OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

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

UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANIZATION

17178

IDENTIFICATION AND PROMOTION OF INDUSTRIAL INVESTMENT PROJECTS FOR THE LOCAL PRODUCTION IN DEVELOPING COUNTRIES OF MACHINERY AND EQUIPMENT FOR THE UTILIZATION OR PRODUCTION OF NEW OR RENEWABLE ENERGY FROM SOLAR, BIOMASS (EXCLUDING BIOGAS) AND MICRO-HYDRO SOURCES

PROJECT No. US/GLO/81/109

FINAL REPORT

57

baldo & c.
CONSULTING ENGINEERS

UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANIZATION

IDENTIFICATION AND PROMOTION OF INDUSTRIAL INVESTMENT PROJECTS FOR THE LOCAL PRODUCTION IN DEVELOPING COUNTRIES OF MACHINERY AND EQUIPMENT FOR THE UTILIZATION OR PRODUCTION OF NEW OR RENEWABLE ENERGY FROM SOLAR, BIOMASS (EXCLUDING BIOGAS) AND MICRO-HYDRO SOURCES

PROJECT No. US/GLO/81/109

FINAL REPORT

July 1988

baldo & c.
CONSULTING ENGINEERS

baldo & C.
CONSULTING ENGINEERS

I N D E X

ANNEXES

0. SUMMARY AND CONCLUSIONS

This programme has been finalized to the identification and promotion of industrial investment projects for the production in developing countries of machinery and equipment for the utilization of new or renewable energy from solar, biomass (excluding biogas) and micro-hydro sources.

It has been conducted by UNIDO with the financement of the Italian government and with the cooperation of ENEA, the Italian national agency for nuclear and alternative energy.

Five developing countries participated to the programme, namely Ethiopia, Somalia, Sudan, Thailand and Zimbabwe.

In each country a national team, usually composed by three members, carried out the following main activities :

- preparation of a country paper on the manufacture, use, applications and marketing of equipment using renewable energy in this country
- identification of specific investment opportunities/projects in the selected industrial subsector

These activities were carried out on the basis of substantive documentation prepared by UNIDO with the assistance of the subcontracted consultant (Baldo &

C.). The same consultant visited the five countries in order to discuss the drafts of the country papers, assist the national team in project identification etc.

The following projects were eventually identified:

Ethiopia	:	3 projects
Somalia	:	4 projects (two of which could be considered multi-projects because foresee the manufacture of several different equipment)
Sudan	:	11 projects
Thailand	:	4 projects
Zimbabwe	:	5 projects
		=====
		28

These 28 projects can be divided as follows by sub-sector:

- Solar energy applications	:	12 projects
- Wind energy applications	:	5 projects
- Biomass use application	:	9 projects
- Micro-hydro turbines	:	3 projects
- Other	:	1 project
		=====
		31 (1)

(1) The difference (31 to 28) is due to the fact that some projects in Somalia are multi-purpose ones.

All these projects have been disseminated among Italian companies manufacturing the equipment and machinery in subject. The response was quite satisfactory; in fact 185 companies were identified and contacted, 49 companies out of 185 showed interest and requested additional information; 35 companies confirmed their interest after reading the programme documentation and the projects information and eventually 30 companies decided to participate to the programme.

The national teams visited Italy where had the opportunity to visit 13 manufacturing plants and the ENEA renewable energies testing and research center. Bilateral meetings were held in Rome, Milan as well as during factory visits.

These meetings had as result 25 letters of intent signed or preliminary cooperation agreements reached among Italian industries and Ethiopian, Sudanese and Somali delegations (Thai and Zimbabwe delegations had no authority to sign letters of intent but they will report the results of the visit to local promoters once back in this country for immediate follow up).

Projects can be divided as follows:

A : Projects that can be undertaken with limited external financing required

B : Projects that can be undertaken but that will require significant financing (soft loans) for the foreign currency portion.

C : Projects that are unlikely to be implemented without significant aid (grants and soft loans)

The projects can therefore be listed as follows: (between brackets the name of the Italian Company selected)

Class A :
- biomass gasification project in Ethiopia (SES)
- biomass gasification project in Zimbabwe (SES)
- flat solar collectors project in Ethiopia (EUROKELLER)
- master plan for energy in Somalia (CESEN)
- deep cycle batteries for photovoltaic systems in Sudan (DAGA)
- solar cookers/solar panels in Zimbabwe (ENERGO PROJECT)

Class B :
- wind pumps/generators projects in Ethiopia (ISEA)
- photovoltaic systems production in Zimbabwe (HELIOS TECHNOLOGY)
- microhydro turbines project in Ethiopia (IREM)
- biomass briquetting in Sudan (various)
- microhydroturbines project in Zimbabwe (IREM)
- wind pumps/generators in Sudan (ISEA)
- photovoltaic systems production in Sudan (HELIOS TECHNOLOGY)
- solar panels production in Sudan (various)

- biogas digesters production in Sudan (SPI)

Class C : - wind pumps/generators project in Somalia (RIVA CALZONI)
- photovoltaic systems production in Somalia (SEI)
- microhydroturbines production in Somalia (various)
- briquetting systems in Somalia (ENERGO PROJECTS)
- solar cookers production in Somalia (ENERGO PROJECT)
- solar panels production in Somalia (various)
- ethanol production in Sudan (various)

Class A projects could account for a total investment of approximately 5 million U.S. dollars.

Class B projects could account for a total investment of approximately 8 million U.S. dollars.

Class C projects could account for a total investment of approximately 15 million U.S. dollars.

Proposed follow up could include:

- dissemination of information gathered during the italian phase among public/private sector industry (by the national team)

- final identification of local sponsors (when not done before)

- visit of Italian entrepreneurs to participating developing countries in order to finalize

agreements with local promoters and agree on terms of reference of pre-investment studies

- carrying out of pre-investment studies (financing and/or co-financing could be provided by UNIDO, Italian bilateral cooperation, ICE, COI, local development banks, etc).

- preparation of projects for demonstration, institution building, technical assistance like:

  . solar pumping system for demonstration/research in Thailand
  . energy master plan in Somalia, with special emphasis on renewable energies application
  . renewable energies research station in Zimbabwe

etc

- implementation stage

The methodology followed during the programme gave good results but can be improved.
Main improvements that could be introduced in next investment promotion programmed are:

- project questionnaire specifically prepared for this programme was too complicated and, in many cases, was abandoned in favour of the standard UNIDO form.
  This proved to be enough adequate because for most of the identified projects studies were not available.

- the way some of the national teams disseminated the information on the programme among industrial and financial sectors was not completely adequate and

this turned out into a lower number of projects identified.
Next programmes should foresee a better methodology for information dissemination; it should be "tailor-made" to meet local conditions (centrally planned economies or not, importance of private sector in industry etc) and it could include seminars, informal workshops etc)

- the importance of a national workshop has been underevaluated in some of the participating countries while it is essential for the final screening of projects and for policy making reasons.
  It is essential that the public and private sectors industries attend the workshop.
  Informal meetings among industrialist/government/ energy research agencies/UNIDO/consultants can be held in preparation of the national workshop.

- the visit of local sponsors together the national team should be incentivated by all means (for instance by paying a part of the travelling expenses).

- the schedule of the bilateral meetings has to be carefully planned: 1 hour was generally not enough. In addition national teams should be provided with a short introduction of the company they are going to meet.

1. APPLICATIONS OF RENEWABLE ENERGIES

The production of energy is usually associated with the burning of a fuel: petroleum and its derivates, coal etc. Other sources of energy are anyway available, sources that are not consumable like the sun, the wind and the water or that can be renewed, like the wood and the biomasses.

The use of these alternatives sources can produce significant amount of energy (thermal, electrical, mechanical) by means of appropriate equipment particularly suitable for use in rural areas or remote location where electrical energy is not easily available or where the cost of conventional fuels is too high.

Typical applications for sources of renewable energies are:

A. Cooking

The cooking of the food in one of the major uses of energy in a developing country and it can be as high as 50-60% of the total energy used. In addition most of the fuel used is wood and this is a cause of a progressive deforestation that is undermining the ecological system in many African and Asian countries. Wood is anyway a renewable source of energy but that means that reforestation programmes be implemented and that the best use of the scarce wood is done.

Appropriate technologies have been already introduced in several countries and these include:

- the production of metal kilns to produce charcoal with greater efficiency than the present artisanal methods;
- the production of charcoal from crop wastes
- the bricketing of crop-waste in order to increase the density and obtain better efficiency, (bagassa, rice husks, coffee shells, groundnuts shells etc.);
- the production of stoves optimized in order to increase efficiency and decrease the amount of fuel to be used;
- the production of brickettes of charcoal dust to decrease its losses during transportation (up to 25%).
- the production of solar cookers

8. Water pumping

Water is in many cases a problem because it is needed in large quantity for human being, animals and irrigation. The use of pumps in conjunction with diesel engines is very extensive but both fuel and engine maintenance are expensive and not always available. In addition fuel has to be transported and it costs energy too. Again the use of renewable energies can improve the situation, at least in areas where these sources can be made available. Major sources could be:

- wind, especially where its speed is over 3-4 meters/second as an average;
- the gasification of wood or other biomasses (maize cobs for instance) in simple kilns in order to produce a gas that is used to run the diesel engine;
- solar energy by means of systems, called photovoltaic, that transform the solar energy into electricity.

Among the three systems the wind energy is usually the most used and it is also the less expensive and simpler even if it can be employed only where enough wind is available.

Solar photovoltaic systems are still expensive and therefore suitable for applications where enough wind is not available and traditional fuel scarce; the cost of this systems is anyway decreasing and it is alreacy competitive in many cases.

C. Production of electricity

The production of electrical energy in rural and remote areas is usually carried out by means of small diesel generators. The use of traditional fuel can be replaced, in some instances, by renewable sources of energy like:

- wind provided that its speed is in the order of 9-12 meters/second;
- wood and biomasses gasification
- solar photovoltaic systems

- minihydro plants

Once that a source of electrical energy is available, even if small, it can be used in conjunction with low power lighting systems with refrigerators (especially to keep cold vaccines, drugs, etc), specifically built and optimized to require low energy consumption, as well as water pumps, radio sets etc.

D. Production of hot water and crops drying

In many cases large quantities of hot water have to be used, for instance in hospitals, where the production of hot water alone accounts for 50% of the total energy used, or in an Hotel where it accounts for 80% of the total, or in industries like food processing (dairy, jam, tomato paste, canning, bottling, etc). Usually boilers burning traditional fuels are used and their consumption is very large. In many cases the traditional fuels can be replaced by:

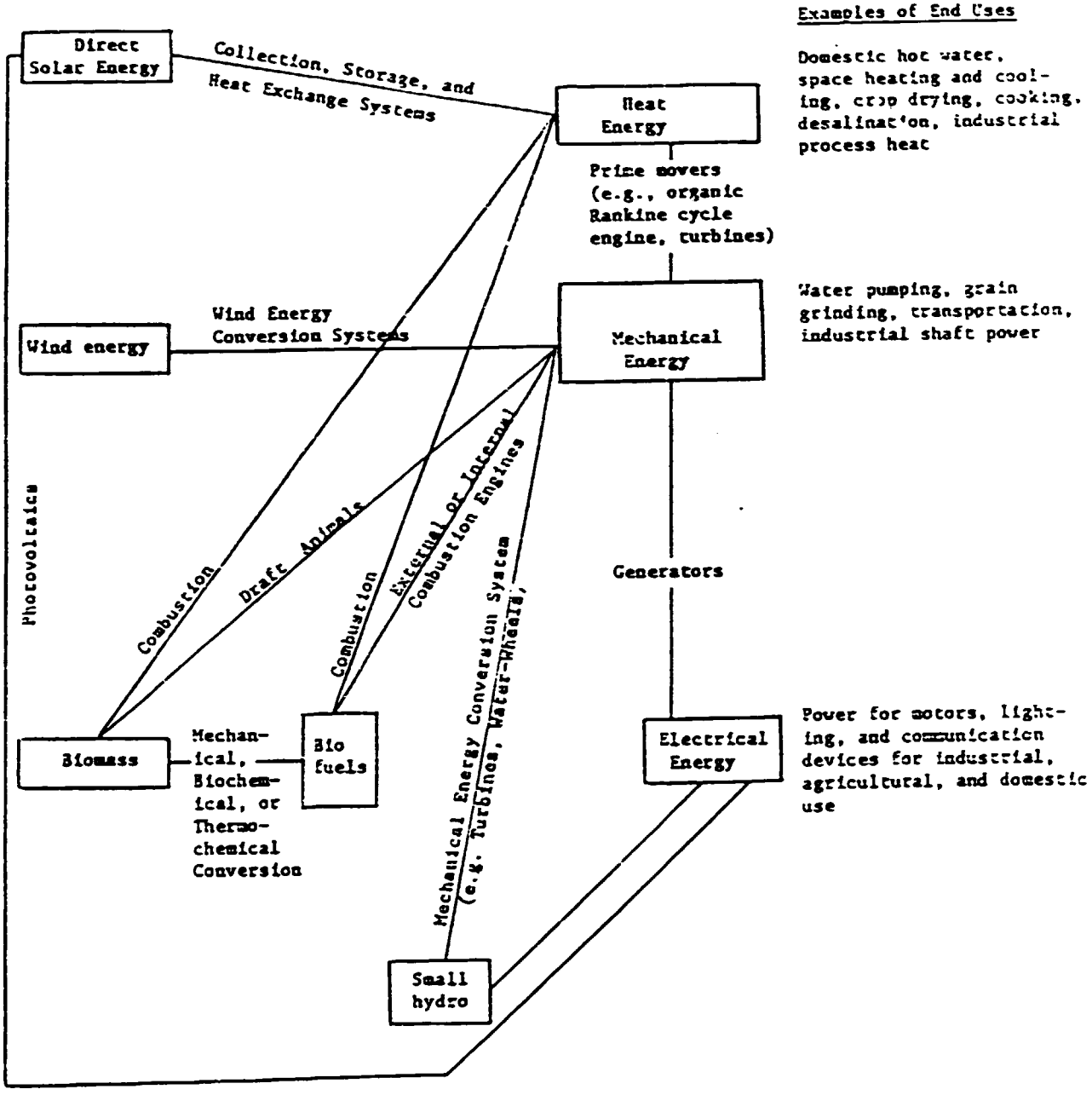
- use of crop-waste (corn cobs, shells etc.)
- solar energy

The latter is particularly important for hot water production and special panels (flat or tubes type) can be used for this purpose, collecting the solar radiations and heating the water up to 80° or more degrees.
In addition solar panels can be used in conjunction with simple equipment to dry the

crops, increasing the speed of the operation and saving expansive fuel.

The introduction of these simple equipment, produced locally, can be of great help to the development of rural areas and urban as well and save a large amount of the traditional fuels that, in many cases, have to be imported, with consequent benefits to the economy of the country and improvement of the living conditions of the people.

Figure 1 MAJOR RENEWABLE ENERGY RESOURCES AND APPLICATIONS FOR DEVELOPING COUNTRIES



2. THE PROGRAMME AND ITS PHASES

The identification and promotion of industrial investment projects for the local production of machinery and equipment for the utilization of renewable energies is the object of this programme.

It has been divided in the following main phases:

- preparation of substantive documentation
- establishment of national teams and beginning of the local activity
- consultant's visits to the participating countries
- final identification of projects
- preparation of the Italian phase
- developing countries delegations' visit to Italy

2.1 PREPARATION OF SUBSTANTIVE DOCUMENTATION

To support the fulfilment of the program under consideration, a substantive documentation has been prepared. Such documentation includes the following papers:

2.1.1 A background paper on the state of the art in the field of the production of machinery and equipment for the utilization or production of new or renewable energies.

In the first part of this paper, a list of the machinery and equipment that could be taken into consideration for the development of this industrial subsector, is provided.

The second section describes the process for initiating and successfully developing an industrialization program in this subsector. Information in mainly based on analysis of previous experiences and studies.

2.1.2 An annotated outline of a Country Paper (CP), which is to be prepared by the developing countries themselves. The scope of this paper is to present to possible local or foreign investors, a complete profile of the country itself, appropriate for promoting their interest in new projects, redeployments, expansions, or rehabilitations in the subsector under analysis.

2.1.3 A collection of industrial profiles concerning the manufacture of machinery and equipment for the utilisation of renewable energies.
Such profiles give a brief description of the manufacture process and information about the requirements of raw materials, equipment, manpower, and area necessary for the construction and operation of the plant.

2.1.4 Industrial investment project questionnaire (IIPQ). The aim of this questionnaire is to expedite consultations between projects sponsors in developing countries and potential joint-venture partners, financiers, suppliers of technology, etc. in the industrialized countries.

Consequently, the purpose of the questionnaire is to:

- facilitate the identification of investment opportunities and/or projects;
- ensure that the information provided in each investment opportunity or project is as complete and accurate as possible.

The above documentation was distributed to several countries interested in participating to the programme.

2.2 ESTABLISHMENT OF NATIONAL TEAMS AND THEIR ACTIVITY

Five developing countries finally joined the programme, namely:

- Ethiopia
- Somalia
- Sudan
- Thailand
- Zimbabwe

In each country a National Team was formed; each team generally included one expert in renewable energies, one industrial economist/industrial planner, one financial expert, preferably from local development banks.

Each national team carried out the following activities:

- preparation of a country paper on the production, use, applications and marketing of equipment using renewable energy in their country. This document was intended to :

  . facilitate the joint identification or generation of opportunities for new investments, redeployments, expansions or rehabilitations
  . identity bottlenecks, difficulties, etc, facing existing industrial plants in the selected subsector in developing countries and hampering further investments.

- identification of specific investment opportunities/projects (new, expansion or rehabilitation projects), in the selected industrial subsector, for establishment in their country, and preparation of the Industrial Investment Project Questionnaire on each identified project
- drawing up a list of qualified nationals and organizations who have experience and expertise in the selected industrial subsector (National Roster).

2.3 CONSULTANT'S VISIT TO PARTICIPATING COUNTRY

Each country was visited by the UNIDO consultant in order to :

- discuss the drafts of the country papers and Industrial Project Questionnaires with each national team and provide guidance and advisory services in the preparation of final country paper, the identification of projects etc.
- visit plants, national organizations and other institutions involved in the renewable energies subsector in order to gather direct information of the state of the art in the country and therefore better select the most appropriate type of technologies Italy could offer
- helping in organize, when possible, together with the national team, national institutions, industrialists etc, an informal workshop in preparation to a national one to be carried out later.
  Such informal workshop were actually held in Sudan, Somalia and Zimbabwe.
  During this informal workshop the following topics were discussed:

  - objectives of the programme and its organization
  - state of the art of the subsector
  - priorities selection
  - identified projects

- Identify other area of interest, not yet identified by the National Team

The Country visits reports are attached in Annexe No. 2.

2.4 FINAL IDENTIFICATION OF THE PROJECTS

The following 28 projects were finally identified:

Country	Project N.	Description	Local Sponsor/ Notes
ETHIOPIA	ETH/001/M/88	Production of wind pumps	Identified by Consultant and endorsed by National Team ENEC, Addis Ababa
	ETH/002/M/88	Production of 28,000 sq.mt/ year solar panels	
	ETH/003/M/88	Production of microhydraulic turbines	Identified by consultant and endorsed by National Team
SOMALIA	SOM/001/M/88	Production of various items including : . wind pumps/ generators . domestics metal stoves	Foundry and Mechanical workshop, Mogadishu

Country	Project N.	Description	Local Sponsor/ Notes
		. biomass briquetting machines . flat solar collectors . microhydro turbines	
	SOM/002/M/88	Production of kilns for charcoal	Union of Cooperatives Movement
	SOM/003/M/88	Production of various items, including: . wind pumps/ generators . solar refrigerators . photovoltaic systems	DOOGGA Co., Mogadishu
	SOM/004/M/88	Production of stoves, high efficiency	EL-BUR Cooperatives, Elbur
SUDAN	SUD/001/M/88	Briquetting plant for biomasses at Gadjed El Thawra	Nile Armor Co. Khartoum
	SUD/001 bis/ M/88	Gasifiers manufacturing	National Energy Administration

Country	Project N.	Description	Local Sponsor/ Notes
	SUD/002/M/88	Production of wind mills at Khartoum north	Esmag International Khartoum
	SUD/002 bis/ .1/88	Production of wind mills at K.N. Alkadaro	National Energy Administration
	SUD/003/M/88	Production of biogas generators (2 units/ day, 30 cu.mt each)	Identified by National Team Sponsor not available yet
	SUD/004/M/88	Production of flat solar collectors at Khartoum north	HAMFI TRADING Co., Khartoum
	SUD/005/M/88	Production of solar cookers, 30,000 pcs/year	HAMFI TRADING Khartoum
	SUD/006/M/88	Lube oil regeneration at Gadeed El Tawra	General Petroleum Corporat.
	SUD/007/M/88	Ethanol from molasses project (partially using existing brewery and distillery factory at Khartoum North)	Blue Nile Brewery Factory

Country	Project N.	Description	Local Sponsor/ Notes
	SUD/008/M/88	Photovoltaic panels assembling, 12 KW/ month in Khartoum Industrial area	IBN HAYAN LTD. SOLAR DIVISION, Khartoum
	SUD/009/M/88	Deep cycle batteries to be used conjunction with photovoltaic systems	Local batteries Company, Khartoum
THAILAND	THA/001/M/88	Production of wind electric generators	USA Econ. Dev. Co., Bangkok
	THA 002/M/88	Solar energy operated air conditioning systems	LANNA RUAMCHANG Chiengmai
	THA 003/M/88	Production of microhydro turbines and biogas generators	Chiengmai Ind. and mining factory, Chiengmai

Country	Project N.	Description	Local Sponsor/ Notes
	THA/004/M/88	Production of equipment for biomass transformation : . gasification . charcoal . briquetting	Project identified by consultant and endorsed by National Team
ZIMBABWE	ZIM/002/M/88	Production of photovoltaic cells, modules and complete systems	National Energy Research Establishment, Harare
	ZIM/003/M/88	Production of high efficiency concentration type solar panels	Ecological designs, Masvingo
	ZIM/004/M/88	Production of photovoltaic modules	APEX Co.,Harare
	ZIM/005/M/88	Production (improvement) of solar collectors	Solamatic, Harare
	ZIM/006/M/88	Production of briquetting machines for biomasses	Airflow, Harare
	ZIM/007/M/88	Wood and crop-waste gasifiers	Nei Cochrane, Harare

2.5 PREPARATION OF THE ITALIAN PHASE

The preparation of the Italian phase was carried out on the basis of the country papers, of the characteristics of the identified projects and on the information gathered during the visits paid in the developing countries.
The following steps have been done:

- drawing up of a "long list" of companies active in the subsector
  185 companies were therefore identified
- sending to all 185 companies a letter explaining the investment promotion programme
- 49 companies out of 185 contacted UNIDO showing interest in receiving additional information on the programme
- the country papers were sent to all 49 companies
- after reading the country papers 35 companies confirmed their interest
- two meetings were then organized, one in Rome and one in Milan where all interested Companies were invited.
  At that meetings the programme was explained in detail and the documentation on the identified projects was distributed.

Eventually 30 companies decided to participate to the programme and the schedule for plant visits and bilateral meetings prepared.

2.6 THE ITALIAN PHASE

The delegation of Ethiopia (2 members) (1), Somalia (3 members), Sudan (2 members) and Thailand (3 members) started the Italian phase on May 16, 1988.

There were a number of plants visits and bilateral meetings as per "schedule" attached as Annexe No 4.
Delegations left to Vienna on June 2. The Zimbabwe delegation (two members plus two entrepreneurs) plus the third member of the Sudan delegation arrived Rome on June 12 and started the Italian phase on June 13. They left on June 21.
A special "short type" schedule has especially arranged for them (their failure in participating to the Italian phase together with the other delegation was beyond this responsibility and willingness).
Details are provided in the following paragraphs.

(1) List of delegates is provided as Annexe No 3.

2.6.1 Visits to plants

The following plants were visited by all delegations with the exception of the Zimbabwe one (if not otherwise stated)

SPI : large bio-gas plant and factory for the production of small steel bio-gas digesters (1) at Ponte San Giovanni (Perugia)

SES : wood (and crop residues) gasifier, pilot plant at Ronciglione (Viterbo). Zimbabwe Delegation also

ITALSOLAR : photovoltaic cells and modules factory at Nettuno (Rome)

ISEA : wind pumps and electrical generators, solar panels and diesel generators fueled with gas. Factory at Perugia. Zimbabwe Delegation also.

TESSARI : workshop for the modification of diesel engines to operate with producer gas or natural gas. Plant at Padua

(1) Even if specifically excluded by the project, the importance of bio-gas was clearly started by all national teams and therefore this topic has been taken into consideration as well.

HELIOS TECHNOLOGY : factory for the production of photovoltaic cells modules and complete systems. Plant at Galliera Veneta (Padua). Zimbabwe delegation also.

IREM : factory in the production of mycrohydroturbines at S. Antonino Susa (Torino) and visit to various sites where units are in operation, Delegation of Zimbabwe, Somalia, Ethiopia, Thailand

ENERGY PROJECT : factory for the production of solar cookers, solar driers and systems for a building heating at Cocquio Trevisago (Varese). Delegations of Sudan, Somalia, Zimbabwe

RIVA CALZONI : factory at Bologna for the production of wind pumps and wind electric generators. Delegations of Etniopia, Somalia and Sudan.

ATI : factory for the production of low cost solar water heating systems at Cesena. Delegations of Ethiopia, Somalia, Sudan.

SIDI : co-generation of electrical energy using bio-gas from urban sewages treatment. Parma.

GARIBOLDI : boilers using rice husks as fuel and rice husks gasifiers in operation at their plant in Milan.
Thailand delegation only.

IOR - PCF : solar panels factory at Mestre (Venise). Zimbabwe and Sudan delegations.

Last but not least all delegations visited the renewable energies testing station of ENEA, the Italian National Agency for Nuclear and renewable/alternative energies. This visit was of peculiar interest to most of participants due to the fact the majority of the participating countries are in need of such a testing station.

These visits, beside their obvious importance for the subsequent bilateral meetings, were also significant to get the participants acquainted with the kind of Technology in this subsector available in Italy.

All delegations expressed their appreciation for the level of technology and most of them have been deemed appropriate for transfer to the participating countries.

2.6.2 Bilateral meetings and relevant results

Nearly all Italian companies participating to the programme had at least one bilateral meeting with visiting delegations.

2.6.2.1 Bilateral meetings list

	COMPANY	PRODUCTS	DELEGATIONS MET	LETTER OF INTENT SIGNED OR PRELIMINARY COOPERATION AGREEMENT
1	SES	biomass gasification	Somalia Ethiopia Sudan Thailand Zimbabwe	 x x
2	CARBOLISI	charcoal	Thailand Zimbabwe	
3	ENERGETICA MERIDIO-NALE	microhydro turbines	Somalia Sudan Thailand Ethiopia	x x
4	EUROKELLER	solar col-lectors	Ethiopia Sudan Thailand Somalia	x
5	ISEA	wind pumps/ generators and concen-trating type solar systems	Sudan Ethiopia Somalia Zimbabwe	x x x

COMPANY	PRODUCTS	DELEGATIONS MET	LETTER OF INTENT SIGNED OR PRELIMINARY COOPERATION AGREEMENT
6 SEI	photovoltaic systems	Somalia Sudan	x x
7 RPA	biomass gasification	Thailand	
8 SRS	energy saving	Somalia	x
9 IOR PCF	solar collectors	Ethiopia Somalia Sudan Zimbabwe	
10 TESSARI	gasifiers	Ethiopia Somalia Sudan Thailand Zimbabwe	
11 HELIOS TECHNOLOGY	photovoltaic systems	Ethiopia Somalia Sudan Thailand Zimbabwe	 x x

	COMPANY	PRODUCTS	DELEGATIONS MET	LETTER OF INTENT SIGNED OR PRELIMINARY COOPERATION AGREEMENT
12	IREM	microhydro systems	Ethiopia	x
			Thailand	
			Somalia	x
			Zimbabwe	
13	TECNIMONT	ethanol plants	Sudan	
14	ENERGO PROJECT	solar cookers/ solar collectors briquetting technology	Sudan	x
			Somalia	x
			Zimbabwe	
15	RIVA CALZONI	wind pumps/ generators	Somalia	x
16	ATI	solar collectors	Sudan	
			Somalia	x
			Ethiopia	x
17	SUNLIFE	solar collectors	Somalia	x
			Ethiopia	
			Sudan	
			Thailand	
			Zimbabwe	

	COMPANY	PRODUCTS	DELEGATIONS MET	LETTER OF INTENT SIGNED OR PRELIMINARY COOPERATION AGREEMENT
18	OAGA	batteries for photovoltaic systems	Sudan	x (gentleman agreement)
19	TERMOSOLARE ITALIANA	solar technology	Sudan Thailand Ethiopia Somalia	 x
20	SOM	micro-hydraulic systems	Ethiopia Somalia Thailand	 x
21	RIELLO	solar collectors	Thailand Ethiopia Somalia	
22	GTS	solar collectors, solar energy wind pumps and generators	Somalia Thailand Ethiopia	
23	SALMINI	wind pumps and generators	Thailand Ethiopia Somalia Zimbabwe	 x to be x confirmed (gentleman agreement)

COMPANY	PRODUCTS	DELEGATIONS MET	LETTER OF INTENT SIGNED OR PRELIMINARY COOPERATION AGREEMENT
24 GARIBOLDI	rice husks gasification and combustion	Thailand	
25 CESEN	various	Somalia Thailand Ethiopia Sudan	x
26 FINEXPORT	biogas (SPI)	Sudan	x
27 CONSITO	ethanol	Sudan	x
28 SIDI	biogas	plant visit by all delegations	
29 ITALSOLAR	photovoltaic system		
30 COSTA	briquetting	Zimbabwe	

After the return of the team to Zimbabwe a number of local private companies have expressed the interest in discussing joint-ventures agreements, with:

SES : biomass gasification
COSTA : briquetting of biomasses
CARBOLISI : charcoal production

2.6.2.2 Notes on the results of the bilateral meetings

- Ethiopia had presented 3 projects and has found potential Italian partners for joint venture for all three. In addition the Ethiopian delegation signed a letter of intent with an other company in the field of biomass gasification (project previously not identified).

  In the field of wind pumps/generators two Italian companies have been selected due to the different type of product offered. The Ethiopian delegation carefully analysed the type of product offered by Italian companies and selected very appropriate technologies.

- Somalia has signed letter of intent with several Italian potential partners. The agreements cover all the projects presented with the exception of the production of kilns for charcoal (SOM/002/M/88) and the production of stoves (SOM/004/M/88). It has to be pointed out that the two major projects are in fact multipurpose and foresee the production of several equipment for which different technologies (and therefore different partners) are required.

  The fact that one member of the Somali delegation was also manager of the most important public company involved in this kind of projects increased, of course, the effectiveness of the bilateral meetings.

In addition the Somali delegation had authority to sign on behalf of the various private and public companies participating to the programme and that was additional advantage.

It has to be noted, anyway, that the Somali delegation did not make a real selection of the potential Italian partners, leaving that to a subsequent phase.

A very comprehensive and organic proposal for the development of the production of wind pumps in Somalia has been made by an Italian Company, taking also advantage from the traditional good relationship between Italy and Somalia and the consistent possibility of obtaining funds from bilateral cooperation.

- For the same reason an other letter of intent has been signed for the preparation of a master plan for the energy sector in Somalia, as well as the establishment of a renewable energy testing and training station.

  According to the Italian company sponsoring the project (belonging to the public sector) the funds are already available and therefore project could be start soon.

- Sudan presented 10 projects (plus one for the production of batteries to be used in conjunction with solar photovoltaic systems, added during the Italian phase). Potential partners (letter of

intent or gentleman agreement) have been found for all projects but 3 (gasifiers, oil regeneration plant and Ethanol from molasses; for the latter a gentleman agreement has been found with an engineering company but the feasibility of the project, i.e. the transformation of an existing brewery, seems doubtful).

The team was very active in spite of the fact that the most experienced member had not the possibility to participate (he came later together with the Zimbaowe delegation).

The team members had not the power to sign letter of intent but they have reached a number of gentleman agreements with Italian companies on the ground that information will be passed on to the local sponsor once back to Sudan and he will then exchange letters of intent with the so identified Italian potential partner.

- Thailand delegation too had not authority to reach any agreement with Italian companies. Due to the fact that most of Thai companies active in the subsector are privately owned, the delegation did only a "scouting" work, trying to identify which kind of technologies/products could be of interest to the Thai subsector. From this point of view the mission has been fruitful because a number of areas for future cooperation has been identified, particularly in the field of photovoltaic systems for water pumping and steel bio-digesters for bio-gas. The Thai delegation will disseminate the

information gathered during the Italian phase as well as the several offers of cooperation (joint ventures etc) received from Italian companies to the Thai subsector.

- Zimbabwe delegation (Ministry of Energy) included two entrepreneurs too. Industry active in the subsector is privately owned and therefore the mission of the energy ministry team was to assess the types of technology available, to identify potential partners for the 6 projects promoted as well as to gather information to be then disseminated among industries.

  This exercise was successful for all promoted projects and as soon as the team is back to Zimbabwe the local promoters will contact selected Italian industries to study cooperation terms.

  In addition the Zimbabwe delegation was extremely interested by some models of wind pumps/generators and microhydroturbines and is considering the possibility of asking Zimbabwean industries to investigate in possible local production.

  Last but not least the two entrepreneurs had several contacts with Italian manufactures of production equipment and a number of formal quotations have been requested that will probably turn out into purchase orders. All these equipment are needed for the production/testing of energy related machinery.

2.7 THE VIENNA PHASE

The national teams from the participating developing countries attended the Vienna phase of the programme which was devoted to activities for following-up the results of the previous phases of the programme and specifically to:

- discuss with concerned UNIDO substantive branches problems faced by the participating industrialists in each developing country and ways and means of solving these problems including the preliminary formulation of technical assistance projects and programme lending needs identified;

- provide follow-up assistance to projects sponsors in promoting their projects through UNIDO/IID network or Investment Promotion Services and the Industrial Promotion Information system (INPRIS), and assist in contacts with financing institutions to secure required financing for specific projects as well as for "programme lending" needs;

- evaluate the Vienna phase of the programme as well as the entire programme.

3. PROPOSED FOLLOW-UP AND ITS FINANCING

3.1 FOLLOW-UP

The Italian phase has given the possibility to Italian industry and national teams to carry out a comparative analysis of needs and products/services that can be offered and the decision to go ahead with the majority of projects has been taken. It has to be noticed that only in few cases direct contacts between promoters/industrialists were possible and therefore the following follow-up steps are deemed necessary:

- visit of Italian industrialists to some of the participating developing countries where subsector industries are mainly privately owned in order to :

  . get acquainted with the country, its industry, infrastructures, procedures, financial climate, market etc.
  . identity area of cooperation with local agencies/institutions operating in the field of renewable energies.
  . provide technical information on the products/technologies offered to a large number of potential local sponsors (already identified by national teams)
  . contact local sponsors/potential partners and start negotiations with them.
  . agree upon the terms of reference for the pre-investment studies to be carried out and on the type of cooperation envisaged.

- preparation of the pre-investment studies. These could be carried out in cooperation by the two parties, with the assistance, just in case, of a specialized consulting company.

  The study must be carried out for all projects being the information provided by promoters in the participating developing countries not enough to fully evaluate their techno-economic feasibility.

- implementation stage

- subsector strenghtening; it could be obtained by:

  . establishing/strenghtening of renewable energies research or testing centers in all participating developing countries (Somalia and Zimbabwe have already presented relevant documentation to the Italian bilateral cooperation)
  . organizing training programmes for scientists/engineers in the design and application of renewable energies equipment
  . study-tours.

3.2 FINANCING

Financing and co-financing is needed for most of the projects and this is due, in part, to the small size of many companies operating in this subsector. In spite of their size, anyway, most of them expressed their interest in joint-ventures but, again the majority, would like to have some financial back-up,

at least until a final decision is taken. The problem of financing/co-financing can therefore be analysed separately as follows:

- visits to participating developing countries : many companies are ready to visit the countries on their own expenses. An effective way to coordinate their activities and reduce the costs would be, anyway, the organization of collective visits.

- pre-investment studies: in case the typical co-financing scheme of CDI/ICE is adopted, the source of financing for the pre-investment studies would be as follows: (assuming 20% the local cost).

20%	promoter in developing countries
40%	UNIDO and/or Italian bilateral cooperation and/or ICE and/or ICE/CDI
40%	Italian promoter

- project implementation : need for financing varies from project to project and from country to country. Generally speaking all promoters in the participating developing countries will provide local currency financing (equity, funds from development banks etc) while foreign component can be tentatively originated, as shown in the following table:

Country / item	Ethiopia	Somalia	Sudan	Thailand	Zimbabwe
- equity, foreign part	▭	▭	—	—	▭
- know how/engineering	●	●	▭	△	▭/●
- equipment/machinery	▭	▭	△/▭	△	△/▭
- components/ parts	○	○	○	△	○
- training/technical assistance	●	●	●	●	●

△ : commercial loans; ▭ : soft loan (Italian bilateral co.); ● : grant; ○ : commodity aid.

In addition other source of funds could be the World Bank and the Regional Development Banks.

4. CONSIDERATIONS ON THE PROGRAMME

The comments of all national teams were largely positive on the results of the programme.
Anyway, a number of defects/constraints have been identified and could be taken into consideration to improve next industrial investment promotion programmes. Some few of these points are listed here below:

- the questionnaire for project description that was prepared for this programme was too complicated and could have been filled only if a feasibility study would have been available; and that was not the case; therefore the standard UNIDO questionnaire has been used for most of the projects.
- the time allowed to the consultant to pay the visit to the participating country, one week, may be not enough, taking into consideration that in some cases identification of projects must be discussed in detail with national team;
- the system of information dissemination in countries where the private sector is predominant should be improved and the national team should also include a representative of local industrial association/federation.
  The dissemination of information should be done in two different phases, namely:

  . during the identification of the projects and of local promoters
  . after the visit to the industrialized countries, in order to disseminate the information gathered.

Dissemination during the first phase could be done by UNIDO by organizing a number of workshops in which the programme is comprehensively introduced. Industrialists, Finance Institutions and National agencies should attend.

As far as the second phase is concerned, ICE, an Italian Trade Institute, could assist in organizing travel, contacts for Italian entrepreneurs, a number of "round-tables" and/or lectures to better disseminate the information on the proposed technologies, identify other interested partners etc. Also the air and hotels fares would be more convenient.

- preparation of pre-investment studies: co-financing is generally required, in the sense that Italian companies are of course not expecting a profit out of this phase but they would like to have reimbursed at least major expenses (travel, external consultant if needed etc).

  Major sources for financing/co-financing could be :

  . UNIDO
  . the center for industrial development CDI, an agency of European Communities that has a special agreement with ICE for pre-investment studies co-financing
  . Italian bilateral cooperation through the DGCS of the Ministry of foreign affairs
- the presence of some promoters from participating developing countries during the visit to the

sponsor industrialized country would be very effective and is highly recommended

- future programmes should also include the provisions to organize visits of interested industries to participating developing countries by offering co-financing of transportation expenses. These trips could be organized immediately after the end of the "Vienna Phase" and would permit to go ahead in exploring cooperation possibilities within short period.

baldo & C. s.r.l.
CONSULTING ENGINEERS

ANNEXE 1

EQUIPMENT AND MACHINERY

TAKEN INTO CONSIDERATION

FOR THE UTILIZATION OR

PRODUCTION OF NEW OR RENEWABLE

ENERGY FROM SOLAR, BIOMASS

(EXCLUDING BIOGAS) AND MICRO-HYDRO

SOURCES

A N N E X E 1

EQUIPMENT AND MACHINERY TAKEN INTO CONSIDERATION

The list of the suggested equipment and machinery deemed appropriate for production by industry in developing countries includes:

. flat plate solar collectors
. solar dryers
. solar cookers
. photovoltaic systems
. hydraulic turbines
. wind motors
. equipment for biomass conversion

1. FLAT PLATE SOLAR COLLECTORS

Water heating by flat plate collectors is the solar technology most ready - technically, economically and commercially - for wide spread applications, even if its diffusion in many cases is made difficult by the high fixed investment cost.

Final water temperatures can be in the range of 45 to 80-100°C. Efficiency is as high as 0.5-0.6; this means that the available energy in tropical regions can be as high 2700 to 3500 Kcal/d.m² for at least 250 d/y.

The flat plate solar collectors find utilization in the following fields:

- domestic uses
- agro industry and food processing
- textile industry
- social and sanitary facilities

2. SOLAR DRYERS

The solar dryers utilize the same energy source as the traditional technique, that normally consists in exposing the products to be dried directly to the solar radiation.

New solar dryers offer the following advantages in comparison with the traditional technique:

- decrease of the losses due to the contamination of the product (bacteria, mildews, insects);
- improvement of the hygienic characteristics of the dried product.

In any case, the solar dryers are only suitable for treating a limited amount of products due to the very high energy demand; their typical application is in family owned farms in rural areas.

3. SOLAR COOKERS

Under their name all those cooking systems that utilize solar radiation as an energy source are classified.

The main types of solar cookers are three: the box type, the sun basket type and the solar steam cooker.

Box type cooker: it consists of a well insulated box with a narrow window, through which the solar radiation can enter inside, where the kettle is placed.
The heat losses outsice this box are very low; so the internal temperature increases steadily. The efficiency of these systems is very high, more than 50%; the amount of food to be cooked can be up to 4 Kg and the length of time required is in the range of 3 to 4 hours. The cost of this type of cooker is very low, so its use is convenient even where the cost of firewood is low.

Sun basket ype cooker: the operating principle of this type of cooker is the same as that of the concentrating solar collectors; so in this cooking system the kettle is located in the focus of a parabolic mirror. This system utilizes only direct radiation; as a consequence, only in these regions having more than 250 days/y without fog or clouds this system can be conveniently used; furthermore, since the cost of this system is rather high, it can be convenient only where the cost of fuel (firewood included) is high.

Solar steam cooker: this system is made-up of two parts: a certain number of concentrating solar collectors and a kettle with a double wall. An element of a heater exchanger through which water flows and is heated is put in the collector's focus; after the last collector the water is converted to steam and, as such, it condenses in the cavity of the kettle, thus transferring heat to the food inside; then the condensate is pumped again to an through the collectors. The advantage of this system, compared top the other two, consists in the possibility of cooking inside the house; but it is rather costly and then very seldom economically justified, except when it is also possible to use the steam for industrial uses.

The main application of all these systems is the cooking of food in rural areas especially where they can substitute firewood with a consequent contribution to deforestation problems solutions.

The steam systems can also be used for sterilizing surgical instruments and bed-linen in nospitals in rural regions.

4. PHOTOVOLTAIC SYSTEM

Photovoltaic solar cells convert sunlight into electricity. They contain no moving parts, produce no noise and pollution, and require little maintenance.

A typical assembly of solar cells produces about 10 watts of electricity per square foot of area on a sunny day, at noon.
Actual mass produced solar cells have a conversion efficiency of 10 to 13% in sunlight.

The basic element for the photovoltaic generation is the Silicon cell. This cell, after proper treatment, is assembled in such a way to compose the photovoltaic module.

The module is therefore the core of the photovoltaic electricity generating system that requires two other components: the control panel and the storage battery.

Many applications of photovoltaic systems are:

- lighting (in conjunction with low power lamps)
- water pumping
- feeding radios, refrigerators (better if modified to need low power) etc
- installations in remote areas; meteorological stations, signal systems for railways or airports, telecommunications, systems etc.

The passive use of photovoltaic systems has been hampered by the high cost of the cells but, as a matter of fact, this cost is continuously decreasing and the systems are now competitive in several cases when other sources of energy are not available.

5. HYDRAULIC TURBINES

Hydropower is generally considered a major option for energy production in developing countries.
The results of the studies worked out by the World Energy Conference in 1974 show the hydropower developed so far was around 17% of the potential considered reasonably developable; the largest part of this power potential is reported to be located in Africa, Asia and South America.

However there are limitations, both technical and economic for further development. In most cases, also, it becomes necessary to coordinate hydropower development with the development of the water resources for other purposes such as irrigation, water supply for domestic and industrial use, flood control and navigation.

In any case, hydropower technology is well established and proven; sources are easier to identify than for other types of energy; the life cycle (typically 30 or 40 years) is longer than, e.g., for a diesel plant (10 or 15 years).

So, the opportunity to emphasize the importance of improvement in the development of the exploitation of such energy, which is perfectly renewable, non polluting and a real means to achieve a much broader goal, which is the integrated rural development, is obvious.

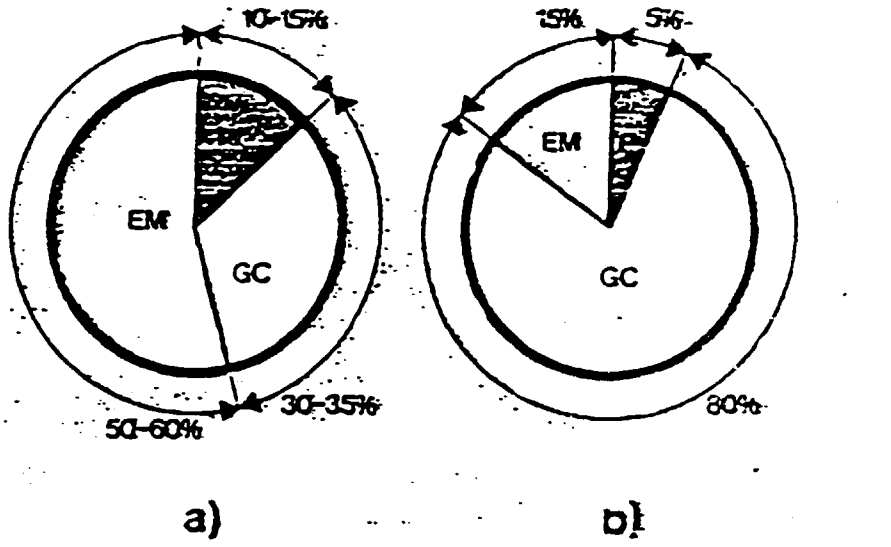


Fig. 1 Investment cost comparison between a mini hydropower plant and a large plant

Source: Hydroart

Projects can be large scale for big energy and related industrial development, or small scale for rural and decentralized industrial applications; small units offer ample opportunity for local construction and management and according to the history of electrification in many industrialized countries, small machines seem to be the most interesting ones for the development of industrial regions in a developing country even if their utilization is geographically limited to suitable sites, along rivers and other sources of flowing water: in fact their installation can be less expensive than an electric network, due to the low density power demand in rural regions; construction technology can be simple; construction material can be easily selected among the more common ones; installation does not require complex studies and difficult work and repairs are easy and not costly. (ref. fig. 7).

Anyway, power outputs can be available from less than one kilowatt to many megawatts.

Efficiency: very high for large turbines, quite lower but acceptable for the smallest types, the objective being to achieve the most effective rather than the most efficient generating plant.

The annual load factor is largely dependent on the variations of the river flow-rates; but with small machines, very often exploiting only a part of the available flow rate, it can be high enough.
Average cost of produced power: 5 to 10 US c/kwh.

6. WINDMOTORS (WECS)

Apart from firewood combustion, wind is the oldest renewable source used in the world especially for water pumping and wheat milling.

Tropical areas in general have comparatively low average wind velocity, while some tropical areas suffer periodic extremely high wind velocities. (Fig. 2)
Temperate areas in general have reasonable average wind velocities and certain locations are very suitable for the production of energy.

A WECS (Wind energy conversion system) can be of many different designs and sizes (Fig. 3).
Some types are particularly fitted for winds of low average speed (about 6 m/s) and are normally used to drive pumps directly coupled to the wind motors; WECS of this type are normally called wind pumps.

Other types are suitable only for winds of high speed (9 up to 12 m/s) and are normally used for electricity production; WECS of this type are thus normally called wind generators.
Therefore the selection of a WECS (mechanical driving or electricity wind speed is largely dependent on the local electricity production). Wind generators can operate interconnected with an existing electric network or can stand alone with or without energy storage; it can run coupled to a diesel generator or a hydroelectric power plant to save conventional fuels or water; it can operate night and day.

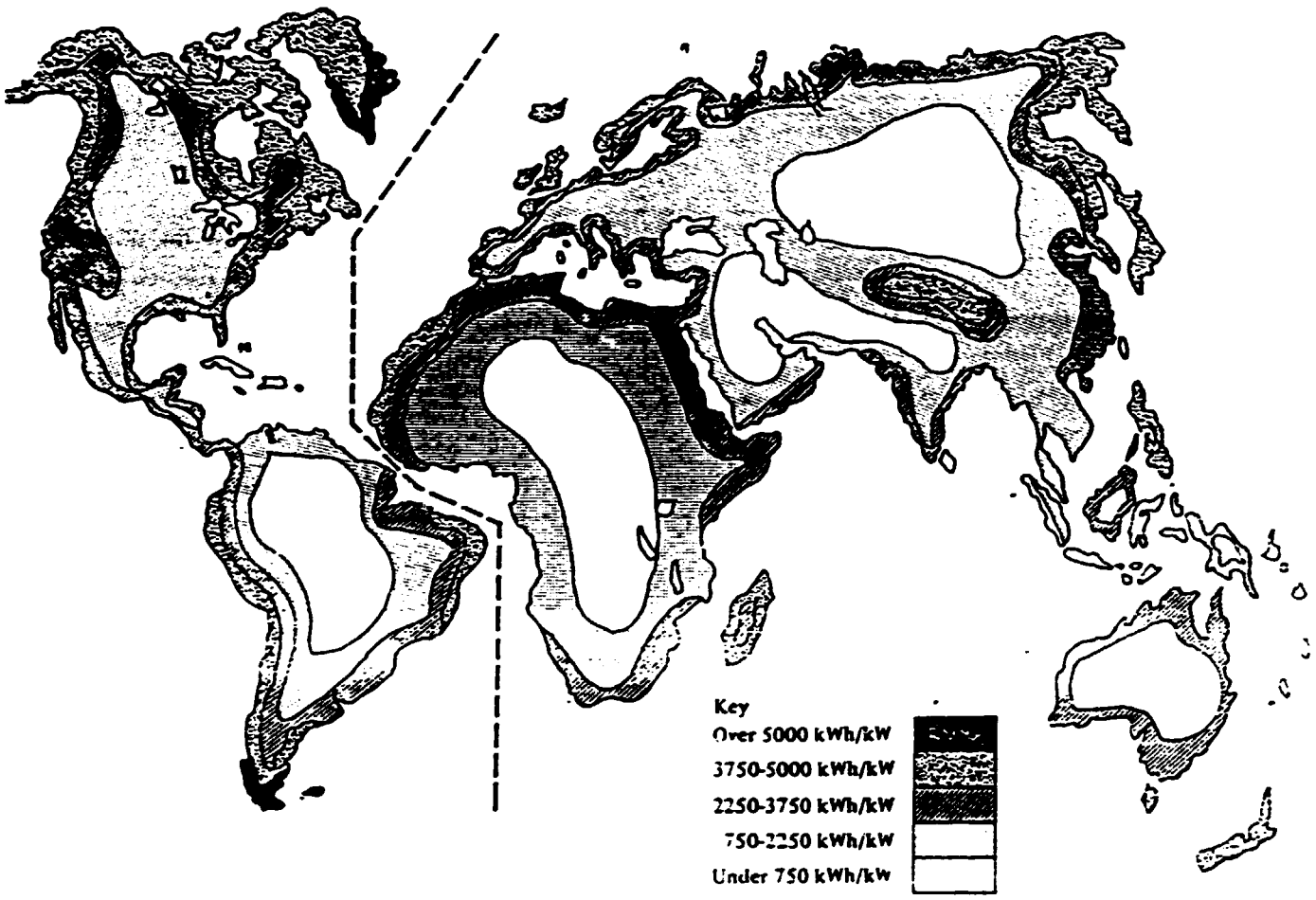
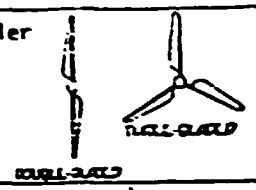
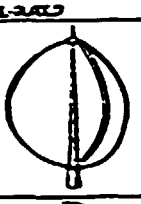
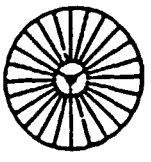
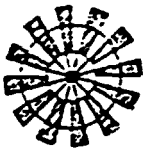
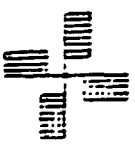


Fig.2 Availability of wind energy (annual specific output of windmills rated at 25 mph). *(Courtesy of WMO/DOE.)* (REF. 10)

Fig. 3 Operating characteristics of major rotor types (REF. 10)

Rotor Type	Tip/Speed Ratio Range	C_p*	RPM	Torque	Typical Load
Propeller (lift) 	6 to 10 (up to 20)	0.42	High	Low	Electrical Generator
Darrieus (lift) 	5 to 6	0.40	High	Low	Electrical Generator
Cyclogiro (lift) 	3 to 4	0.45	Moder-ate	Moder-ate	Electrical Generator or Pump
Chalk Multi-Blade (lift) 	3 to 4	0.35	Moder-ate	Moder-ate	Electrical Generator or Pump
Sailwing (lift) 	4	0.35	Moder-ate	Moder-ate	Electrical Generator or Pump
Fan-Type (drag) 	1	0.30	Low	High	Pump
Savonius (drag) 	1	0.15	Low	High	Pump
Dutch-Type (drag) 	2 to 3	0.17	Low	High	Pump or Mill Stone

* C_p power coefficient

The load factor will vary between 20 and 40 percent for normal machines.
In the small scale range an overall efficiency, from wind to final output, in the 30-40 percent range can be achieved.

7. BIOMASSES CONVERSION

Wood and biomasses are perfectly renewable energy, available in large amounts (tropical forests are reported to cover an area equal to 15% of the total world surface); wood is largely used as firewood especially for domestic cooking and heating; but the quantity used in any country appears to vary significantly over a period as a function of governments directives, want of preserving forests, environmental considerations and the cost and storing/distribution problems of conventional fuels in rural areas; even if reliable statistics are not available, there is no doubt about its usefulness as an energy source but there are doubts about the efficiency of its exploitation.

In addition to wood, there are large amounts of wastes or by-products (originating from wood working, agricultural and, sometimes, domestic garbage) which are an important reserve of energy and whose utilization as fuel is a "whole profit", being something of no other value and often a source of possible pollution.

Typical examples of such by-products are listed below:

- rice husk, coffee shell, grass cutting, saw dust,

bagasse, cotton waste;
- peanut shell, walnut shell, cabbage-palm shell, babassu shell, fruit pits, exhausted barks from tanning extraction;
- chipped wood, shell and floss coconut, trimmings, peat

Wood and such wastes can be efficiently utilized in three main ways depending on the specific requirement of energy users, that is:

. direct combustion
. gasification
. carbonization

The average value of the heat output (LHV) from the direct combustion of 1 Kg of such fuels, with 10% moisture and 5% ash, can be estimated at about 3900 Kcal. This calorific value is largely depencent on moisture content which can reach 60%; so, whenever possible, it is convenient to dry the waste before incineration.

Direct combustion is mainly suitable for materials of very small size as those listed above in the first group. Hot products of combustion can be used as drying means or for production of hot water or steam, for technological use as well as for the power production.
If electricity is the only required production, gasification is probably the most suitable method, especially for small or medium power demands: the produced gas, after washing, is fed directly to a diesel generator; the wood consumption can be estimated in the range of 1.2 to 1.3 kg/kwh.

With the carbonization process, from 1 kg of fuel, in a vertical retort, the following products can be obtained (1)

- charcoal (LHV = 7300 kcal/kg)	0.150 to 0.400 kg/kg
- tar	0.050 to 0.150 kg/kg
- pyroligneous acid	0.200 to 0.400 kg/kg
- fuel gas (LHV = 2500 kcal/kg)	0.140 to 0.350 kg/kg

The carbonization system can be a solution for producing at the same time charcoal, gas and tar.

Charcoal has applications in the metallurgical process or as an easily handled fuel for many domestic uses; gas can be burnt and pyroligneous acid and tar processed for separating very useful chemicals: solvents, acetic acid, turpentine, creosote and lobe oils.

Charcoal itself can be further treated to obtain activated carbon, a well known auxiliary for the food or chemical industry.

(1) not taking into account the fuel required for the carbonization process.

baldo & C. s.r.l.
CONSULTING ENGINEERS

ANNEXE 2

COUNTRY VISITS REPORTS

INDENTIFICATION AND PRODUCTION OF INDUSTRIAL INVESTMENT PROJECTS FOR THE LOCAL PRODUCTION IN DEVELOPING COUNTRIES OF MACHINERY AND EQUIPMENT FOR THE UTILIZATION OR PRODUCTION OF NEW OR RENEWABGLE ENERGY FROM SOLAR, BIOMASS (EXCLUDING BIOGAS) AND MICROHYDRORESOURCES

UNIDO PROJECT US/GLO/81/109
REPORT ON THE CONSULTANT'S MISSION TO ETHIOPIA

0. FORWARD

The Consultant arrived in Addis Ababa on November 27, 1987 and started the work with the Ethiopian National Team on the same day. During the stay the Consultant and the National Team had the opportunity to review the state of the development of research and production in the subsector by visiting a number of institutions and industries that may be involved in the development of the sector, including:

- Agricultural & Industrial Development Bank
- Maru Tefera General Metal Works
- Tana Private Limited Company
- General Metal crafts and foundry works
- Research Center of the Ethiopian Water Works Construction Authority.

As a conclusion of this stage of the work, the National Team, instead of organizing a "workshop", due to some practical difficulties, will pay a visit to all the manufacturers with potential capacities in the sector in order:

- to discuss with them the final issue of the Country Report;
- to prepare projects ideas, with the help of the industrial profiles annexed to the "Baldo Report", to be presented at the Italian phase of the project;

1. PRIORITIES

The following priorities have been identified by the National Team:

- solar energy
- wind energy
- hydraulic energy

2. BACKGROUND INFORMATION

2.1 PRESENT PRODUCTION UNIT MARKET

Equipment for the utilization of renewable energies are not yet manufactured in the Country; anyway the capacity and the machinery of many of the existing workshop are perfectly fitted for a profitable activity in this field, pointed that they acquire the proper technology.

2.2 SOLAR ENERGY

Many utilization in this sector have been already identified and quantified: water heating for technological uses as well as for social institutions (schools, hospitals, hotels etc.) and domestic uses can absorb the production of about 100 m^2/d of solar collectors.
Even in the field of solar dryers the possibilities of utilization seem very promising.

2.3 WIND ENERGY

Wind speed, even low, is enough for low - medium size pumping systems which are needed in a pressing way in the rural areas.

The research centre created for this purpose by the water works Construction Authority has already designed, constructed and installed, in addition to 60 hand pumps for shallow wells and ' for deep wells, 8 wind units which are working satisfactorily.

2.4 HYDRAULIC ENERGY

A study relevant to the possible locations of micro-turbines is in preparation by the Eth. National Energy Country. The need of turbines especially of the Mitchel-Banki type for driving floor mills is considered very high. An estimation of the possible market will be tentatively carried out.

3. OTHER ACTIVITIES

The draft of the Country Paper has been discussed in details; the final issue, after the comments by the manufacturers, will be likely issued within the end of December, 1987.

INDENTIFICATION AND PRODUCTION OF INDUSTRIAL INVESTMENT PROJECTS FOR THE LOCAL PRODUCTION IN DEVELOPING COUNTRIES OF MACHINERY AND EQUIPMENT FOR THE UTILIZATION OR PRODUCTION OF NEW OR RENEWABGLE ENERGY FROM SOLAR, BIOMASS (EXCLUDING BIOGAS) AND MICROHYDRORESOURCES

UNIDO PROJECT US/GLO/81/109
REPORT ON THE CONSULTANT'S MISSION TO SOMALIA

The consultant arrived Mogadishu on November 15, 1987 and left on November 23.
We had the opportunity to work the whole week with the National Team, meet Governmental Officiers, visit plants and to attend to a mini-workshop.

1. PERSONS MET

1.1 NATIONAL TEAM

- Mohamed Ali Dahir, Director of the National Foundry and Chairman of the Technical Committee for Energy.
- Musa Ahmed Musa, Director of Planning, Ministry of Industry.
- Said Firdhis, economist, Dharoor Consultants Co.

1.2 GOVERNMENT OFFICIERS

- H.E. Mohamed Sheik Osman, Minister of Finance
- H.E. Hussein Abdulla Alasow, Minister of Industry
- Mohamed Nour Alyn, Vice Minister of Industry
- Osman Jama Ali, Chairman of the National Political Committee for Energy.
- Abbas Yassim, Directo General of Budget
- Ali Hassan, Director General of Cooperation, Ministry of Foreign Affairs.
- Dr. Omar Elsi, Permanent Secretary, Ministry of Industry.
- Hussein El Abe, Permanent Secretary, Ministry of Planning.
- Said Hamed Youssef, Director General, Somali Development Bank.

1.3 U.N. SYSTEM

- M. Ristic, UNDP Res. Rep.
- B. Locke, UNDP Deputy Res. Rep.
- Dick Van Duijin, UNIDO consultant to the NFMW

1.4 OTHER ORGANIZATIONS

- Mohamed Ibrahim Egal, President of the Chamber of Commerce.
- Dagga Co. General Manager
- A. Incarnato, Italian Embassy

2. COUNTRY PAPER

The Country Paper has been reviewed with the National Team and a number of changes, mainly in the number, structure and type of projects to be presented has been agreed upon.
In particular the following comments have been done by the consultant and fully endorsed by National Team.

2.1 Add paragraph with data on wind speed in the different areas of the Country, solar radiation etc. Information on previously installed equipment (wind, solar etc) and their performances would also be of benefit for a comprehensive understanding of the present situation.

2.2 Add paragraph with statements on the kind of applications for which renewable energies equipment are needed and selected and identified priorities: i.e. cooking, water pumping, electricity generation, refrigeration, crop drying etc.

2.3 The present situation suggests that a "Renewable Energy Research Station" be created with the help of Governmental Agencies (National Foundry and Metal Workshop, etc.) and University.
Goal of this center or station is to study the application of renewable energies equipment in the Country, to select most appropriate technologies, to identify most appropriate equipment taking into consideration prevailing local conditions, to construct prototypes and test them in both laboratory and actual operating conditions. In few terms this station should became the focus for the development of this subsector in the Country and provide technical assistance to both private and public sector in the start up of production of the equipment identified as useful for the Country.
Other inputs, like specific training, are needed.

2.4 The Industrial Project

The Industrial Projects identified in the draft of the "Country Paper" have been taken into consideration. In many cases the market is not existing or is too low to justify a local production.
A long work to optimize the products characteristics and to introduce them in the market is needed as well as the problem of "buyers financing" should be taken into consideration (in many cases product cost will be too high to be afforded by potential buyers).

In any case production of different products as indicated in the draft country paper should be concentrated in existing or newly created workshops in order to decrease

initial capital investment and reduce the fixed portion of the production cost that, in some cases, would be too high.

An order of priority that could be suggested is the following:

A. Production of wind mill and relevant pumps

The past experience has proven that this kind of wind mills are well accepted and that their application presents no major difficulties being the wind speed quite enough in most of the country.

A market survey should be carried out but it seems that the number of units to be produced per year can be greater than the 100 pcs. indicated in the C.P.. The National Foundry and Workshop has already built prototypes and has enough room and equipment to start production once that suitable know how and few additional equipment and other inputs are provided (training etc.).
Other private sector workshops could also be involved in the production.
The production of generators can also be considered at a later stage, when the characteristics of the "eolic system" has been optimized and the areas where they can be installed have been identified so that a market penetration programme can be finalized.

B. Equipment for bio-masses conversion

This project can be implemented by the National Foundry and Workshop or by the Union of Cooperatives or by both, with or without the cooperation of the private sector and could mainly include the design and production of:

- Bio-waste briqueting machines
- Briqueting machines for charcoal dust
- Metal kilns for charcoal production
- Gas producers (biomasses gasification)
- Boilers for direct combustion of biomasses

The first three items are of great importance and their introduction would represent an important step in energy saving in the Country.
The production of gas producers and boilers for direct combustion could become interesting in a second stage, after practical testing and in conjuction, when possible, with reforestation programmes. The use of crop-waste to be used as fuel in boilers should be studied and planned carefully in locations where these wastes are available (bagassa, coffee shells, grain husks, corn cobs etc).

C. Solar energy and related applications

Within this subsector the following equipment can be considered:

- flat type solar collectors for water heating
- solar dryers (with flat type solar collectors) for crop drying;
- photovoltaic systems for electricity production
- refrigerators and low power lights to be used in conjunction with photovoltaic systems.

Considering the prevailing climatic conditions in Somalia the application of solar energy should not present difficulties but a major constraint has to be taken into consideration: the cost. The above mentioned items, and particularly the photovoltaic systems are very expensive and cannot be afforded but the large farms, governmental schemes etc, reducing therefore the amount that can be actually produced. On the other hand all the components, parts and raw materials should be imported. An accurate market investigation should therefore be carried out, perhaps in cooperation with potential foreign partners to assess the feasibility of the project.

D. Stoves

The project seems interesting and can be implemented by both the NFMW and Elbur Cooperatives being different types (casted or metal fabricated).
Both sponsors are already producing these stoves and therefore the requirements for improvements in both quality and quantity should be identified in terms of equipment, raw materials, know how, training etc.

E. Other projects

Both the projects related to the production of charts and LPG bottles could be presented even if not exactly in line with the present programme.

2.5 Projects financing and "market financing"

A paragraph could be added to the C.P. on possibilities of financing the projects (industrial) and the buyers.
If possible, identification of main governmental guidelines and measures needed for the development of the subsector could be provided (for instance soft loans for farmers and communities buying renewable energies equipment (wind mills, charcoal production kilns, solar dryers etc.). The C.P. will be modified and submitted on December 15.

3. WORKSHOP

A formal workshop will be held in December for the official clearance of the emended version of the Country Paper. On the same time an informal meeting has been held with the presence of H.E. the Ministry of Industry, his Deputy and the Chairman of the Political Committee for Energy. Member of various Ministries as well of the private sectors were also attending together with UNDP Resident Representative and his Deputy. Both the Ministry of Industry and the Chairman of the Committee for Energy addressed the attenders, while the Deputy Minister of Industry has presented the draft of C.P. within the guidelines of the Government policy for energy and the Consultant has introduced the UNIDO programme.
The Consultant has also been required to present a conference on the Somali Radio.
The text is attached and has been already translated in Somali. Broadcasting was planned for Nov. 23.

baldo & C. s.r.l.
CONSULTING ENGINEERS

INOENTIFICATION AND PRODUCTION OF INDUSTRIAL INVESTMENT PROJECTS FOR THE LOCAL PRODUCTION IN DEVELOPING COUNTRIES OF MACHINERY AND EQUIPMENT FOR THE UTILIZATION OR PRODUCTION OF NEW OR RENEWABLE ENERGY FROM SOLAR, BIOMASS (EXCLUDING BIOGAS) AND MICROHYDRORESOURCES

UNIDO PROJECT US/GLO/81/109
REPORT ON THE CONSULTANT'S MISSION TO SUDAN

0. FORWARD

The consultant arrived in Khartoum on October 19, 1987 and started the work with the Sudanese National Team on October 20. During the stay (until October 27), the Consultant and the National Team had the opportunity to review the state of the development of research and production in the sub-sector by visiting a number of institutions and industries active in the sector, including:

- Energy Research Council and their branch RERI (Renewable Energies Research Institute).
- Renewable Energies Research Center at SOBA
- Sahana Drilling Co.
- Sudan Development Corporation
- Blue Nile Brevery (to be rehabilitated and transformed for molassas distillation for Ethanol production)
- Sudan Industries Association

With the cooperation of this last institution and of UNIDO an informal "workshop" has been organized to which the persons listed in Annex A attended.

1. PRIORITIES

The following priorities have been identified by the National Team and the conclusions have been shared during the informal workshop:

- Wind energy
- Biogas digesters
- Solar energy for non water pumping applications
- Biomass transformation (cotton stalk carbonization and bricketing)

2. BACKGROUND INFORMATION

2.1 Wind Energy

Wind speed is enough for low/medium size water pumping systems in 60% of the Country and suitable for electric power generation also in, at least, 30% of the Country's surface.

Studies carried out by RERI show that the cost of each cubic meter of water pumped is very much lower when wind pump is used instead diesel engines (in addition to the difficulties in keeping normal the supply of diesel oil in various remote areas).
Emphasis has been therefore given to the use of this source of energy. A prototype has been built by a local engineering company with the help of a Dutch technical assistance programme and it has been installed in a farm where has been satisfactorily in operation of the last 9 months.

The beginning of the production of a first batch of 40 units (out of 60 bookings) has been hampered by the lack of foreign currency to buy some raw materials.
Other companies are interested in producing wind pumps and studies are underway. The cooperation between RERI and the industry in this field has been excellent.

2.2 Biogas digesters

A number of comparative tests have been carried out by RERI and the most promising models are the Chinese and the Indian types. Further investigations are needed then the systems should be introduced in large number.

2.3 Solar energy

Photovoltaic systems as well as solar collectors are under test at Soba research center. P.V. systems are considered too expensive, for the time being, for water pumping application while the interest is concentrated on:

- low power lighting
- communication system
- refrigeration (drugs stores etc)

In addition solar cookers are considered of topic importance (67% of the total energy is consumed in housing, 90% of that value is needed for cooking) and

several models have been already manufactured and tested.

2.4 Biomasses

Domestic fuel use of wood and charcoal amounts to almost 75% of the total annual Sudanese energy consumption and that causes an heavy deforestation.
The charcoal production techniques are considered already quite advanced and therefore no substantial savings can be obtained by increasing conversion efficiency, therefore alternative fuels (agriculture residues) and energy saving stoves must be introduced. One source of alternative biomasse for charcoal conversion has been identified in the cotton stalks, one million tons of which are available every year.

Comprehensive studies and experimental work carried out by RERI in cooperation with UNIDO have shown that the production of good quality of charcoal is technically and commercially possible. It is anticipated that the kilns, mills, bricketing machines etc. can be manufactured in Sudan once that suitable design is provided.
Studies are also underway in the field of biomasses gasification.

2.4 Other renewable energies applications

- Microhydro systems are considered very promising but adequate studies are not yet completed.

- Crop driers using solar energy are under testing but, so far, results are not encouraging, also because of poor design.

- Ethanol production from molasses: a project proposal will be presented by SOC.

3. THE WORKSHOP

Even if not called officially as "national workshop" but only as informal meeting in preparation of the workshop that will be organized for the approval of the Country Paper, the attendance has been very qualified and a number of ideas have been originated.

Main points discussed have been:

- goals and schedule of the promotion programme
- presentation of main topics of the Country Paper

- Identification of priorities for Sudan
- State of the Art in Sudan
- Cooperation among Research Institutions, Industries and financial institutions
- Constraints to development of the subsector (lack of financing for components/raw materials import for producer and lack of long terms loans for buyers etc.)
- Conditions that should be guaranteed in order to help the subsector development.
- Identification of projects

As result a proposal has been formulated (see Annexe A)

4. OTHER ACTIVITIES

The draft of the Country Paper was not yet ready but the consultant had the opportunity to read several parts of it (handwritten) and to make comments on the preparation of final report (new data etc.) and of the project questionnaires.
It has been requested that the final report be submitted within the end of November 1987.

ANNEXE A

NAME	COMPANY/INSTITUTION
O. ABU KASHAWA	Businessmen & Employers Federation
SIDDIS A. OMER	Energy Research Council
ABDELMONEIM EZOBEID	Energy Research Council
AHMED MOHD. HAMID	The Ministry of Industry
KAMAL ELKIN FADL BAKHA	Industrial Bank of Sudan
YOUSIF ZAHI SID AHMED	Sudanese Ind. Ass.
MUSTAFA A. OSMAN	Sudanese Ind. Ass.
IBRAHIM MOHAD IBRAHIM	Sudan Rural Development Co.
EL TAYEB IDRIS SISU	Energy Research Council
AHMED ABASAUD	Energy Research Council
F.M. DEBUL	UNIDO Khartoum
HASSAN WARDI	Energy Research Council
ERIK DOOYEWEERD	UNIDO
ROBERTO BENVENUTI	Baldo & Co. Milan, Italy
ELMUBARAK ALI	Sudan Development Co.
AWAD HIGAZI	Sud. Devt. Corp.
MOHAMMAD TAG	Tag Cosmetics Toiletries Ltd.
A. MONEIM TAHN	Tag Cosmetics Toiletries Ltd.

ANNEXE B

This is a text of a proposal submitted by SROC that has been shared by many participants.

It is proposed to set up a task force with the following terms of reference:

1. Study approaches to materialise the motions regarding focusing on the 3 renewable energy sources singled out as most appropriate for Sudan. Namely:

   - Wind mill (constraints
   - Biogas)
   - Small scale solar energy (etc. by way o a
     lighting, health, education) feasibility study

2. Demonstration with the objective of creating demand (studying approaches to most suitable ways).

3. Approaching the Government in pursuit of a favourable policy.

4. Approaching financial institutions to get them involved from the very beginning.

IDENTIFICATION AND PRODUCTION OF INDUSTRIAL INVESTMENT PROJECTS FOR THE LOCAL PRODUCTION IN DEVELOPING COUNTRIES OF MACHINERY AND EQUIPMENT FOR THE UTILIZATION OR PRODUCTION OF NEW OR RENEWABLE ENERGY FROM SOLAR, BIOMASS (EXCLUDING BIOGASS) AND MICRO-HYDROSOURCES.

UNIDO PROJECT US/GLO/81/109
CONSULTANT REPORT ON THE VISIT TO THAILAND

0. FORWARD

Consultant's team arrived in Bangkok on July 12, 1987 and started the work with the THAI National Team on July 13. During the stay the Consultant and National Team had the opportunity to review the state of the development of research and production in the field of machinery and equipment for the utilization or production of new and renewable energy. A number of institutions and industries active in this sector have been visited, including:

- Industrial Economics & Planning Division, Ministry of Industry
- Office of Policy and Planning, Thailand Institute of Scientific and Technological Research
- Energy Technology Dept. of said Institute
- Energy Research and Development Division, NEA, Min. of Sc. Tech. En.
- Special energy Division of the Energy Technology Dept. of the Electric Generating Authority of Thailand
- The Industrial Finance Corporation of Thailand
- The Association of Thai Industry
- Energy Industry Development Office of the Ministry of Industry
- Northern, Industrial Economics Develop. Centre, Chiengmai
- Three factories identified by the National Team as already producer (or potential ones) of equipment and machinery related to the field in subject.

1. PRIORITIES

Both the Consultant and the National Team, on the basis of the conversations held with concerned parties and from the documentation they had the possibility to study, arrived to the conclusion that the following areas should be considered of high priority within the renewable energies machinery and equipment production:

- biomass transformation (wood gasification, crop waste briqueting, charcoal production mainly)
- micro-hydraulic turbines for power generation at selected sites
- solar cell operated equipment (mainly for water pumping, telecommunication in remote areas, refrigerators, etc.)
- wind operated pumps and generators (limited to the southern part of the Country).

2. BACKGROUND INFORMATION

2.1 Biomass

The Country has already started a programme foreseeing fast growing tree plantations in various sites and this will provide excellent raw material for both gasification and charcoal production. Trials have been already done in the field of crop waste utilization (mainly rice husks) and the institute for Scientific and Tecnnological Research has got an extremely fine experience in designing and operating them.
On the other hand present utilization of biomass is very low and better technology and equipment are needed, also to produce charcoal, the most used fuel for cooking; the present efficiency in charcoal production is in the range of 20% by weight on wet basis, while the use of better equipment could considerably increase the conversion efficiency.

2.2 Micro - hydro turbines

Locally designed turbines are presently in production, 10-200 Kw range. 10 to 20 units are installed every year and this number could increase but an accurate research on site selection is needed (assistance from bi-lateral or multilateral sources could be of benefit in this respect). Improvement of turbine characteristics and model diversification could be sought.

2.3 Solar and wind energy

A comprehensive study has been carried out by Thai and foreign consultants on the availability and reliability of solar and wind energy.
The solar energy potential is quite good, being, as an average, 4.7 kWh/sq.mt/day. Two Joint Ventures are presently operating in the Country, but special applications only are so far considered because of the high

cost of installation and, in turn, of electrical energy produced (2$/kWh).
Wind potential energy is, on the contrary, quite low. Only few areas, mainly in the Southern part of the Country, are reasonably suitable for wind energy exploitation. Some 2,000 units have been installed so far, mainly for water pumping.

3. OTHER ACTIVITIES

The Consultant and the National Team have cooperated in visiting some of the industries already identified as willing to expand or initiate activities in this field; in particular USA Ec. Dev. Co. factory was visited in Bangkok, and Chiengmai Industry and Mining Factory and Lanna Ruamchang Co. in Chiengmai; one questionnaire was completed in such occasion and other questionnaires, as agreed, will be provided together with the final report. In their contacts both the Consultant and the National Team have found a general agreement on the absolute necessity for the developing of this activity of a well established financial plan as a support to both the manufacturers and the end users.
Both teams have agreed in planning the Italian and Vienna Phase taking into account the priorities outilined under par. 1.
The idea of organizing a national workshop has been discussed with the National Team and with the Association of Thai Industry and both parties agreed in principle.

Timing for such workshop should be agreed but, in principle, should be held after the Italian project phase so that additional information can be disseminated.
The following priorities have been indicated for the Italian phase:

- visits to selected plants
- substantive discussions on identified priorities (bio-mass conversion etc.) with Italian manufacturers.

The National Team hopes also to have the opportunity to get in touch with the team of the other Countries participating to the program in order to investigate any possible form of cooperation.

4. CONCLUSIONS

The National team will review the Country Paper in accordance with the results of the work developed together with the

consultant team and will issue the final report, in 30 copies, and complete with some questionnaires as soon as possible.

INDENTIFICATION AND PRODUCTION OF INDUSTRIAL INVESTMENT PROJECTS FOR THE LOCAL PRODUCTION IN DEVELOPING COUNTRIES OF MACHINERY AND EQUIPMENT FOR THE UTILIZATION OR PRODUCTION OF NEW OR RENEWABGLE ENERGY FROM SOLAR, BIOMASS (EXCLUDING BIOGAS) AND MICROHYDRORESOURCES

UNIDO PROJECT US/GLO/81/109
REPORT ON THE CONSULTANT'S MISSION TO ZIMBABWE

The Consultant arrived in Harare on November 8 and left on November 14. During his stay he had the opportunity to work with the National Team, The Ministry of Energy, to receive and review with them the Country Paper and to visit all local sponsors that identified suitable projects in order to obtain additional information on these and the main priorities. A mini-workshop was also organized.

1. PERSONS MET

1.1 UNIDO

Mr. A. Olsen, J.P.O.

1.2 MINISTRY OF ENERGY

- Mrs. J. Chadzingwa, Dept. of Energy Resources and Development.
- Mr. R. Tirivanhu, team member
- Dr. I.M. Zinzombe, Dep. of Energy Resources and Development.

1.3 PRIVATE SECTOR SPONSORS

- C.E. Haden, Nei Cochrane Engineering (P.V.T.) LIMITED
- Charles V.C. Beswick, Airflo, a division of Mashonaland Holdings Ltd.
- Austing Birney, Airflo, a division of Mashonaland Holdings Ltd.
- Faizal Gangat, Ecological Designs
- D.M. Mollat, WS & G. hi-tech.
- Derrick McDiarmid, Solamatic Systems.
- Mr. Mgwarai Mazike, National Energy Resources Est.

2. PRIORITIES

Several equipment using renewable energies are already produced in the Country, or at least, assembled (solar panels, solar cookers, photovoltaic systems, boilers using biomasses, gas producers etc).
Great emphasis is given to the development of this subsector and priorities have been identified in:

- Solar energy applications
- Biomasses uses

On the contrary wind speed is low in most of the Country and cannot be exploited as well as mini-hydro sources are, so far, not identified in great number.

3. PROJECTS IDENTIFIED

The following projects have been identified (both questionnaires and the simplified UNIDO form will be submitted with the final C.P.):

- NEI COCHRANE ENG. Ltd

  Biogasses gasification, boilers (improvement of existing production).

- AIRFLO

  Biomasses (cropwaste) briquetting and firing (improvements, technical assistance and foreign exchange funds for components import).

- WS & G hi-tech

  Photovoltaic systems (improvement to present production)

- ECOLOGICAL DESIGN

  Solar systems, biomasses applications (plant for the production of vacuum tubes solar panels).

- SOLAMATIC SYSTEMS

  Solar applications

- NATIONAL ENERGY RESOURCES EST.

  Photovoltaic systems (new plant)

- NATIONAL FOOD CORPORATION

  Butanol production from maize (as additive to diesel)

- Sponsor to be identified (RIO TINTO ?)

  Calcium carbide production.

The last project will probably not be presented because there is already a strong Japanese interest for possible joint venture.

As result of the mini-workshop held in Harare it is possible that other projects could be presented during the Italian and Vienna Phases.

4. WORKSHOP

A mini workshop has been organized at the Ministry of Energy. Representatives of the Development Bank, the Ministry of Industry and the Confederation of Zimbabwe Industries also attended. The programme and the C.P. were introduced. The Confederation of Zimbabwe Industries will publish the new in their bulletin.

5. FINAL REPORT

Final report will be sent to Vienna within December 15.

ANNEXE 3

DELEGATIONS FROM PARTICIPATING

DEVELOPING COUNTRIES

COUNTRY	NAME
SOMALIA	Mr. Said Aden Mohammed Director Projects Department Somali Development Bank
SOMALIA	Mr. Muse Ahmed Khayre Ministry of Industry
ETHIOPIA	Mr. Gebremariam Beyene Agricultural Industrial Development Bank
ETHIOPIA	Mr. Mulugeta Adamu Ministry of Mines and Energy D/Manager of Energy and Project
SUDAN	Mr. El Mubarak Ali Osman B. Sc. Economics Sudan Development Corp. Project Department
SUDAN	Mr. Mahjoub Mohd Mustafa El Roubi Elect. Eng. Co. Manager
SUDAN	Mr. Hassan Wardi Hassan Head Solar Energy Research Department

COUNTRY	NAME
THAILAND	Mr. Seing Chart Limpsuree The Industrial Finance Corporation of Thailand
THAILAND	Ms. Gunruan Amatyakul Industrial Economics and Planning Division Ministry of Industry
THAILAND	Mr. Charmroom Malaigrong Ministry of Industry
ZIMBABWE	Ms. Chadzingwa Ministry of Energy
ZIMBABWE	Mr. R. Tirivanhu Ministry of Energy
ZIMBABWE	Mr. C.E. Haden Managing Director Cochrane ind.
ZIMBABWE	Mr. Faizal Gangat Managing Director, ecological design

baldo & C. s.n.c.
CONSULTING ENGINEERS

ANNEXE 4

PLANT VISITS AND BILATERAL

MEETINGS SCHEDULE

DURING ITALIAN PHASE

Wednesday 18/05/1988

All day : all delegations in Ponte San Giovanni
S.P.I., Mr. Berna

Thursday 19/05/1988

Morning : all delegations in Ronciglione (Viterbo)
S.E.S., Mr. Gautier

Afternoon : all delegations in Nettuno (Roma)
ITALSOLAR, Mr. Corsini

Friday 20/05/1988

09.00 SUDAN - ISEA (Mr. Bonservizi)
09.00 THAILANDIA - RPA (Mr. Solinas)
09.00 SOMALIA - ENERGETICA MERIDIONALE (Mr. Giubergia)
09.00 ETHIOPIA - EUROKELLER (Mr. Bellistri)
10.00 ETHIOPIA - ISEA
10.00 SUDAN - ENERGETICA MERIDIONALE
10.00 THAILANDIA - CARBOLISI (Mr. Vicini)
11.00 SOMALIA - ISEA
11.00 THAILANDIA - ENERGETICA MERIDIONALE
11.00 SUDAN - EUROKELLER
12.00 THAILANDIA - EUROKELLER
15.00 ETHIOPIA - ENERGETICA MERIDIONALE
15.00 SOMALIA - EUROKELLER
16.00 SOMALIA - S.E.I.
17.00 SUDAN - S.E.I.

Monday 23/05/1988

Afternoon :

14.00 ETHIOPIA - IOR PCF (Mr. Carlo Milan)
16.00 SOMALIA - IOR PCF
16.30 SUDAN - IOR PCF

Tuesday 24/05/1988

Morning : all delegations in Padova

TESSARI, Mr. Dal Checco

Afternoon : all delegations in Galliera Veneta (Padova)

HELIOS TECHNOLOGY, Mr. Franco Traverso

Wednesday 25/05/1988

All day : ETHIOPIA, THAILANDIA and SOMALIA in Torino

IREM, Mr. Bonino

09.00 SUDAN - TECHNIMONT (Mr. Colombi)

Afternoon : SUDAN in Cocquio Trevisago (Varese)

ENERGO PROJECT, Mr. Gennaro Bracale

Thursday 26/05/1988

Morning : SOMALIA, SUDAN and ETHIOPIA in Bologna

RIVA CALZONI, Mr. Comand

Afternoon : SOMALIA, SUDAN and ETHIOPIA in Cesena

ATI, Mr. Mariani

Friday 27/05/1988

09.00 ETHIOPIA - SOM (Mr. Grilli)
09.00 SOMALIA - ATI
10.00 SOMALIA - SOM
10.00 ETHIOPIA - ATI
10.00 THAILANDIA - RIELLO (Mr. Razzo)
11.00 THAILANDIA - SOM
11.00 SUDAN - ATI
11.00 ETHIOPIA - RIELLO
11.00 SOMALIA - SUNLIFE
12.00 SOMALIA - RIELLO
12.00 ETHIOPIA - SUNLIFE
12.00 SUDAN - TERMOSOLARE ITALIANA (Sig. Troncale)

15.00 SOMALIA - GTS (Mr. Battaggi)
15.00 SUDAN - SUNLIFE
15.00 THAILANDIA - TERMOSOLARE ITALIANA
16.00 THAILANDIA - GTS
16.00 SUDAN - HELIOS TECHNOLOGY
16.00 ETHIOPIA - TERMOSOLARE ITALIANA
17.00 ETHIOPIA - GTS
17.00 THAILANDIA - SUNLIFE
17.00 SOMALIA - TERMOSOLARE ITALIANA

Monday 30/05/1988

Morning : all delegations in Parma

SIDI, Mr. Cadonici

Tuesday 31/05/1988

All day : all delegations in Genova

CESEN, Mr. Taccetti

Wednesday 1/6/1988

09.30	SUDAN - ENERGO PROJECT
09.00	ETHIOPIA - IREM
09.00	SOMALIA - RIVA CALZONI
09.00	THAILANDIA - SALMINI
10.00	THAILANDIA - GARIBOLDI
10.00	SOMALIA - ENERGO PROJECT
11.00	THAILANDIA - IREM
11.00	ETHIOPIA - SALMINI
12.00	SOMALIA - IREM

VISITS SCHEDULE FOR

ZIMBABWE DELEGATION

Monday 13/06/1988

09.00 - 11.00 : Meeting with ENEA

Afternoon :

Visit to ENEA Testing Station

Tuesday 14/06/1988

Morning : Visit to S.E.S. plant
(Ronciglione, RO - Mr. Gautier)

Afternoon : Visit to ISEA plant
(Ponte San Giovanni, PG - Mr. Bonservizi)

Evening : Transfer to Milan

Wednesday 15/06/1988

Morning : Visit to IREM plant
(S. Antonino Susa, TO - Mr. Bonini)

Afternoon : Visit to ENERGO PROJECT plant
(Cocquio Trevisago, VA - Mr. Bracale)

Thursday 16/06/1988

Morning : Visit to IOR PCF plant
(Mestre, VE - Mr. Milan)

Afternoon : Visit to HELIOS TECHNOLOGY plant
(Galliera Veneta, PD - Mr. Franco Traverso)

Friday 17/06/1988

09.00 : ZIMBABWE - GARIBOLDI (Mr. Grugni)
10.00 : ZIMBABWE - GHINI (Mr. Ghini and Mr. Bonino)
12.00 : ZIMBABWE - CARBOLISI (Mr. Vicini)

14.00 : ZIMBABWE - COSTA (Mr. Tasca)
15.00 : ZIMBABWE - SUNLIFE (Mr. Cenevese)
16.00 : ZIMBABWE - SALMINI (Mr. Salmini)

baldo & C. s.a.s.
CONSULTING ENGINEERS

ANNEXE 5

PROGRAMME FOR THE VIENNA PHASE

0455c-ihs-31-05-88

INDUSTRIAL INVESTMENT PROGRAMME FOR NEW AND RENEWABLE ENERGY EQUIPMENT*
(US/GLO/81/109)

PROGRAMME FOR THE VIENNA PHASE: 2 - 10 JUNE 1988

Thursday, 2 June 1988

10:30	Arrival at Vienna airport and transfer to Hotel Haydn.
14:30 - 15:45	Registration: Ground floor, C building, Vienna International Center (VIC).
16:00 - 17:00	Opening session. Discussion of the Vienna phase programme. Presentation and discussion of the activities of Industrial Training Branch, Feasibility Studies Branch and Industrial Management and Rehabilitation Branch, Department of Industrial Operations. (Conference room V, C building).
17:00 - 19:00	Reception.

Friday, 3 June 1988

9:00 - 11:00	Presentations by the developing country national teams (Ethiopia, Somalia, Sudan, Thailand). (Conference room V, C building).
11:00 - 12:30	Presentation and discussions of the activities of the Area Programmes Division, Transfer of Technology Programme Branch. (Conference room V, C Building).
12:30 - 14:00	Lunch
14:00 - 15:30	Presentation and discussion of the activities of the Industrial Operations Technology Division. (Conference room V, C building).
15:45 - 17:00	Individual country meetings with UNIDO officers.

Saturday and Sunday 4-5 June 1988

Free

VIENNA PHASE: 2 - 10 JUNE 1988
(page 2)

Monday 6 June 1988

08:30 - 10:00	Individual country meetings with UNIDO officers:
10:00 - 16:30	Round Table Conference with Austrian companies (Vogelbusch, Voest Alpine, Solkav, Posch and Partner) and Ms. Holzer representative of Ministry of Economy, Mr. Schneider representative of Austrian federal Economic Chamber and Mr. Burger-Scheidlin from Investment Promotion Service of Austria.
15:30 - 17:30	Presentation of Austrian Energy saving programmes at energie Verwertungs Agentur.

Tuesday, 7 June 1988

09:00 - 12:30	Visit of plant producing energy from straw.
14:00 - 15:30	Individual country meetings with UNIDO officers.
15:45 - 16:30	Presentation and discussion of the activities of Technology Programme Branch - Mr. Bromley. (Conference room IV, C building).

Wednesday 8 June 1988

08:30 - 12:30	Individual country meetings with UNIDO officers
12:30 - 13:45	Lunch
14:00 - 16:30	Individual country meetings with UNIDO officers

Thursday 9 June 1988

08:30 - 12:00	Evaluation of the programme by the participants and review of recommandations for follow-up and modalities for such follow-up.
12:00 - 14:00	Lunch.
14:00 - 16:30	Individual country meetings with UNIDO officers.

Friday, 10 June 1988

Travel from Vienna to home country

---

* Programme for the identification and promotion of industrial investment projects for the local production in Ethiopia, Somalia, Sudan, Thailand and Zimbabwe of machinery and equipment for the utilization of new and renewable energy from solar, biomass (excluding biogas) and micro-hydro sources.

ANNEX I

INDIVIDUAL COUNTRY MEETINGS WITH UNIDO OFFICERS

Friday, 3 June 1988

15:45 - 17:00	Individual country meetings with UNIDO officers.
15:45 - 16:15	Ethiopia team with Mr Rezek: IO/IIS/FEAS, D 1355
15:45 - 16:15	Somalia team with Mr Martin: PPD/AREA/LDC, D 1773
15:45 - 16:15	Thailand team with Mr Caldas Lima: IPCT/DTT, D1972
16:15 - 16:45	Sudan team with Mr Rezek: IO/IIS/FEAS, D 1355
16:15 - 16:45	Ethiopia team with Mr Martin: PPD/AREA/LDC, D 1773
16:15 - 16:45	Somalia team with Mr Caldas Lima: IPCT/DTT, D1972
16:45 - 17:15	Thailand team with Mr Rezek: IO/IIS/FEAS, D 1355

Monday, 6 June 1988

08:30 - 10:00	Individual meetings with UNIDO officers:
09:00 - 09:30	Sudan team with Ms J. Jensen: IO/AREA/LDC, D 1770
09:00 - 09:30	Thailand team with Mrs Orlowski, PPD/AREA/AP, D 1737
09:00 - 09:30	Ethiopia team with Mr Fuerkus, IO/TEC/ENG, D 1162
09:00 - 09:30	Somalia team with Mr Williams, IO/TEC/CHIM, D 1277
09:30 - 10:00	Somalia team with Mr Fuerkus, IO/TEC/ENG, D 1162
09:30 - 10:00	Ethiopia team with Mr Williams, IO/TEC/CHIM, D 1277

Tuesday, 7 June 1988

14:00 - 15:30	Individual country meetings with UNIDO officers:
14:15 - 14:45	Somalia team with Mr Alan Buckle, IO/T/MET, D 1232
14:15 - 14:45	Ethiopia team with Messrs Fuerkus and Nogueira da Silva, IO/T/MET, D 1252
14:15 - 14:45	Sudan team with Mr Williams, IO/TEC/CHIM, D 1277
14:45 - 15:15	Thailand team with Mr Fuerkus, IO/TEC/ENG, D 1162
15:00 - 15:30	Sudan team with Mr Alan Buckle, IO/T/MET, D 1232
15:00 - 15:30	Somali team with Mr Rezek, IO/IIS/FEAS, D 1355

Wednesday, 8 June 1988

08:30 - 16:30:	Individual country meetings with UNIDO officers
08:30 - 9:00	Sudani team with Ms. Jensen: IO/AREA/LDC, D-1770
08:30 - 9:00	Ethiopia team with Mr Abdelmoneim: IPCT/II/PIF, D-1067
08:30 - 9:00	Thailand team - Mr. Makovets, IO/IIS/IMRB, D-1374
09:00 - 9:30	Sudan team - Mr. Makovets, IO/IIS/IMRB, D-1374
11:00 - 11.30	Ethiopia team - Mr. Makovets, IO/IIS/IMRB, D-1374
11:00 - 11:30	Thailand team with Mr Fritz, IO/T/ENG, D 1148
11:30 - 12:00	Somalia team - Mr. Makovets, IO/IIS/IMRB, D-1374
11:30 - 12:00	Thailand team with Mrs Orlowski, PPD/AREA/AP, D-1737
11:30 - 12:00	Sudan team with Mr Abdelmoneim, IPCT/II/PIF, D-1067
12:00 - 12:30	Sudan team with Mr Carrier, IPCT/DTT/INF, D-1920

ANNEX I
INDIVIDUAL COUNTRY MEETINGS WITH UNIDO OFFICERS
(page 2)

Wednesday, 8 June 1988

13:30 - 16:30	Individual country meetings with UNIDO officers
13:30 - 14:00	Somali team with Mr Abdelmoneim, IPCT/II/PIF, D-1067
14:00 - 14:30	Ethiopia team with Mr Diallo, IO/PPRB, D-1110
14:00 - 14:30	Thailand team Mr Mimura, IO/SD/FEAS, D-1367
14:00 - 14:30	Sudan team with Mr Fuerkus, IO/TEC/ENG, D-1162
14:00 - 14:30	Somali team with Mr Tabah, PPD/SPA/ECDC, D-1611
14:30 - 15:00	Thailand team with Mr Diallo, IO/PPRB D-1110
14:30 - 15:00	Sudan team - Ms. Lorenzo, IO/IIS/TRNG, D-1413
14:30 - 15:00	Somalia team with Mr Bromley, IPCT/DTT/TEC, D-1903
15:00 - 15:30	Somalia team with Mr Diallo, IO/PPRB D 1110
15:00 - 15:30	Ethiopia team - Ms. Lorenzo, IO/IIS/TRNG, D 1413
15:00 - 15:30	Thailand team - Mr. R.O. Williams, IO/T/CHEM, D 1277
15:00 - 15:30	Sudan team with Mr Bromley, IPCT/DTT/TEC, D-1903
15:30 - 16:00	Sudan team with Mr. Diallo, IO/PPRB D 1110
15:30 - 16:00	Somalia team - Ms. Lorenzo, IO/IIS/TRNG, D-1413
15:30 - 16:00	Thailand team with Mr Bromley, IPCT/DTT/TEC, D-1903
15:30 - 16:00	Ethiopia team with Mr Maadi, IPCT/II/PIF, D-1078

Thursday, 9 June 1988

14:00 - 16:30	Individual country meetings with UNIDO officers
14:00 - 14:30	Sudan team with Mr Kulur, IPCT/DTT/TEC, D-1905
14:30 - 15:00	Thailand team with Ms Lorenzo, IO/IIS/TRNG, D-1413
14:30 - 15:00	Sudan team with Mr Maadi, IPCT/II/PIF, D-1078
15:00 - 15:30	Sudan team with Mrs Maltezou, IO/IIP, D-1571