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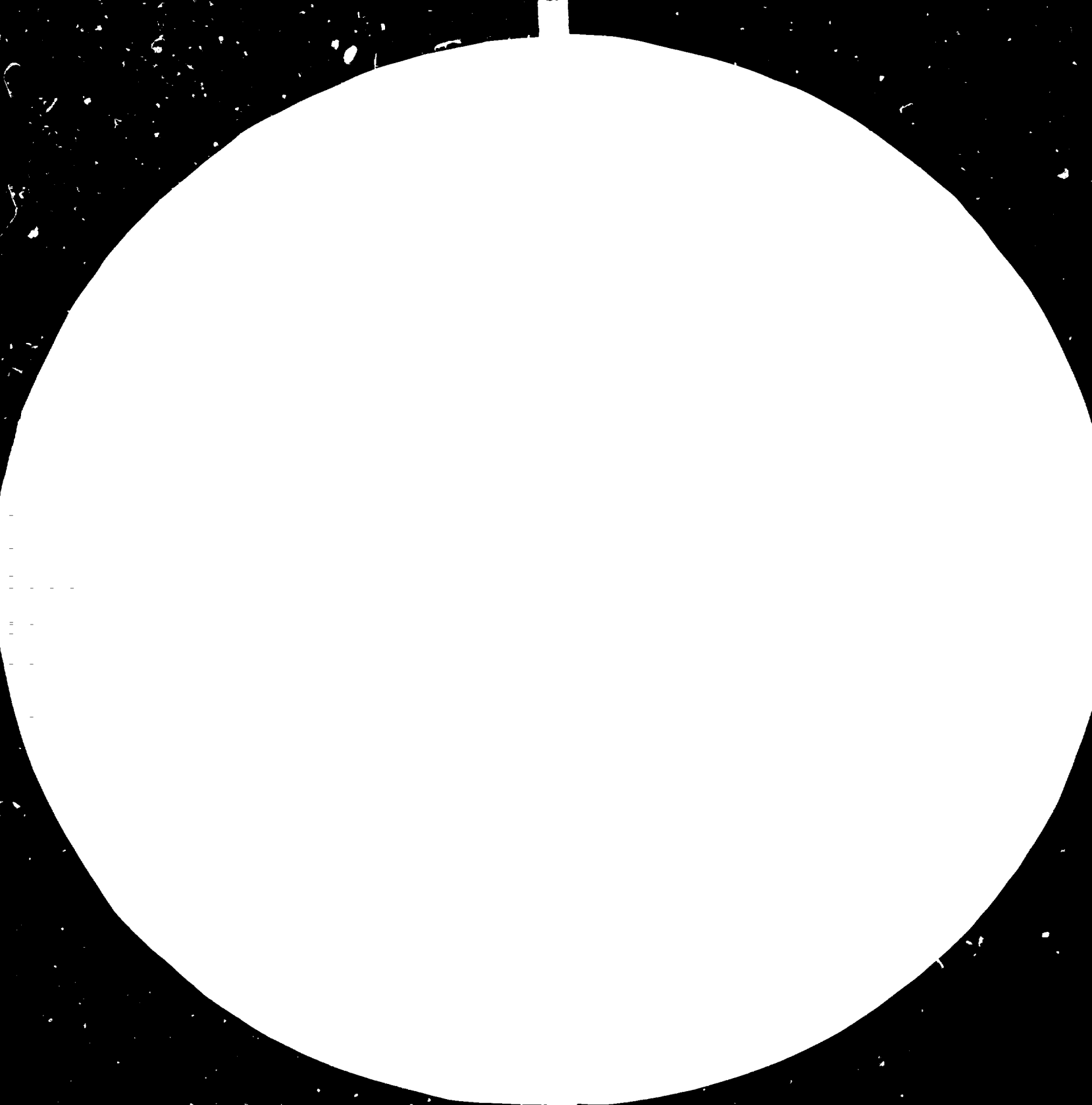
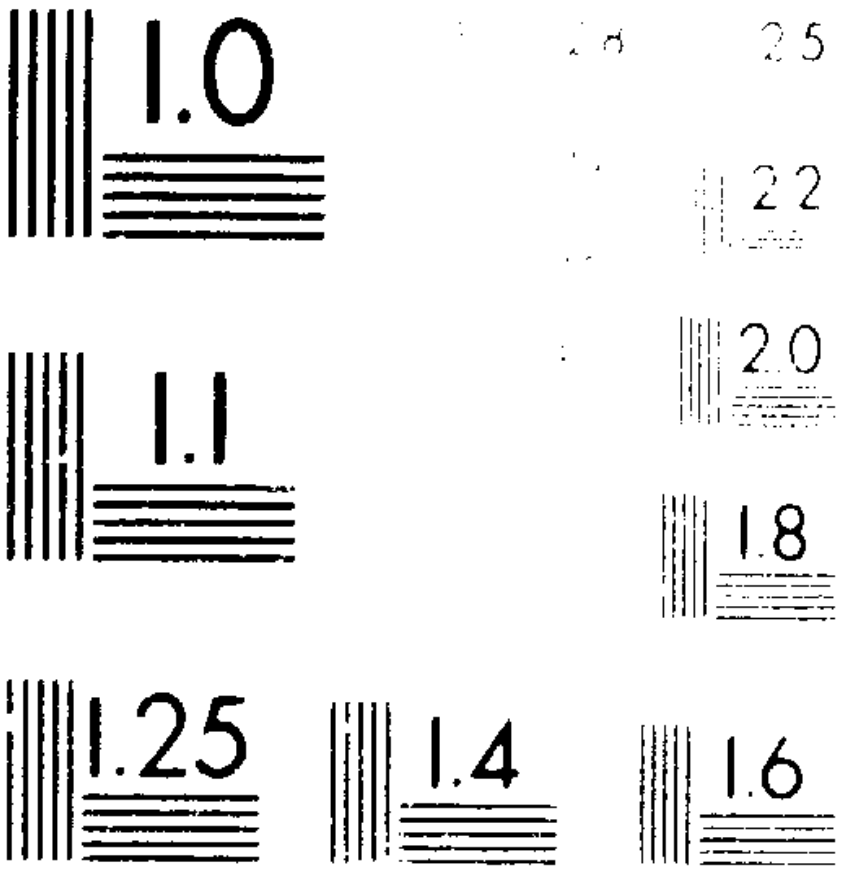
UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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Hungary

ENERGY CONSERVATION IN THE OPERATION OF BUILDINGS

DP/HUN/80/C01

PEOPLE'S REPUBLIC OF HUNGARY

solar energy

Final Report*

Prepared for the Government of People's Republic of Hungary
by the United Nations Industrial Development Organization
acting as executing agency for the United Nations Development Programme

Based on the work of Leslie F. Jesch
Solar Energy Consultant

United Nations Industrial Development Organization
Vienna

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FIRST REPORT

by Dr. L. F. Jesch, Solar Energy Consultant

on his mission and his recommendations to the Hungarian Government

on behalf of the United Nations Industrial Development Organization (UNIDO)

under contract: DP/HUN/80/001/11-51/32.1.K.

Mission dates: 9 July 1983 to 17 July 1983

Host organisation: Hungarian Institute of Building Science (ETI)
Duration: 9 days
Duty station: Budapest, Hungary
Purpose of project: Utilization of solar energy for auxiliary hot water supply and eventual heating of one family houses and small public buildings.
Objectives:
- -to discuss the directions to be taken in Hungary by the the solar energy equipment manufacturing industry.
- -to make proposals for future developments for the industry
- -to discuss the progress made with computerised simulation programmes
- -to propose future developments for simulation and mathematical modelling

SUMMARY

This was the first mission following the visit of Dr. Kunszt to Birmingham at which time a programme of cooperation was discussed. The programme set out the task of how best to help the Hungarian Government agencies in their efforts to introduce and to implement energy conservation and energy saving measures in the building sector. The approach was to pass on information and practical experience accumulated in the West in order to reduce wasteful duplication of research effort in areas where western experience proved unsuccessful. A plan for this programme has been made and thus the limited objectives of the first mission have been achieved.

An important part of the programme was to get acquainted with the organisational structure and key personnel of ETI and especially the ones who were proposed to come and work in the Solar Energy Laboratory in Birmingham, UK during the course of 1984. These contacts were made and a good working relationship was established with ETI personnel.

* * *

1. The guiding principle of the consultations was to provide ETI with a view of past and present progress made in the West in the development of solar technologies and equipment. We wanted to transfer experience in the use of these and to make recommendations for future directions best suited for the requirements of ETI.

2. As a routine: two meetings per day were held, sometimes in a plenary session with several interested Sections of ETI participating, at other times with one or two key scientists present. Individual consultations with younger specialists were also worked into the schedule. A very useful meeting in which Dr Imre from the Tecnical University, who is a consultant on solar energy and biomass applications was held to discuss the current status of this field of research and development. All these took place at the host institution's location and at the University.

3. We invited leading members of industry, science, business and political organisations involved in solar energy for a reception. This gave an opportunity for meeting many key people in a short time. We participated also at the inaugural meeting of theHungarian Section of the International Solar Energy Society (HISES) and officiated the proceedings as representative of the international organisation. During the meeting we gave an opening address and welcomed the formation of the first national section by a socialist country.

4. We discussed the history and current problems of the Swedish cooperative programme and in particular the progress and difficulties experienced in the development of the mathematical modelling project. It was agreed that more time was required for trying to find a good solution and that the next mission will concentrate on this.

5. We had visited the Szentendre Clima Lab and discussed with scientific staff the operational requirements and future instrumentation needs.

6. Conclusions

It was agreed that the mission has achieved its stated objectives and set out the future course to be followed in the next year. The visit of two ETI scientists to the Birmingham Solar Energy Laboratory has been arranged and the program of the second mission has ben outlined for 1984.

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FINAL REPORT

by Dr. L. F. Jesch, Solar Energy Consultant

on his mission and his recommendations to the Hungarian Government

on behalf of the United Nations Industrial Development Organization (UNIDO)

under contract: DP/HUN/80/001/11-51/32.1.K.

Mission dates: 19 June 1984 to 29 June 1984

Host organisation: Hungarian Institute of Building Science (ETI)
Duration: 11 days
Duty station: Budapest, Hungary
Purpose of project: Utilization of solar energy for auxiliary hot water supply and eventual heating of one family houses and small public buildings.
Objectives:
-to evaluate the progress made in Hungary since last summer in the solar energy equipment manufacturing industry.
-to make proposals for future developments for the industry
-to evaluate the progress made with the DEROB computerised simulation programme
-to propose future developments for simulation and mathematical modelling

Contents:

SUMMARY

This was the second mission following the first one in the summer of 1983 which set out the task of how best to help the Hungarian Government agencies in their effort to introduce and to implement energy conservation and energy saving measures in the building sector. The approach was to pass on information and practical experience accumulated in the West in order to reduce wasteful duplication of research effort in areas where western experience proved unsuccessful. This has been done and the objectives have been achieved.

A further task to transfer already developed or easily developable technologies which could satisfy Hungarian domestic requirements and moreover which could provide export opportunities is seen as the most important next move. A proposal is made for such technology transfer programme.

* * *

1. The guiding principle of the consultations was to provide ETI with a view of past and present progress made in the West in the development of solar technologies and equipment. We wanted to transfer experience in the use of these and to make recommendations for future directions best suited for the requirements of ETI.

2. As a routine: two meetings per day were held, sometimes in a plenary session with several interested Sections of ETI participating, at other times with one or two key scientists present. Individual consultations with younger specialists were also worked into the schedule. A very useful meeting in which Dr Zold from the Tecnical University, who is a consultant on computer simulation was held to discuss the current status of the DEROB development. Allthese took place at the host institution's location.

3. We paid a visit, addressed a seminar, organised by the Hungarian National Academy of Sciences (MTA) at Pecs and gave interviews to the press and radio. We participated also at the inaugural meeting of the Passive Solar Branch of the Hungarian Section of the International Solar Energy Society (HISES) and gave an introductory address. These occasions served the useful purpose of giving a wide ranging personal contact with practicing engineers, architects, administrators, industrialists and scientists on whose future activities the success of the Government's programme depends. Direct exposure of ideas and practices to them is bound to have an effect.

4. The format of the consultations followed the document entitled "Tematika", dated 1984.06.20, prepared by Dr. Tomory of ETI and based on the job description proposed by us to ETI and to UNIDO.

5. Progress made in Hungary since last summer in the solar energy equipment manufacturing industry. Dr. Tomory gave an overview which indicated that apart from some smaller efforts the VEIKI and BARCS collectors are the only survivors of a general down-trend in the industry. FUTOBER is not proceeding with previous plans but waiting for new and inexpensive prospects to emerge. There is some interest in plastic or rubber collectors. The market can not stand high price capital equipment. About 45-50,000 Forint per one family dwelling is the current price for domestic hot water solar systems.

We thought this to be a serious problem. No reasonable and worthwhile solar installations can be produced for this price. Cheap systems in the West had a history of turning out to be more expensive in the long run because of the maintenance costs and the wasted investment in capital costs. The world price of similar systems is 2 - 4 times higher. There are several governments which give tax incentives and direct loans etc. to persuade individuals to install energy saving devices and features. A well thought out and designed production and marketing policy could bring the price and quality to within a range of interest to customers.

Total investment in solar devices should be amortised in about 20 years time during which fuel prices will justify the initial expenditure. This also means that the installation has to last 20 years so the good quality is essential. Hungary is dependent on foreign oil import and she is therefore not able to control the price of the most expensive fuel in the national energy budget. A long term investment in energy saving is very clearly justified.

Domestic hot water heating by solar should be declared as a contemporary energy rationalising method (KORSZERU ENERGIA RACIONALIZALASI MODSZER) and the appropriate national energy policy bodies like OEGH should make announcement that a special credit (ENERGIA KORSZERUSITESI HITEL) is available from OTP with the already established upper limit of 100,000 Ft at 2 % interest. The vicious circle of no credit - no investment - no energy saving has to be broken by the Government.

6. Proposals of future developments for the solar energy industry. There was an interest in developing concentrating collectors in Hungary. The problems associated with this were discussed. Although it seemed that one million Ft was available from an industrial sponsor and a matching sum from the Government (EVM), it was agreed that the possibility of further work should be very carefully analysed before funds are committed.

Our own view was expressed that the experience in the West has been that the difficulties in making high precision parabolic or cusp etc. shape surfaces which are needed for the high concentration ratios, increase the cost considerably even if the specific industrial background and manufacturing capacity is already available. The necessary tracking mechanisms further escalate the cost. Dust and other weather factors require the ability of rotating the collectors into a face down parked position. The low proportion of direct beam radiation and the attendant high proportion of diffuse radiation characterising the climate of Hungary have the consequence of not enough direct beam radiation available during the year to justify the higher investment in concentrating collectors. Diffuse radiation cannot be concentrated and this makes the use of concentrating collectors a proposition more suitable for dry southern countries.

7. There were some questions raised by ETI personnel which were not related to concentrating collectors but were detailed in the "Tematika" under item 2 and came up for discussion. Our view was that western experience is that active solar systems have gone through a period of economic criticism, but they are coming back again as interesting prospects which are worth considering. Currently it is the passive solar application which is considered the most readily acceptable one. Hybrid systems are preferred

by us in which both the passive design principles and the active solutions are employed.

For energy storage we recommend 70 - 90 kg/m^2 in domestic hot water preheating applications and about ten times that for space heating.

Integral roof collectors: are preferred for new installations but care has to be taken in respect of problems with access to the collectors from behind in the roof space. It is important to assure that glazing panels are removable and reinstallable if access is required from the front. Glass is heavy, it bends if it is long and it is very difficult to handle on a sloping surface which is coplanar with the roof.

Trends: collectors should be durable, made of high quality materials. Avoid aluminium, plastic and other materials which corrode or are photo-degradable. Do not design or use snap-on copper fin-and-tube collectors as these have low bond-conductance. Frost protection can be done with either ethylene glycol or propylene glycol solutions, but drain-down systems are much better. Dirt, dust, discoloration reduce the tau-alpha product and whence the collection efficiency, but not too much. The real enemy is the appearance of dirty collectors. Selective surfaces are useful in providing a non-equilibrium condition by absorbing more than emitting. Several companies(like Stamax, Maxorb etc.) in Israel,USA, UK offer different units. The new collectors marketed by Energy Engineering Ltd. in the UK, offer a good combination of the durability of stainless steel with the improved thermal performance of selective surface coating which provides 92 % absorptance and 20 % emmittance. Boxed in collectors should be well sealed against rain water and thermally insulated against heat loss.

8. Simulation by computer programs. During consultations the program for the development of mathematical models was extensively reviewed. We believe that ETI is in an excellent position now to develop an all Hungarian, independent and new simulation program which is based on detailed analyses of the thermal behaviour of buildings. ETI have done a good job in studying other programs and creating their own ideas. In the process they have built a strong and well tried team which includes Dr. Zold of the Technical University. Our personal discussions with the team convinced us of the following:
   a. the ETI-BME team should concentrate on the rapid development of a new Hungarian computer program which would enable the user to make quick estimates of building structure behaviour. This model should emphasize the ease of use, quick input and rapid output of results, so that it could be a design tool in the hands of young architects and building services engineers. The goal is to achieve regular daily use of this program as a tool, like pocket calculators are used today and like nomograms were used thirty years ago.
   b. as time permits, the ETI-BME team should continue with their work on larger and more comprehensive model which could be useful for larger and more prestigious applications, for which more money is available in the design budget.
   c. a compatibility of the two (a. and b.) is desirable, but not absolutely necessary. This compatibility consideration should not hold up the development of the rapid method model. The two programs have to be used differently. It is like a pocket calculator does not

have to be compatible with a desk computer to be useful.

d. it is essential that both a. and b. are made simple to understand, easy and quick to input, userfriendly and well documented.

e. both a. and b. should be made to work on the new TPA 11-440 machine which is soon to be purchased by ETI.

f. it is important to write a. in a language and form that makes it usable on microcomputers now becoming available in Hungary.

g. both a. and b. when they become available should be subjected to a rigorous verification and validation process. Birmingham University could help in this process.

9. TPA 11-440: a new computer for ETI. The need for improved computers was discussed. We learned that ETI will purchase in the near future a computer jointly with TTI and locate it at TTI's headquarters. We pointed out the difficulties with having access to a remote computer. Some personnel will have to be located near the machine with permanent office facilities and a daily support from ETI with respects to work related material and information. Furthermore a priority access protocol has to be worked out with TTI in advance of the installation of the machine and a joint supervisory body should be set up to deal with daily matters and with the implementation of policy set by the two directors of ETI and TTI.

Remote terminals give some relief to the above problems if they are sufficient in number and if the telephone lines and MODEMs are of sufficient quality as to not impede communication. For effective use of such terminals a minimum requirement is about 1200 BAUD rate. Below that the user gets frustrated by the slow speed of data transmission. This rate or ever eight times of this rate is easily obtained when the terminal is hard wired to the central processor within say 50 meters. Over telephone lines and modems data corrution is very much increased at 9600 baud rate.

The best solution is to have many small machines in every division of ETI, readily available to scientists like Mr. Kun Gazda, sitting on their desk and used by them day and night. This way their direct involvement guarantees that the best individual performance is achieved. The dependence of a creative scientist on a computer operator is the potential for destroying that creativity. It would be very useful to analyse the user reactions to the currently operated PDP-8 machine.

The latest and much modernised version of the original DEC computer PDP-11 will be available in Birmingham later this year and this opens up certain possibilities for cooperation in the use of the machine for multipurpose functions like monitoring, control of operations, software development and simulation all at the same time. We intend to develop programs which are compatible with DEC, Apple II and IBM PC micros. ETI would be welcome to participate in a well planned joint program.

10. We discussed other topics which were not detailed in the document "Tematika" but were of importance for the Hungarian development program:

a. Biomass. The combined pig-farm, brewery, mushroom growing complex one uses solar energy and was proposed by Volgyes & Kovacs or similar ideas deserve more attention than they receive today. Agricultural uses of solar energy and energy management in general is recognised in many countries as both important and economically justifiable

applications. Miss Kovacs needs help and encouragement in the disciplined development of her ideas. Someone with computing experience should write a program which would model the mass and energy balances of her scheme. ETI could sell the design in Hungary and possibly abroad as well. We could assist with computer modeling if required.

b. Swimming pool and fish hatchery heating. These are the bestsolar applications because of the low temperature levels at which heat is needed are within the range of what solar heating can supply. The demand for heat and the availability of solar energy also coincide in the summer to make this a very attractive proposition. Cheap non metallic collectors are adequate. We had very good experience with these applications: they extend the swimming season and also extend the hatching season, which means increased fish reproduction rates. We could give specific help to ETI and the Hungarian Government with already developed technologies and equipment.

c. SzentendreClimaLab computerisation.This new facilityneeds a modernisation by using a microcomputer based control and data logging system. We recommend that UNIDO should consider fundirg this program. We are prepared to write an outline proposal so that if ETI wishes to proceed it could approach UNIDO.

d. SCRIBE This readily available software program is primarily for architects and building services engineers (epuletgepesz mernokok) and it is passive solar oriented, but it does heat load calculations. We recommend that ETI should buy an Aplle II computer with a colour monitor, graphics card, printer program package and offer architects and other clients fast and appealing as well as accurate design service.

e. f chart, f load, met 1, met 2, dday etc. These software programs are fast, simple and easy to use for quick calculations in predesign. Like SCRIBE they run on an Aplle II hardware package. They have the same utility as it is described above.

As part of the UNIDO program two scientists from ETI: an engineer and an architect have spent some time in Birmingham. They also took part in a short course designed for users of software programs written fcr microcomputers in the field of energy conservation in buildings. Therefore ETI has already some background in the use of these and it is recommended that they build on that experience by acquiring the necessary software and hardware and using it in everyday life. We can help ETI with this if they wish to proceed.

11. Conclusions

It was agreed that the mission has achieved it's stated objectives and produced some useful results. Working level contacts have been established and the directions for future work have been clearly defined.