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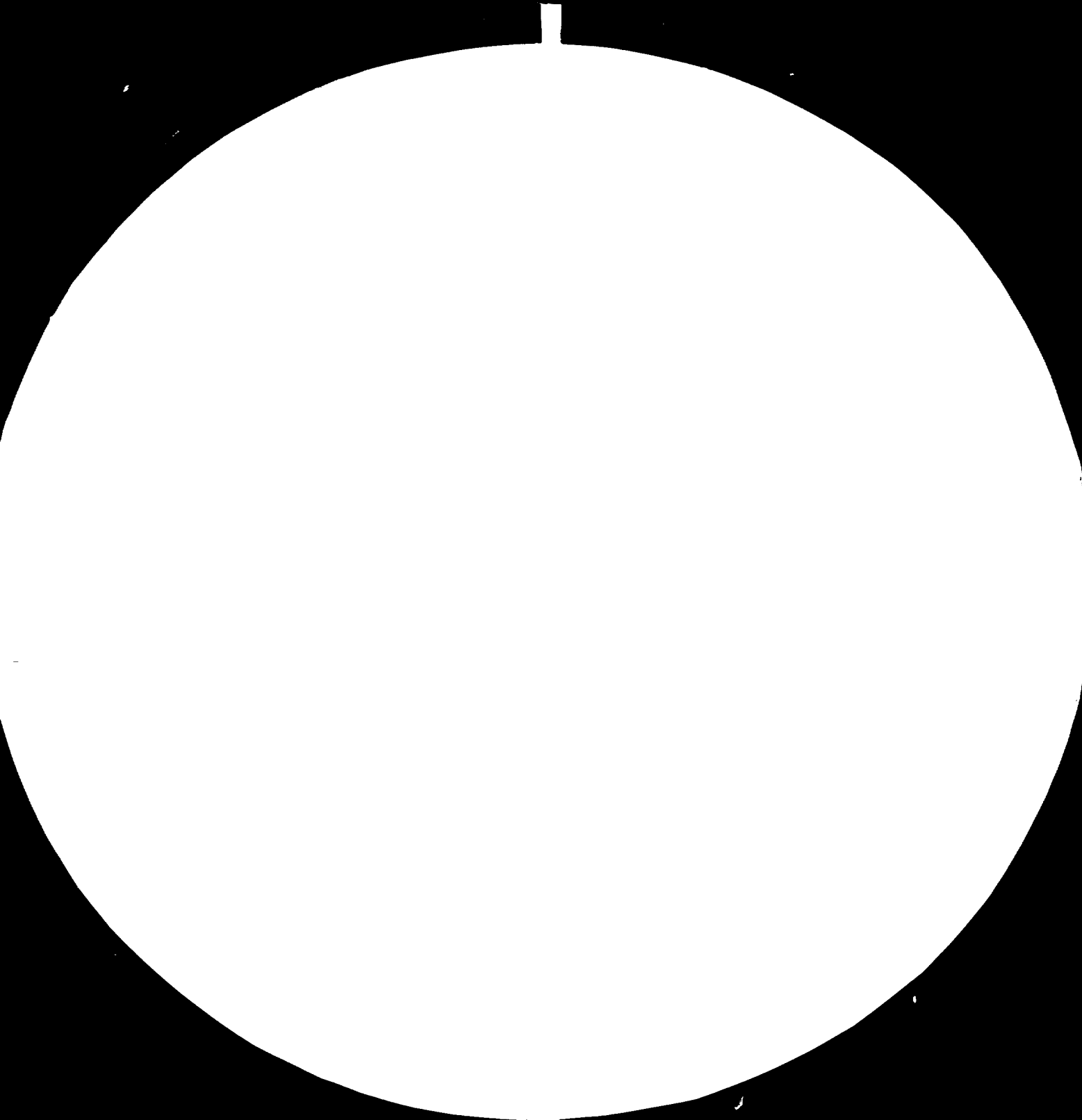

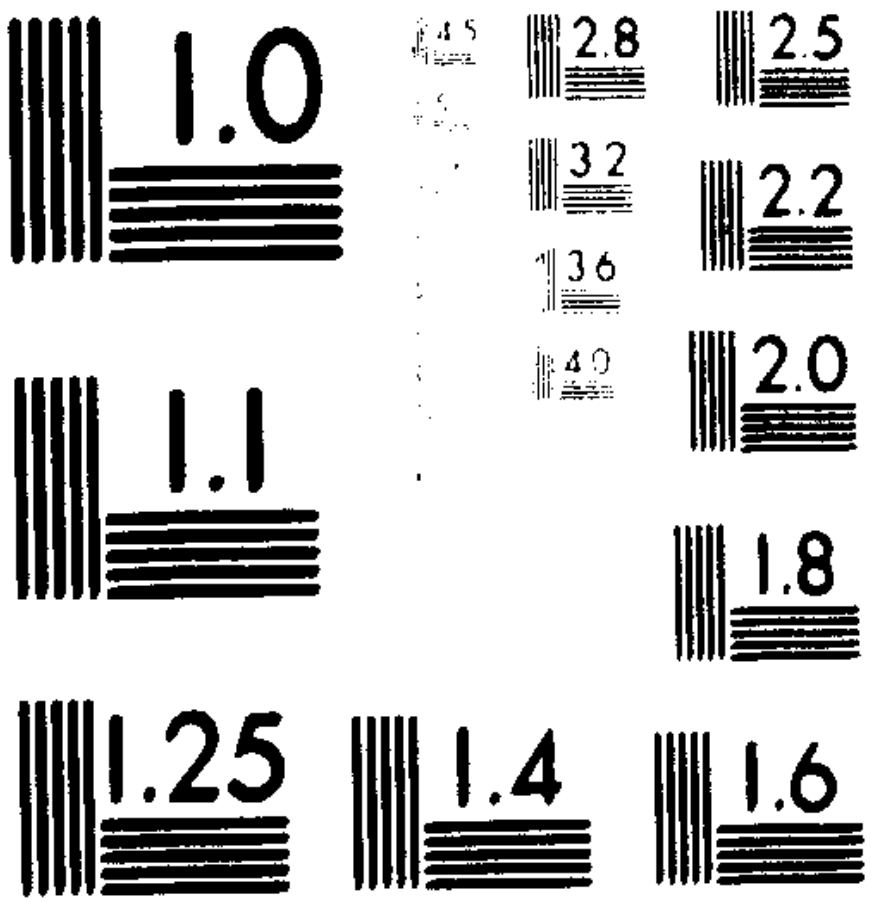

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G R E E C E

STRENGTHENING OF THE

HELLENIC ORGANIZATION FOR STANDARDIZATION

E L O T

MISSION ON

CERTIFICATION AND QUALITY CONTROL TESTING

OF SOLAR ENERGY COLLECTORS

TERMINAL REPORT

PREPARED FOR THE GOVERNMENT OF GREECE

B Y

KENT A. REED

UNIDO EXPERT ON MISSION

2 APRIL 1980

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1. SUMMARY

A one month mission was undertaken to study and review the present situation in Greece with regard to solar energy collectors. The objective of the mission was to further develop and strengthen the Hellenic Organization for Standardization (ELOT) in its product certification marking program. It was found that Greece has an expanding solar energy industry with a large number of mostly small manufacturers. Only one manufacturer is performance testing his product. There is, therefore, a clear need for solar energy collector testing and certification. It was further found that ELOT has prepared a standard for measuring the instantaneous thermal performance of flat-plate, water-heating collectors, but does not have a suitable laboratory at which to perform the testing. It is recommended that such a laboratory be established, equipped, and staffed. It is further recommended that the test data obtained be used in a rating scheme that can lead to informative labelling of solar energy collectors. It is recommended that any full fledged collector certification and quality marking program be postponed until after such programs are in operation for similar products such as electric water heaters. It is recommended that Greece participate actively in the development of international standards for solar energy thermosyphoning water heaters.

KAR/ck

2. INTRODUCTION

2.1 The short term mission covered by this report is one of six included in Project DP/GRE/78/001/01/37, which began in April 1979 and is to have a three year duration.

The development objective of this project is to further strengthen and develop the Hellenic Organization for Standardization (ELOT), thereby enabling it to elaborate, develop, and effectively implement the national policy and system of industrial standardization, quality control and certification marking schemes. The harmonization of these activities with those of other countries of the European Economic Community (EEC) would contribute to establishing and developing the full partnership of Greece in the EEC.

2.2 Within the scope of its development objective, the project aims at a number of immediate objectives including:

1. to establish legal, institutional, organizational, technical and administrative framework for a national certification marking scheme;
2. to plan and establish testing laboratories as well as the inspection and certification scheme for central heating boilers, and for solar energy collectors;
3. to strengthen and develop the testing laboratory, the inspection and certification scheme for electrical household appliances;
4. to undertake the harmonization of ELOT's activities in standardization, quality control and certification schemes with those of EEC bodies;
5. to plan, organize and establish the ELOT quality control testing and standards laboratories;
6. to train Greek personnel in standard practices.

2.3 Four experts have already completed their missions in this project. Reports have been prepared covering the legal, etc., framework for a certification marking scheme (Frontard - 01); the certification and quality control laboratories (Redfern -03); certification and quality control testing of central heating boilers (Kapitaniak - 04); and the training of testing laboratories personnel (Deri - 06).

2.4 The mission covered by this report concerns the certification and quality control testing of solar energy collectors. The expert's duties include:

1. to study and review the present situation in Greece with regard to the design, manufacture, installation, testing, quality control and certification marking procedures for solar energy collectors;
2. to recommend practical measures aimed at improving these procedures, within the framework of the national certification marking systems to be established under the auspices of ELOT;
3. to assist in specifying the additional laboratory testing and measuring facilities and equipment required for improving and developing the above-mentioned services;
4. to give advice and information covering the organization and operation of testing and certification procedures in the EEC countries.

The complete description in contained in Appendix 1 of this report.

2.5 The expert's findings and recommendations are contained in the body of this report. Supporting information is contained in the appendices.

3. FINDINGS

3.1 The following findings are based on a study and review of the present situation in Greece with regard to solar energy collectors. This study and review was accomplished through discussions with the personnel of ELOT, with other Government personnel, with University faculty, and with manufacturers. A number of companies were visited, as well as the two known test laboratories. The final reports of previous experts (especially Frontard - 01 and Redfern - 03) were reviewed, since they set up the frameworks for the present study.

3.2 Greece has an expanding solar energy collector industry. Some 37 manufacturers sold about 30.000 metre^2 of collector in 1979, and expect to sell 40.000 metre^2 in 1980. Two manufacturers are rather large, accounting collectively for more than 50% of the sales, while the rest are considerably smaller.

3.3 The solar energy collector product being manufactured and sold in Greece is the flat-plate, thermosyphoning water heater. Although a few manufacturers also sell their flat-plate collectors separately for active water heating sytems (with pumps, tanks, controls etc.), this accounts for only a small part of their sales. With the exception of a few demonstration projects, there are no solar energy space heating systems in Greece.

3.4 In Greece, as in the EEC and the United States, the solar energy industry is quite young -- the oldest surviving company started in 1974. The products being sold are evolving continuously as experience is gained and newer materials and information become available. Only one manufacturer has a test facility at which he can evaluate product changes quantitatively (See Appendix 3).

3.5 There is a Hellenic Solar Energy Manufacturers Association which is trying to police the industry by asking its members to meet certain criteria. These include having a brand name (i.e. an identifiable product), having a qualified engineer, and having made a real capital investment in the manufacturing facility. Members of this association have expressed great enthusiasm for a certification scheme for solar energy collectors.

3.6 Research is being pursued in Greece to develop advanced components and systems for solar energy space heating and cooling applications. This research, primarily at educational institutions, is now guided by the Scientific Research and Development Agency, which has a solar energy program plan. The program coordinator expressed enthusiasm for a certification scheme which would apply not only to the present-day products, but also to these future developments.

3.7 One solar energy research group, at the University of Patras, has not only been developing components, but has also been testing experimental solar energy collectors for several years. Although their test apparatus is sparse they now possess considerable experience in performing and evaluating collector tests. This interdisciplinary group has prepared a site at the University which would be suitable for a full fledged test laboratory, and has considered the question of the equipment needed to bring it into operation. There are technician-grade personnel available. This finding is discussed in more detail in Appendix 3.

3.8 In recognition of the growing solar industry in Greece, of the relative immaturity of its products, and of the potential for contributing to the national energy conservation goal with quality solar energy equipment, ELOT has given solar energy collector certification a high

priority. As a first step, ELOT has written Standard 388 - I/II, adapted primarily from ASHRAE 93-77 (USA). This standard specifies the method of testing to determine the instantaneous thermal performance of flat-plate, liquid-heating solar energy collectors. (See Appendix 6). There is no standard for rating or certifying a collector, nor is there any standard relating to thermosyphoning water heating systems (but there is none in the EEC or the United States, either).

3.9 ELOT does not have a laboratory suitable for testing solar energy collectors, does not have the necessary equipment, and does not have the necessary personnel. A proposal from the firm DORNIER to the Greek government for a joint project in solar energy testing has been transmitted to ELOT because it includes solar energy collector testing facilities, but it does not appear to meet ELOT's needs, being more in the way of a research and demonstration project.

4. RECOMMENDATIONS

R1. It is recommended that a solar energy test laboratory be established at the proposed site at the University of Patras in a joint and cooperative venture between ELOT and the University of Patras. This selection of location best meets the guidelines in Appendix 4. The testing program will include both routine certification testing for ELOT (which must take precedence) and experimental work for the University of Patras. The latter, experimental work is essential since it will provide the data needed to develop new standards and procedures. A list of suggested equipment is given in Appendix 5.

R2. It is recommended that financial support for equipment for this laboratory (see Appendix 5) be sought from UNIDO/UNDP (there is some provision for this in the current UNIDO project), and from the Greek Scientific Research and Technology Agency (in a joint proposal from ELOT and the University of Patras). The latter agency is appropriate because the laboratory will become a centre for research on active solar system components. Because of the large capital investment required, other sources of support may be necessary as well.

R3. It is recommended that the test laboratory be headed by a qualified engineer who is clearly identified as being in charge of the day-to-day operation. His responsibilities will include ensuring the equipment is functional and in calibration, scheduling tests of solar energy components, ensuring the tests are done correctly, preparing the final test reports in approved format, and signing them. The traceability and accountability provided by this one-man-in-charge scheme are essential to the success of a certification program.

R4. It is recommended that this engineer, once selected, be given a UNIDO fellowship for one or two months to study first hand the collector testing procedures at a recognized solar energy test laboratory in the EEC or the United States. He can discuss with the personnel how the procedures should be modified to meet the needs of the Greek program. There is provision for such a fellowship in the UNIDO project.

R5. It is recommended that at least one qualified technician be assigned to the test laboratory full time. This is essential to ensure uniformity in the test results. Although solar energy collector testing is called "routine", the quality of the data depends to a considerable degree on the technician performing the tests.

R6. It is recommended that this technician, once selected, also be given a UNIDO fellowship for one or two months. To provide maximum benefit for the Greek program, this fellowship should coincide with the engineer's fellowship (R4), so that the two personnel can study the procedures together and discuss and analyze them together. There is provision for fellowships in the UNIDO project.

R7. It is recommended that a UNIDO expert on solar energy collector testing be brought to Greece for a short term mission after the test laboratory has been established and the engineer and technician have received their study fellowship. The purposes of this mission are to:

1. ensure that the appopriate equipment has been obtained for the laboratory and that it is properly connected and functional;
2. help the engineer and technician shake down the equipment and refine the collector testing procedures in actual tests;
3. provide the test laboratory and ELOT with the latest information on solar energy system standards development, in the light of the needs of the Greek program.

R8. It is recommended that ELOT adopt all of the outside test laboratory guidelines (Redfern - Appendix 9) with respect to the test laboratory recommended above, since a variety of testing efforts will be carried out there.
The testing done for ELOT will be done in accordance with Standard 388-I/II.

R9. It is recommended that ELOT develop a Certificate of Performance to be issued for collectors which are tested. The certificate would completely describe the collector (perhaps using the collector characteristics sheet already developed), state that it had been tested in a standard way at an approved laboratory, and certify the data (see Appendix 6).

R10. It is recommended that as a first step toward a collector marking scheme, ELOT develop a collector rating procedure which is based on instantaneous thermal performance (see Appendix 6). An informative label for collectors should be developed which uses the rating.

R11. It is recommended that any full certification and marking program for solar energy collectors be postponed until such programs are in place and functioning for other products. This allows the administrative procedures to be worked out while solutions are sought for the technical problems confronting collector certification.

R12. It is recommended that an organizational framework be set up within ELOT to deal with these certification activities, as has been recommended by previous UNIDO experts on mission. For solar energy collectors, the simple Certification Division concept (Redfern - 01) would suffice if supported by a solar energy committee, although the more formal Certification Board/Branch Certification Committee structure (Frontard -

Annex 5) would also work. For considering questions concerning certificates of performance and informative labelling, the committee need only have representatives of the solar energy collector industry and of consumers. For considering questions concerning new standards -- for example, on thermosyphoning water heaters -- the membership should be expanded to include technical and academic people.

R13. It is recommended that ELOT (representing Greece as provided in Law No 372/76) press for early development of international standards on thermosyphoning collector performance. Interactions can take place through the International Standards Association (ISO) and the International Energy Agency (IEA). A substantial contribtuion from Greece would be experimental data on thermosyphoning collectors taken at the test laboratory recommended above (R1).

5. ACKNOWLEDGEMENTS

All the individuals met during this mission have been enthusiastic and frank in discussions of their activities, their objectives and their problems.
This was particularly so with the ELOT personnel. The cordiality and openness of all materially aided the study and is acknowledged gratefully.

Mr. Damianos Agapalides of ELOT is singled out for special thanks, because his constant help made the mission a success. In addition to his regular work, he arranged appointments, personally drove to the meetings, translated difficult concepts, and provided considerable background information.

Mrs. Christina Karydakis of ELOT is also thanked for her careful typing of this report.

APPENDIX 1

UNITED NATIONS DEVELOPMENT PROGRAMME

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

PROJECT IN GREECE

JOB DESCRIPTION
DP/GRE/78/C01/11-05

POST TITLE	Consultant in certification and quality control testing of solar energy collectors (testing methods, procedures and laboratories)
DURATION	One month (with possibility of return missions)
DATE REQUIRED	September 1979
DUTY STATION	Athens, with travel in the country
PURPOSE OF PROJECT	To assist the Government in strengthening and developing the national standardization and certification marking schemes
DUTIES	The consultant will be attached to the Hellenic Organisation for Standardisation (ELOT) under the Ministry of Industry and Technology, and, working in close cooperation with other relevant Government ministries and departments, institutions, organisations and industrial enterprises, will be expected to:

1. study and review the present situation in Greece with regard to the design, manufacture, installation, testing, quality control and certification marking procedures for solar energy collectors (including the relevant standards)

2. recommend practical measures aimed at improving these procedures, within the framework of the national certification marking systems to be established under the auspices of ELOT

3. assist in specifying the additional laboratory testing and measuring facilities and equipment required for improving and developing above-mentioned services

4. give advice and information covering the organisation and operation of testing and certification procedures in the EEC countries.

The consultant will also be expected to prepare a final report covering the findings of his mission and his recommendations to the Government on further action to be taken.

QUALIFICATIONS

University degree in engineering, technology or applied physical sciences. Extensive experience in the design, manufacture, installation, testing and certification of solar energy collectors. Full knowledge about the relevant standards, quality control and testing procedures with particular reference to the practices and laboratories in the EEC and other industrialized countries.

LANGUAGE

English or French with a good working knowledge of English.

BACKGROUND INFORMATION

1. Since the end of the Second World War the economic development policy of Greece has aimed primarily at aligning the national standard of living to the level of the industrialized countries of Western Europe. This programme has been largely successful since the income per capita which was equivalent to 39% of the average figure for these countries in 1955, was raised to 53% in 1977.

During this period the Government encouraged foreign investments in Greece together with the importation of the relevant technologies, in order to provide Greek industry with better opportunities for commercialisation of its products abroad.

2. One of the top priorities of the Government of Greece lies in the conservation of energy, as well as in the search for alternative sources of energy. According to a report published in 1977 by the National Energy Council, the average annual rate of increase of energy consumption was 12,4% for 1965 - 1972 and about 9,5% for 1975-1976. In 1976 the demand was satisfied by 25,9% solid fuels, 70,5% liquid fuels and 3,6% hydropower. Industry accounts for 43,4% of energy consumption, transportation for 23,8% and residential and other uses for 32,8%.

3. Within the framework of the above priorities and policies of the Government of Greece, the Hellenic Organisation for Standardisation (ELOT) was established in 1976 by the Law No. 372/1976, as a non-profit institution, under the supervision of the state exercised by the Minister of Industry. The establishment of the National Council of Standardisation which would form part of the procedure for organising and operating ELOT, was announced in 1977.

4. To further develop and strengthen those activities, the need for assistance in the following fields was expressed by the Hellenic Organisation for Standardization (ELOT):

- legal framework for certification procedures
- setting-up and equipment of a laboratory for testing of central heating equipment, heating appliances and solar energy collectors
- setting up and equipment of a laboratory for basic electrical equipment

- feasibility, creation and operation of a system for supervising compound constructions (factories, building constructions, etc.).

5. In addition to the above considerations about energy conservation, the activities of ELOT in the fields of standardization, quality control and quality certification schemes will provide a major contribution to improving the quality, reliability and safety of Greek products, materials and equipment intended for local consumption as well as for export. This contribution should also be seen in the light of Greece's full partnership in the European Economic Community (EEC) and ELOT would play a crucial role in bringing about the harmonization of the Greek national standards, quality control and quality certification schemes with those of such EEC bodies as CEN, CENELEC, CENCER and the CB Scheme. ELOT would also represent Greece in the international activities in standardization, quality control and certification marking.

RS/ts - 20-11-1978

APPENDIX 2

PERSONS MET ON MISSION

1.	IN TRANSIT	
	Mr. Frank REDFERN,	UNIDO Expert.
2.	UNDP - ATHENS	
	Mr. Hans KAMBERG,	Resident Representative, UNDP.
	Mr. Nicholas COUSSIDIS,	National Program Officer, UNDP.
3.	ELOT	
	Mr. Alexander MORAITAKIS,	Managing Director.
	Mr. Evangelos VARDAKAS,	Deputy Managing Director, Planning and Development Division
	Mr. Alekos PAVLOPOULOS,	Legal Adviser.
	Mr. Vassilis PHILOPOULOS,	Technical Division.
	Mr. Damianos AGAPALIDES,	Chemist, Planning and Development Division.
	Ms. Christina KARYDAKIS,	Secretary of Direction.
4.	SCIENTIFIC RESEARCH AND TECHNOLOGY AGENCY	
	Mr. MELISSAROPOULOS,	Scientific Advisor, Solar Energy Program Coordinator.
5.	UNIVERSITY OF PATRAS	
	Prof. Rigas RIGOPOULOS,	Chair of Physics II Laboratory.
	Prof. GEORGALAS,	Theoretical Physics Laboratory.
	Prof. Alexander TSOLIS,	Chemical Technology Laboratory
	Dr. P. YIANOULIS,	Physics II Laboratory.
6.	INDUSTRY VISITS	
	Mr. George MICHALOYANNAKIS,	Solar Manufacturing and Marketing Manager, BP-Ellenas. (Chair of Hellenic Solar Energy Manufacturers Association).
	Mr. Michael KEENE,	Technical Advisor and Export Manager. BP-Aktis SA.
	Mr. Panos LAMARIS,	Managing Director, Sole Ltd. (Secretary of Hellenic Solar Energy Manufacturers Assn).
	Mr. Andreas KESTEKIDES,	Sales Manager, THEA Ltd.

APPENDIX 3

SOLAR ENERGY TEST LABORATORIES VISITED

BP/CICERO.

The test facility at the BP/Cicero plant near Corinth was built to allow quantitative evaluation of design changes to the company's product, the BP-CALPAK collector. Accordingly, the testing is principally comparative in nature. Three test stands are equipped and instrumented for performing instantaneous thermal performance tests on water heating collectors, essentially in the manner of ELOT Standard 388-I. The equipment includes pumps, heat exchangers, pressure regulators, heaters, filters and the like, while the instrumentation includes platinum resistance thermometers, pyranometers, flow meters, anemometers etc., as well as a microprocessor-controlled data acquisition and analysis box which prints out the data as useful quantities in the appropriate engineering units. Few qualified personnel are available to run these tests.

In addition, there is a large pad available on which thermosyphoning water heating systems can be placed for side-by-side comparison. The systems are run all day, and then the amounts of thermal energy collected are determined from the final tank temperatures. Overnight thermal loss rates can also be determined. No serious attempt has been made to develop a testing standard for these systems. Any physical changes observed in the collectors during testing are reported back to the plant as part of the quality control effort.

Mr. Michael Keene of BP/Aktis is the Technical Advisor to this testing activity, and has been responsible for interpreting the test results.

He is thanked for the tour and thorough explanation of the facility which he provided.

UNIVERSITY OF PATRAS.

The solar energy collector testing at the University of Patras has been in support of the experimental developments of the Solar Energy Group headed by Prof. Rigas Rigopoulos, Chair of the Physics II Laboratory. A small test stand has been constructed which tracks the sun, maintaining the collector at normal incidence. Supporting equipment includes some tanks, pumps, heat exchangers, and the like, and the instrumentation includes thermocouples, pyranometer, and strip chart recorders. Data is analyzed with an off-line minicomputer. Although the test apparatus is sparse, the personnel have used it very well. They now possess considerable experience in performing and analyzing instantaneous thermal performance tests on solar energy collectors. They understand the limitations not only of the apparatus but also of the methods of testing such as are given in ELOT Standard 388-I/II, and they are looking ahead at the testing requirements needed for advanced collectors.

The group has prepared a site which would be suitable for a full-fledged solar energy test laboratory. The site is on the University grounds outside of Patras proper and hence outside the major haze envelope. A large, roughly square area has been graded by bulldozer near the northern fence line of the grounds. There is a clear view of the sky to the south and southwest. There is a distant mountain range which rises perhaps 10° - 15° above the horizon to the southeast which might limit early morning testing during December/January.

A one-room concrete structure has been built on a concrete pad in the northeast corner of the present clear area. This building is more than adequate for an equipment building. At present there is neither water nor electrical service in the building, but they can be brought in from nearby. There is land for a substantial expansion of the site if required. The group has drawn up a list of equipment needed to equip the site for testing to ELOT Standard 388-I/II. There are technician-grade personnel available, who have been working with the group part-time.

Prof. Rigopoulos and the entire solar energy group at the University of Patras are thanked for their hospitality and informativeness.

APPENDIX 4

SOLAR ENERGY TEST LABORATORY GUIDELINES

For outdoor testing of solar energy collectors the prime requirement is "good sun". For this reason a solar energy test laboratory should not be located in a metropolitan area where there is considerable haze. The site chosen should be clear of obstructions and have a clear view of the sky to the south, southeast and southwest. Any supporting buildings, equipment, utility poles or the like should be to the north of the site. As an absolute minimum, an area 3m x 4m should be reserved for each collector test stand. A larger area is desirable. If more than one test stand is contemplated, they should be laid out on an East-West line and sufficiently far apart to avoid mutual shading. The area for some distance in front of the test stands (i.e. to the south) should be surfaced with earth or grass. Parking lots, cars and buildings can lead to anomalous results due to increased ground reflection. Space should be reserved behind the test stands for auxiliary equipment used in the tests.

At least two test stands should be available, both to allow comparison of collectors, and to increase the rate at which collectors are tested. Three test stands would be better. Assuming that one collector test takes three weeks to complete (although tests can be completed in two weeks in good weather, they can stretch to a month or more during poor weather), then continuous testing with two stands will allow 34 tests a year, and with three stands, 52. In all probability, at any given time one stand will not be functional, due to equipment or collector problems, hence three stands are highly desirable. At least one of the stands should be of the altazimuth type allowing the collector to be kept facing the sun. This requirement allows both for comparing various test methods being developed in other countries, and also for testing advanced collectors currently in the developed stage. The other stands can be of the south-facing, tilt-adjustable type.

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A structure should be available for housing the electronic instrumentation used in testing. This structure, which can be a trailer or a building, may require heating and/or cooling to maintain the interior temperature in the range 20°C to 30°C or so. Although most equipment will operate over a much wider temperature range, few will maintain the stated accuracy. Similarly, if the electrical service at the site does not maintain the line voltage constant to within 5%, then A.C. voltage regulators should be provided to ensure the electronic equipment maintains calibration.

Running water should be available at the site for water-heating collector testing. A typical consumption rate would be 2 litre/second for each collector tested in an open-loop configuration. If the water has a high mineral content, then it may be necessary to treat to prevent boiler-scale from building up in the test loops.

The personnel at the solar energy test laboratory should have access to technical personnel who are well versed not only in instrumentation and collector testing techniques but also the principles of operation of solar energy collectors. Although solar energy testing has become routine in the sense that standard test methods are available, every test requires some interpretation. Some collectors must be analyzed rather carefully before they can be tested successfully.

APPENDIX 5

EQUIPMENT LIST

This list is in preparation and will be provided in the final draft.

APPENDIX 6

DISCUSSION OF SOLAR ENERGY COLLECTOR CERTIFICATION

The certification of a product usually proceeds in three stages. Standard test methods are used to generate test data on the product. The test data are used to generate a rating for the product. Finally, the rating is used in the certification of the product. It is to be noted that this process usually quantifies the performance of the product, so that various certified products can be ranked relatively. Concerning operational characteristics, quality of construction, or durability, however, certification usually indicates merely a pass, so that products cannot be ranked on the basis of these attributes. The pressure drop across a solar collector, for example, is measured during testing, but, high or low, it does not figure into the rating. On the other hand, a collector that leaks at the required pressure drop would be denied certification.

For solar energy collectors, ELOT has achieved the first stage in the above by preparing standard 388-I/II. This standard specifies the test method for measuring the instantaneous performance of a collector. The resulting data are expressed as an efficiency which is a function of temperature (both collector and ambient) and solar irradiance. At this stage a certificate of performance would be appropriate. It would certify that the collector performance had been measured in a standard way, and that the data were presented in a standard way.

The next step is to develop a rating procedure for the collector based on integrated or average performance. In the United States, the Solar Energy Industry Association (SEIA) has developed an all-day rating procedure (PCS-1-79) which is based on the instantaneous thermal performance data. For a standard profile of meteorological and solar conditions, the day-long output of the collector is calculated for different fluid inlet temperatures.

The results are expressed in terms of energy delivered per panel per day, for both a summer day and a winter day. Note that no consideration is given to the use of the energy; it is assumed that any energy delivered is used.

In the United Kingdom, the British Standards Institution (BSI) is developing an all-year rating procedure (see for example BS 5918:1980) which computes that part of the collector output which would be used by a reference water heating system, again with specified meteorological and solar conditions, as well as a hot water demand profile. The result is expressed in terms of energy delivered per year. BSI has gone a step further and define collector classes based on the amount of output.

Both these procedures use model calculations based on measured instantaneous thermal performance. It has been suggested that the day-long performance be measured instead, but no progress has been made at normalizing the results from different days and sites.

At this stage, an informative label would be appropriate since the original data have been reduced to a few numbers, or a class. The label would certify that the collector had been tested in a standard way, and that under certain specified conditions it would deliver a certain amount of energy. Of course, in most real circumstances the amount delivered would be different, but this is not too different a situation from air conditioners, for example, which are rated for a specific set of temperatures and relative humidities.

The final stage, full certification (or quality marking) of solar energy collectors is much more difficult to gain. Precedents have not been set in other countries yet due to the unanswered questions concerning the implications to the consumer of such certification and marking.

Durability and quality of construction are inextricably tied in, but adequate measures of these properties do not exist. A first step might be to require the collector be built to a code of practice (which then must be written!), or that it pass (however that is determined!) various exposure and operational characteristics tests.

In the case of thermosyphoning water heaters, not even the first stage has been reached. These are systems containing a number of components including a collector, a tank, typically also a heat exchanger and an electrical heater. Testing of the components separately, according to current standards, does not tell how the system will perform. Again, precedents have not been set elsewhere due to unanswered questions. A strong experimental program is probably needed to help define necessary procedures and important parameters.

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