling storage unit	-	15	-	-
Water pumping station	-	15	-	-
Observation-tower	30	-	-	-
Meeting room	-	-	100	55
Administration Office	-	120	-	-
Social buildings	-	-	200	100
Infrastructure	200	-	-	-
Equipment	200	200	-	-
<u>Operational Expenditures</u>				
- Personnel	680	680	680	680
- Maintenance costs	160	160	160	160
- Transportation and Communication Expenditures	60	60	60	60
- Technical works	150	150	150	150
- Miscellaneous	50	50	50	50
Component Total	1100	1100	1100	1100
T o t a l	1545	1450	1400	1255

GRAND TOTAL (1980-1983) : 5 550 k \$

MARMARIS RESEARCH CENTRE ORGANIZATION DIAGRAM  
(NATIONAL STATUS)



# LEGEND

- 1 = Head Office
- 2 = Manager
- 3 = Administration Group
- 4 = Technical Group
- 5 = Scientific Projects Management
- 6 = Workshops
- 7 = Wood and Plastic Works
- 8 = Ron Works
- 9 = Sanitary Works
- 10 = Measurement Dept
- 11 = Drawings Dept
- 12 = Chemistry Dept
- 13 = Electrical and Electronics Dept
- 14 = Technical Applications Dept

MARMARIS RESEARCH CENTRE ORGANIZATION DIAGRAM  
(REGIONAL STATUS)

