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DOCUMENT

SEVENTEENTH QUARTERLY REPORT

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DJIBOUTI ENERGY INITIATIVES PROJECT

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Submitted to

United States Agency for International Development

Djibouti

by

Martin Bush

Chief of Party

VOLUNTEERS IN TECHNICAL ASSISTANCE

Djibouti

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1. INTRODUCTION

The principal activity of the last quarter of 1986 has been the coordination by the Project of the joint USAID/UNDP energy planning team. This international team of six energy experts conducted a detailed analysis of present and future energy supply and demand in Djibouti, from a base year of 1985 up to the year 2000. The report of this work--a National Energy Plan for Djibouti--makes numerous recommendations designed to improve the energy situation in the country, and also sets out 20 energy sector development projects for which funding from the international donor agencies will be sought in the near future.

This major activity involved the almost full-time assistance of the VITA team and their ISERST counterparts from mid-August until the end of November. The work is described in greater detail in section 5 of this report.

2. ENERGY CONSERVATION

2.1 The construction of the first of the energy-efficient prototype buildings finally got underway in September only to halt almost immediately afterwards. The earthfill work at the site in Quartier 3 was not performed correctly by the building contractor, and the District authorities at first refused to permit construction to commence.

When the site preparation work was finally approved construction was again delayed. Travaux Publics (T.P.) and the District could not agree on the precise alignment of the house--the building site is not rectangular, no two sides are parallel, and only one side is parallel to the street.

At the last meeting of the Commission on Habitat (which includes the ISERST/VITA team as members) this final question was resolved and construction is now finally underway.

The house will be built with fired bricks made from local clays. These bricks are fired in a kiln which uses waste motor oil as fuel--a technology set up in Djibouti by the Project in 1984. Mr. Syad, the proprietor of the small business, is now doing quite well. He has recently constructed a second and much larger kiln--still using the waste oil as fuel--and he is seeking funds to construct 2 more.

The bricks will be smaller than planned because the larger bricks tend to crack during firing--a problem that has still not been solved.

However, the smaller bricks bake without problems. Mr. Syad has already produced about half the number of bricks which will be required for the construction of this prototype energy efficient building.

2.2. In contrast to the house in Quartier 3, construction of the prototype building at Ambouli got off to a good start. The walls of this building--an annex to the dispensary--are again being constructed with local building material--in this case with pressed earth bricks made with local clay with a small amount of cement added.

This building, a relatively simple one, is almost completed. The pressed earth bricks have been tested at Travaux Publics and have been found to have excellent structural strength. Even after being immersed in water for 1 week the bricks retain their strength and show no sign of degradation.

The pressed earth bricks are fabricated at the building sites using a mechanical press which was rented for this purpose. The hand press, which was used at first, did not provide sufficient compaction and the strength of the bricks was found to be inadequate.

The use of the pressed earth bricks has aroused considerable interest in Djibouti, particularly since the bricks are made on the site and people can watch them being pressed, dried, and used in the walls of the building.

A tour of the building site was organized in December in the presence of the Ministre de la Santé Publique, the Chef de la Mission de Coopération, a representative of USAID, and other interested parties.

2.3. The third energy efficient building project at Balbala continues to be delayed since proprietorship of the location has still not been accorded to ISERST despite every effort by the Commission on Habitat.

2.4. The National Energy Conservation program proposed by the Project has been accepted in principle by the Government. The Government has officially created a fund of 89 million FD (\$503,000) to finance energy conservation measures in Djibouti.

The UNDP has also expressed a desire to support this initiative. A proposal has been prepared by the Project team and submitted to the UNDP for review.

This program is noteworthy since it is believed to be the first time that any national government has used the profits earned by its state electricity generating authority resulting from the fall in the price of oil to finance a nation-wide energy conservation program.

The Project is proposing that this program should insulate domestic refrigerators and replace incandescent lamps with fluorescent strip lights in all the homes in Djibouti-ville which are registered consumers of electricity generated by Electricité de Djibouti (EdD). About 15,000 households would be involved.

2.5 Energy conservation work continues to be routinely carried out by the Project technicians. For example, all the refrigerators (about 100 in all) used by the Ministère de la Santé mainly for the storage of vaccines in Djibouti-ville have now been insulated. At the same time the technicians sealed the air-conditioning units into their wall openings, and demonstrated how the filters should be cleaned.

2.6 The construction of the main ISERST building is nearly completed. In December, thermal insulation was added to the walls and the roof of the building. One half of the building has insulation on the inside; the other half is insulated on the outside. This variation will permit a comparison of thermal performance when the building is occupied this summer.

Several tours of the building have been put on for local architects, builders, and technicians to show the installation of the thermal insulation. The new offices also have double-glazed windows, and when finished in March, this building will be the largest energy-efficient building in Djibouti.

2.7 The construction of an annexe, and the retrofitting of several classrooms, of the Ecole Francaise is almost finished. The work closely follows the recommendations made in a report prepared by the Project last year. The classrooms have screened openings to encourage natural ventilation; the roofs are ventilated to permit solar heat to be carried away; and the walls are shaded to block direct solar gain.

2.8 The first part of a report on energy use in the Imprimerie Nationale has been submitted to the Direction de l'Imprimerie. The report recommends that a small air-conditioning unit be installed in the one room in the building which requires continuous cooling. This simple measure will obviate the need for the building's large A/C unit to be run at night, and will save the Imprimerie almost \$7,000 a year in electricity costs.

3. RENEWABLE ENERGY

3.1. The first of the solar pumps from Total Energy Development (TED) has been received and tested. While the performance of the pump is as good as the SEI and the AEG solar pumps previously tested at ISERST, there are two problems with the TED design which will almost certainly create serious technical problems in the field.

The first problem, and the most serious, is that the pump has no automatic cutout system. Neither overspeed nor overheat protection is provided. Installed in the shallow wells of Djibouti, it will not be too long before a pump of this kind finds itself sitting in the mud at the bottom of a well pumped almost dry--a disaster for a pump with no protective system designed to cut off the power to the electric motor.

The second problem is the size and weight of the pump. The electric motor and pump are encased by a hemi-spherical float chamber almost a metre in diameter. The pump projects through the bottom of the float into the water. While the unit works well in the water, out of the water it is awkward, cumbersome, and difficult to handle. Moreover, the unit cannot easily be supported in a horizontal position without the entire weight resting on the foot-valve assembly at the bottom of the pump cylinder. Given the rough ride and handling that all equipment must expect in Djibouti while being moved around the country, it does not appear that the pump is likely to last too long before something breaks or is knocked out of alignment.

These concerns have been conveyed to the local director of TED, and passed on to TED in France. The AFME has also been informed.

3.2. The photovoltaic system intended for the dispensary at Hol Hol has been received. Unfortunately, ARCO Solar sent the wrong refrigerator with the system. The correct unit was received some weeks later. The system, which includes 4 fluorescent lights, has been set up in the Renewable Energy building by Project technicians who have checked that the system components--refrigerator, fluorescent lights, batteries, and solar panels--are working correctly.

3.3. The new 5KW Nova inverter has been received and has been installed in the Renewable Energy Building. The unit is working well. A shipment of spare parts for the Aermotor windmills has also been received, and an order of flowmeters has also arrived in Djibouti for installation on the windmills and the new solar pumps.

3.4. A trip was made over to Mediho to review the site where it is planned to install one of the new AY McDonald solar pumps. Detailed

inspection of the well suggested that the proposed pump would probably not work satisfactorily at this site.

The problem is that the well is situated in a water course which, according to the local people, floods at least once a year. When the site floods the water level is about a metre over the top of the well. This means that any surface-mounted pump will have to be positioned at least 1.5 metres above the level of the well, which normally has a water level about 4 metres below ground level.

That adds up to a suction head, during pumping, of about 6 metres. Moreover, since Mediho is in the mountains north-west of Obock at an altitude of about 1000 metres, the maximum possible suction head for a surface pump must be reduced by about 1 metre.

It is possible that a suction pump might manage to pump water under these conditions, but experience in Djibouti suggests that surface-mounted solar pumps are inefficient and prone to priming problems when operated at high suction heads in rural wells.

An alternative arrangement is to install a submersible solar pump. The flooding of the water course will have no effect on the operation of this kind of pump. Since the Project has such a pump in stock, this will be the pump installed at Mediho.

3.5. Work is continuing on the site preparation for the new solar pumps which will be installed in the villages of Khalaf and Sagalou in the District of Tadjourah. This work, which is financed by the US Embassy, is being carried out by the District.

All of the new solar pump systems (for Khalaf, Sagalou and Mediho) have been tested by Project and have been found to work satisfactorily. The pumps systems are being stored in the RE Building until the work on the wells has been completed.

3.6 Preparations for moving the 3 large windmills in the north of the country to better sites are almost completed. This work will be carried out with the help of the French Army who will provide 2 teams of 30 soldiers to work with Project technicians in the field.

The moving of the windmills at Khor Angar and Asa Guenita to the new sites at Obock and Ambouli is due to start on January 3. The windmill at Adailou will be moved to a site at Tadjourah in mid-February. Each windmill will be fitted with a water meter so that the output of the machines can be monitored.

The logistics of this operation are proving to be quite complex since the work involves the supervision of about 40 personnel: French soldiers, Djiboutian technicians, and Project personnel--and the

coordination of the agencies involved: the French army command, ISERST, the Districts of Obock and Tadjourah, and the Genie Rural. The teams will camp out for about 7 days while the work is in progress.

Since all 3 windmills will be placed on shallow wells, the windmills will be fitted with much larger pump cylinders. Two 5-inch diameter cylinders have been received from Aermotor in the US, and a 140 mm diameter cylinder has been ordered from Humblot in France.

4. INSTITUTIONAL DEVELOPMENT

4.1 The four young technicians taken on by the Project for a trial period are working well. The team is continuing to insulate refrigerators, to replace lighting fixtures, and to carry out other tasks related to energy conservation in many locations of Djibouti-ville.

4.2 Yacob Nour, the energy planner with the Service de l'Energie who has been seconded to the Project since January 1986, has been accepted for the USAID-sponsored Energy Management and Policy course at the University of Pennsylvania.

Yacob has been actively involved with the national energy planning work which has been coordinated by the Project for the last 9 months and this experience, together with the training he will receive in the US, should provide a solid practical and theoretical basis for his future work in national energy planning and policy development in the Ministry of Industry.

4.3 ISERST's documentation specialist, Nader Abdulkarim, has returned from the US after a 7-month training program in library science and information retrieval technology. The program was arranged and coordinated by the VITA office in Rosslyn.

Nader will now take over the small renewable energy and appropriate technology documentation centre at ISERST which has been supported by the Project since its inception. He has the task of developing the collection into a major bibliographic resource and information retrieval centre which will include all the bibliographic material of the other sections of ISERST.

4.4 The computing capability at ISERST continues to develop with the support and encouragement of the Project. The small Apple IIE, for a long time the only computer at ISERST, is now very much overshadowed by

the 2 Bull Micral 60 computers which have been recently installed in the Project offices.

Financed by USAID and the UNDP, the new computers are being used for energy sector modeling, energy demand forecasting, the economic analysis of energy projects, and the preparation of the National Energy Plan.

ISERST personnel now routinely use Appleworks, Wordstar, and Lotus 123, and it is planned that the Institute's accounting procedures, at the present time laboriously performed by hand, should eventually be carried out on one of the Micral 60's.

Training on the Wordstar word processing program was carried out by the Bull technical representative resident in Djibouti, Mr. Antoine Large. Mr. Large gave 12 hours of training, spread over a 1 week period, to 4 Djiboutian secretaries who work with the Project

5. ENERGY POLICY AND PLANNING

5.1 The major focus of the Project during the last quarter of 1986 has been the national energy planning work. The members of the international team of energy experts who participated in the study are listed below:

<u>NAME</u>	<u>POSITION</u>	<u>AFFILIATION</u>
Ioan STANCESCU	Senior energy analyst (team leader)	UN energy consultant based in Germany.
Arturo VILLAVICENCIO	Energy analyst	National Institute of Energy (INE), Quito, Ecuador.
Renato PUGNO	Economist	ElectroConsult, Milan, Italy.
Jose Flores GOMEZ	Transportation expert	GRECA associates, and Government of Mexico.
Mihai PETCU	Tariffication expert	Conseiller Technique to Government of Zaire at Kinshasa.
Dominique BRIANE	Rural energy expert	Association Bois de Feu, Aix-en-Provence, France.

The mission schedules of each of the team members was as follows:

Consultant	June	July	aug	sept	oct	nov	dec
Stancescu	XX	X		X	X	XXX	
Villavicencio				XXXX	XXXX	X	
Pugno				XX	XXXX	XXX	
Gomez			XX	XX			
Petcu					XXXX		
Briane			XXX	X			

5.2 Of the two experts who arrived in August to assist with the development of the data base necessary for the energy sector modeling work, Dominique Briane left in early September after studying the supply and demand of wood and charcoal in the rural areas, and Jose Flores Gomez left in mid September after completing his analysis of the transportation sector.

Both experts found it difficult to prepare a final report within the time available. Although both Briane and Gomez presented a report to ISERST before leaving, neither document was prepared in a completely satisfactory manner. Briane chose to revise his report, and prepared a final version in France which was submitted to ISERST at the end of September. The report on the transport sector prepared by Jose Gomez was revised by the Project team.

5.3 Arturo Villavicencio, the energy demand analyst from Ecuador finished his 2-month consultancy on November 8. Villavicencio was responsible for the adaptation of the MEDEE-S computer program to the case of Djibouti, and for the use of this model to estimate the demand for energy up to the year 2000.

The MEDEE-S model requires that a detailed set of data be available to the programmer. It turned out to be much more difficult than anticipated to collect, organize and reconcile the statistics available in Djibouti. The greatest problem has been contradictory data. Rather than just take the mean value of Government figures which sometimes have differed by a wide margin, the team sought to arrive at more precise values by discussing the data with the various Government agencies and services responsible for the calculation and publication of the statistics. This approach, however, was time-consuming and often frustrating.

In addition, constant problems with the new Bull computers--both hardware and software--threatened to seriously delay the energy modeling work. However, with the help of the UNDP--who lent the project one of their computers at the most critical time--the modeling of the energy sector was completed by the first week of November.

The MEDEE-S program now running at ISERST is a sophisticated model of national energy demand. The computer program has been set up in a way which accurately models the economic and social structure of the country, and the simulation relies on a data base which has been revised, extended, and brought up to date by Project personnel over the last 9 months.

In addition, Villavicencio developed a supply-side model which uses an optimisation routine to determine the set of energy supply options which satisfy the projected demand for energy in the most economic manner.

Projections of energy demand until the year 2000 have been made under the base scenario of the status quo or 'business as usual'. Other scenarios, which model various rates of economic growth and the impact of energy conservation, have also been run.

5.4. Mihai Petcu, the expert on electricity tariffs who works for the Government of Zaire, spent 1 month in Djibouti studying the system of tariffication used at the present time by EdD. A previous study prepared by Electricité de France (EdF) was not well received by the Government of Djibouti, and Petcu's task was to re-examine the EdF proposal and, working in collaboration with the directors of EdD, arrive at a tariffication structure which was both economically efficient and acceptable to the Government.

Petcu worked closely with analysts at EdD and was provided with an office in the administration building of EdD to facilitate his work. Petcu's report on his work in Djibouti: Perspectives de développement du système électrique et tariffication de l'électricité, presents a detailed analysis of the structure of electricity demand, of the cost of supplying electricity, and of the proposed system of tariffication.

5.5. The team economist, Renato Pugno from ElectroConsult in Milan, prepared detailed economic and financial analyses of several of the proposed energy development projects--including the major geothermal project now underway in Djibouti.

Pugno used the Lotus 123 spreadsheet program on the Bull computer to perform the economic and financial analyses. The analyses are stored on minidisks and can therefore be revised if economic or technical data change at any time.

5.6 The final report on the National Energy Plan, which is based on the studies conducted by the international team of energy experts under the supervision of Professor Ioan Stancescu, is being completed by the ISERST/VITA team. The report will identify and present approximately 20 energy sector development projects for which funding will be sought during 1987. The National Energy Plan will initially be prepared in French and English, with an Arabic version perhaps being prepared later.

6. OTHER RELATED ACTIVITIES

None.

7. PROBLEMS AND ISSUES

None at the present time.

8. NEXT QUARTER ACTIVITIES

8.1 The draft of the National Energy Plan will be completed by Project personnel and submitted to the Government for review. The final report, prepared in both French and English, will be ready for the IGADD conference which is scheduled to take place in March.

8.2 The prototype energy efficient buildings in Ambouli and Quartier 3 will be completed. Efforts will continue to start the construction of the prototype house in Balbala.

8.3 The 3 large windmills at Khor Angar, Adailou, and Asa Guenita will be moved to more favorable sites with the assistance of the French army.

8.4 The solar pumps for the villages of Mediho, Khalaf, and Sagalou will be installed.

8.5 The photovoltaic medical refrigerator will be installed at the dispensary at Hol Hol.

8.6 The Project team will continue to promote the national energy conservation program now under consideration by the Government. If the Government approves the project in the form in which it is now proposed, the ISERST/VITA team will be responsible for the technical direction of the program.

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1. INTRODUCTION

This quarterly report covers the period from July to September 1986. It is the 16th quarterly report issued by the Energy Initiatives Project in Djibouti.

The sections which follow review the project activities underway during the reporting period.

2. ENERGY CONSERVATION

1. The energy conservation work is continuing although activities have been delayed by the usual summer slowdown and other interruptions. The Project team consisted of Abdulkarim and Ibrahim from ISERST, and Awad who is being trained for the Service de l'Energie. However, Ibrahim has recently been transferred to the ISERST Seismology laboratory at Arta, Abdulkarim was away on vacation during most of August, and Awad left the project in August to accept a permanent position with the Service de Cadastre--a situation which is very favorable for him, but a disappointment for the Project since Awad is one of the more capable of the Project technicians.

In addition, the national energy planning initiative, particularly the energy surveys organized by consultants Dominique Briane and Jose Gomez, have occasionally required all the technicians to participate, and these activities have also interrupted the energy conservation work.

In an effort to get back on track the project has taken on four young technicians for a 3-month trial period to work on the energy conservation program. The new technicians have been taught how to insulate refrigerators, how to install fluorescent lamps, and how to seal air-conditioning wall units. At the end of the probationary period, the best technician of the group will be employed by ISERST and will continue to work with the Project.

2. Several energy audits have recently been conducted. An energy analysis of the guest rooms at the Sheraton Hotel was performed at the request of the Ministry of Tourism. The Ministry was proposing to reduce the hotel's high electricity consumption (mainly for air-conditioning) by double-glazing the windows in the rooms. An energy analysis revealed that it would be far more cost-effective to insulate the outside walls of the rooms. A technical report has been written and submitted to the Minister.

Energy audits were also conducted of the main entrance areas of the hotel, and a study has been performed of the energy efficiency of the air-conditioning system in the building.

An audit was performed for the office of Notary Abdourahman by the Project energy conservation team and Ali Abdillahi, one of the Djibouti technicians trained in Reims earlier this year. The results of this audit showed several ways in which electricity consumption could be reduced.

The team was also requested to perform a detailed energy audit of the Imprimerie Nationale--a business which is one of the biggest consumers of energy in Djibouti. The Project team has visited the building and is in the process of recommending measures which will reduce the high level of energy use.

3. Several of the recommendations set out in an analysis of the Ecole Francaise performed earlier this year by the Project team have been adopted. The directors of this school reduced the number of air-conditioning units to be installed in the administrative building by half, and improved the circulation of air in two of their classrooms by installing vents in the walls to encourage natural ventilation.

4. The computer room at the ISERST seismology laboratory at Arta has been insulated by the project team. The laboratory will soon install a new computer, and the computer room will need to be almost constantly air-conditioned. The insulation techniques applied in this work were the techniques learned by the Project technicians during their training course in Reims. The payback period for this particular investment is estimated as 10 months.

5. The new team of technicians has continued work started earlier this year on the retrofitting of several Government buildings in the heart of Djibouti ville. Almost 130 air-conditioning units in the Cité Ministerielle have now been sealed into their wall openings. Office workers have also been shown how to adjust the thermostats on the units and how to clean the filters.

Assistance has also been provided to the Ministère de la Santé. Many of their medical refrigerators have been insulated, and the air-conditioners in several of the offices have been sealed.

6. The Project continues, with the help of ISERST, to push for the creation of an energy conservation fund to be used for the financing of a national energy conservation program in Djibouti.

The proposal is to use the profits accrued by Electricité de Djibouti (EdD) as a result of the fall in the price of petroleum to finance a national level energy conservation program which will lead to a significant and long-term reduction in energy demand, particularly of electricity.

Jean-Yves Garnier prepared a report, setting out the economic analysis of the conservation program, which showed that far greater individual household savings would result from the energy conservation program than would follow from a simple reduction in the price of electricity--which was the action that the Government was proposing.

After some debate, The Government officially approved the setting up of a National Energy Conservation Fund in June. A few weeks later the proposal was approved by the Assemblée Nationale. This program will provide over half a million dollars for energy conservation retrofits to about 15,000 houses in Djibouti-ville. The technical work, which involves the insulation of several thousand domestic refrigerators and the replacement of several thousand incandescent lighting units, will be directed by the Project, and will require the supervision of as many as eighteen technicians working in the Quartiers for over a year.

A number of administrative steps still remain to be taken, however, but this national program should begin before the end of the year. The UNDP has expressed an interest in supporting this initiative. A proposal is being prepared for consideration by this agency.

7. Collaboration with the Djibouti Urban Development Project (PDUD) continues. The bids for the house for the Chef du Quartier 3 have been reviewed, and a builder has been selected. Fred Guymont, an engineer from USAID offices in Nairobi, was in Djibouti recently and recommended a number of revisions to the building contract.

The revised contract for the building of the prototype energy-efficient house was signed by ISERST and the Djiboutian contractor in August. However, the start of construction has been delayed by the general slowdown in government administrative operations during August and September.

A contractor has also been selected for the Balbala house and that contract should be signed shortly. However, construction of this prototype building cannot commence until title to the plot of land is formally awarded to ISERST.

Agreement has been reached with the Mission de Coopération of the French Government and the Ministère de la Santé on the financial arrangements concerning the construction of the annex to the Ambouli dispensary. This energy efficient building is being cofinanced by the Mission and by USAID. Construction should begin shortly.

8. Collaboration with the Ministère de la Santé has extended into other areas. The energy conservation team is advising the Ministry on the construction of a new wing for the hospital at Dikhil for tuberculosis patients. This annex will be built according to the principles of bioclimatic and energy-efficient building design being promoted by the Project.

The site for the new building was visited in late August to view the terrain. After examining the data on wind direction at the site, the Project team recommended that the building be oriented so as to maximize the natural ventilation of the hospital wards.

3. RENEWABLE ENERGY

1. Several initiatives are underway. One of the more interesting activities concerns the Project's technical assistance to a private farmer, Mr. Hassema, who owns several hectares of land out at Hanlé in the western part of the country. —

This farmer pumps as much as 250 m³ of water per day from a shallow well to irrigate his land. An economic analysis of the pumping options: Diesel engine, photovoltaic or wind, showed that a wind pump was clearly competitive with the more conventional motor pump alternative. One of the Project technicians presented the results of the study to the farmer, who is considering whether to purchase the windmill pump that we have recommended: a large Kijito windpump from Kenya, with a rotor diameter of 24 feet.

If Mr. Hassema decides to purchase this machine it will be by far the biggest windmill pump in Djibouti, and the first windpump to be privately owned and financed. The farmer has applied to the Caisse de Développement for a loan to cover the cost of this machine which, with freight from Kenya, will cost about \$16,000.

The selection of this machine was based on the estimated windspeed data for the site which was actually measured at Yobocki, about 15 kilometres away from Hanlé but on the same plain. A small anemometre installed for several weeks at the site confirmed that average windspeeds are greater than 4 m/s. The Climatronics unit at Yobocki has now been moved onto the farmer's land at Hanlé to record the long-term mean windspeed at the site, and to check again that windspeeds are sufficient to pump the required amount of water.

The Project has offered to assist Mr. Hassema with the necessary civil engineering work, and with the installation of the machine on the site at Hanlé. If this windmill is indeed purchased the Project will organize a short training program and public demonstration of

wind-powered water pumping at the time the windmill is installed and started up.

2. The renewable energy team has been checking up on some of the photovoltaic pumps in operation in Djibouti. Trips have been made to As Eyla and Obock to confirm that the pumps are working properly, to make any necessary repairs, and to collect data on pump performance. The AY MacDonald pump at Obock was returned to ISERST for examination because the water flow from the pump was found to be very low.

This pump was found to be almost completely plugged up with scale. The pump was dismantled, the impeller descaled and cleaned, and the pump now runs normally. It is clear that pumps operating in highly saline water need to be periodically descaled if they are to continue operating without problems.

An additional AY McDonald pump has been purchased by the Project and is now being tested at ISERST by the renewable energy team. The SEI floating pump, which was sent to Germany for repair in May, has been returned; this pump will be tested by the Project before being installed in the field.

3. The Project renewable energy team continues to provide technical assistance to government agencies, services and individuals interested in installing photovoltaic or wind powered water pumping systems. For instance, with assistance from the Project the Commissaire of Tadjourah has presented a proposal to the US Embassy for the installation of two photovoltaic pumps in the villages of Khalaf and Sagalou, and this proposal has been approved by the Embassy. Two photovoltaic pumping systems have been ordered from AY McDonald in the US.

Technical assistance has also been provided to the Commissaire of Obock for a photovoltaic pumping project in the village of Medeho. This project is also financed by the US Embassy.

The Aermotor windmill at Asa Gueyla has been repaired. This machine has been pumping steadily but had been leaking water through the stuffing box seal. The seal was replaced and the pump is now operating correctly.

4. The Commissaires of Tadjourah and Obock have agreed to the moving to more favorable sites of three of the big wind machines in their districts. These machines (the Aermotors at Khor Angar and Asaguenita, and the Humblot at Adailou) are in good condition but they are not doing much useful work at their present sites--either because the wells are almost dry or, in the case of Khor Angar, because the output from the windmill cannot meet the demand for water at that particular site.

The Aermotor windmill at Khor Angar will be moved to the agricultural gardens of the Service de l'Agriculture at Ambouli, close to the main road where it will be in full view. This site has been chosen because of its high visibility--at the present time few people in Djibouti ville can see a real windmill pump without travelling quite some distance. The nearest operating machine is at Aramadoule (Ali Sabieh) but the machine is not easy to locate.

The relocation of the windmills is to be carried out with the help of the French Army whose assistance has been offered by the commanding officer of the 5th Regiment. The details of this collaborative effort have recently been agreed upon. The first group of 30 men will be available to work for the Project in December. They will be put to work moving the windmills at Khor Angar and Asa Guenita to their new sites at Ambouli and Obock. The French soldiers will also dismantle, clean, and repaint the machines and the towers.

The second group will move the windmill at Aidailou to a site close to Tadjourah early next year. The third group will be deployed in the south of the country and will work to improve several rural wells that need to be deepened, or which require proper construction of the well shaft.

5. The agreement between the Association Francaise pour la Maitrise de l'Energie (AFME) and Total Energie Development (TED) has finally been signed after a delay of close to a year. Under the terms of this agreement, AFME will pay for 4 prototype photovoltaic pumps to be furnished by TED and donated to ISERST and the Genie Rural. The first of the TED floating solar pumps arrived in Djibouti in mid-September and is now under test.

A similar agreement between the Mission de Coopération of the French Government and the Genie Rural has also been signed. Under the terms of this second agreement the Genie Rural will receive ten photovoltaic pumps which will be tested by the Project before being placed in rural wells.

6. Several pieces of equipment have been received. The AY McDonald photovoltaic pump system for Medeho has arrived and has been tested. A submersible pump also manufactured by AY McDonald was delivered and is being tested by Project technicians. An Indian Mark II hand pump, ordered in August, has also been received.

4. INSTITUTIONAL DEVELOPMENT

1. The electrical laboratory in the Renewable Energy Building is being set up. Equipment and instruments have been purchased and installed, and the laboratory is gradually taking shape. When finished, the equipment will enable ISERST technicians to test and repair electrical and electronic equipment such as pump motors, photovoltaic system controllers, and inverters.
2. Training courses were run for two months at ISERST during August and September in collaboration with the instructors at the Lycée d'Enseignement Professionel (LEP). Classes in electrical and electromechanical principles and technology were given three evenings a week in the new electrical laboratory. Eight technicians (including Soulieman, Nabil, and Abdourahman Nour from ISERST) attended the classes. The instructors from the LEP continue to work with Project technicians on a part-time basis.
3. ISERST'S information specialist, Nader Abdulkarim, continues his training in english language and information sciences in the US. Nader will return to Djibouti at the end of the year.
4. The training of Yacob Nour, the energy planning assistant in the Service de l'Energie of the Ministère de l'Industrie, is going well. Yacob is working full time with the international team of energy experts.

5. ENERGY POLICY AND PLANNING

1. Professor Ioan Stancescu conducted his 2nd mission to Djibouti from June 15 until July 8. Professor Stancescu is the leader of the team of international energy experts now working with ISERST and the Energy Initiatives Project to formulate an Integrated National Energy Plan for the Government of Djibouti. The consulting team will also identify and present a comprehensive set of priority energy sector development projects which it is hoped will elicit financial support from the international donor agencies.

After several months of review and evaluation, an international team of experts has finally been assembled. The team members are listed below:

<u>NAME</u>	<u>POSITION</u>	<u>AFFILIATION</u>
Ioan STANCESCU	Senior energy analyst (team leader)	UN energy consultant based in Germany.
Arturo VILLAVICENCIO	Energy analyst	National Institute of Energy (INE), Quito, Ecuador.
Renato PUGNO	Economist	ElectroConsult, Milan, Italy.
Jose Flores GOMEZ	Transportation expert	GRECA associates, and Government of Mexico.
Mihai PETCU	Tariffication expert	Conseiller Technique to Government of Zaire at Kinshasa.
Dominique BRIANE	Rural energy expert	Association Bois de Feu, Aix-en-Provence, France.

The mission schedules of each of the team members is as follows:

Consultant	june	july	aug	sept	oct	nov	dec
Stancescu	XX X			X	X	XX	
Villavicencio				XXXX	XXXX		
Pugno				XX	XXXX	XX	
Gomez			XX	XX			
Petcu					XXXX		
Briane			XXX	X			

2. Besides the usual administrative arrangements, preparations for the arrival of the team of energy experts have focused on the organization of the data necessary for the modeling of energy demand over the short and long term using the MEDEE-S computer program--the computer program which has been developed by the Institut Economique et Juridique de l'Energie (IEJE) in Grenoble for the modeling of energy demand in developing countries. The data base has been brought up to date, while supplementary data have been sought out where these were lacking.

A particular focus was to gather information on the structure of household energy demand in the rural areas. Preliminary household surveys were conducted in Dikhil, Ali Sabieh, Tadjourah, and Obock, by Project technicians. Data were collected on the consumption of wood, charcoal, kerosene, and electricity, as well as supplementary information on how each house was constructed and whether elementary energy conservation principles were being followed.

3. The first member of the expert team to arrive in Djibouti was Dominique Briane, the expert on biomass utilization from the Association Bois de Feu in France. Briane's principal tasks were to determine more precisely the consumption of wood and charcoal in the country, particularly in the rural areas, and to recommend ways in which the utilization of biomass resources in Djibouti could be improved.

After a series of more detailed surveys in Tadjourah, Randa, As Eyla, Ali Sabieh, and Dikhil, conducted by Briane with the help of almost all the Project technicians, and using the results of the recent national census survey, to which the project appended a page on household energy consumption, a much more detailed picture of biomass energy consumption has emerged.

For the country as a whole, 1986 fuelwood consumption is estimated as 27,600 tonnes, with charcoal consumption running at 1,200 tonnes. The total amount of wood required for both biomass fuels is approximately 35,500 tonnes. These figures are significantly lower than previous estimates.

As far as deforestation is concerned, the situation does not appear to have critically affected the availability of fuelwood, although there are problems in the immediate vicinity of a number of district centres. Overgrazing by goats, rather than fuelwood collecting or the production of charcoal, is considered the principal cause of the declining forest resource base. These conclusions remain tentative, however, because the resource base has not yet been fully studied or inventoried.

Apart from recommending that work continue to survey both the biomass resource base, and the regional and seasonal variations in supply and demand, Briane also proposed that an improved method of charcoal production be introduced in Djibouti. The Project technicians have been shown how to make charcoal using a simple covered pit--a technique which doubles the efficiency of the crude technique used in Djibouti.

In a few weeks time when the national energy planning work is completed, and when the season for charcoal production is in full swing, Project technicians will demonstrate the new technique in one of the districts --probably Tadjourah where charcoal is produced in significant quantities. If that initiative is successful, the other Districts will be approached in turn.

Briane also supervised the testing of local kerosene stoves (which were found to be quite efficient), and demonstrated how to improve the efficiency of the traditional 3-stone fire by building a clay enclosure around the 3-stone base.

4. The expert on transportation sector planning, Jose Flores Gomez, arrived on August 16th from Mexico City. One of Gomez' main tasks was to study the transportation sector and to develop a much more detailed picture of the way the system is structured. Several quite detailed surveys have been conducted of vehicle numbers and types, fuel consumption, traffic densities, bus passengers per trip etc. The focus has been primarily on the operation of the urban transport system.

One recommendation which has been made is for the bus and minibus vehicles to be divided into two groups, each of which will operate on alternate days. There are several advantages to this arrangement but it remains to be seen whether this proposal will be accepted by the Government. The bus driver syndicates, however, support the idea.

Other recommendations presented in the report by Gomez include the setting up of a vehicle repair and maintenance center for buses and minibuses, the differential taxing of imported vehicles based on vehicle engine size, the revision of the present fuel pricing policy, the setting up of a documentation center which will collect and hold all the statistical data available on the transportation sector, and the preparation of a development plan for the urban transport system in Djibouti-ville.

5. The third energy expert, Arturo Villavicencio, arrived from Ecuador on September 4th after meeting with Team Leader Professor Ioan Stancescu and Renato Pugno (the economist provided by the UNDP), in Paris on September 2nd. Villavicencio is an expert on the MEDEE-S computer program which is being applied in Djibouti.

The MEDEE-S model requires a fairly comprehensive data base in order to run effectively. Supplementary data on energy consumption, population figures, household structure etc. have been taken from a recent census conducted by the Direction National de la Statistique (DINAS). Project personnel are assisting DINAS with the processing of the data collected during this survey.

6. The project economist, Renato Pugno, arrived in Djibouti on September 14th to start his 2 month mission, and Mihai Petcu, the expert on electricity tarification, arrived in Djibouti at the end of September. Pugno has started work on the economic analysis of the geothermal power development project now underway in Djibouti.

7. The organization of the national energy planning work and the Conference of Donors is being funded by USAID and the UNDP. The planning work is now estimated to cost approximately \$189,000, a sum about evenly split between the UNDP and USAID.

The UNDP office in Djibouti officially signed the accord with the Government concerning this initiative on August 26th. Under the terms of this agreement the UNDP will finance the missions of Renato Pugno and Mihai Petcu. The UNDP will also purchase a computer, provide a secretary for 6 months, organize translation and interpretation services, and provide other office equipment.

8. After several weeks of long-distance communication between the Project team in Djibouti, Arturo Villavicencio in Quito, and the IEJE in Grenoble, the choice of a computer on which to run the MEDEE-S program was narrowed down to either an IBM-PC or a Bull Micral 60 machine.

Since IBM is not well established in Djibouti, in contrast to Bull who have an agent in town who can maintain the equipment as well as provide supplementary technical support, it was decided to opt for the Bull Micral 60 computer.

The computer was ordered from Bull in Paris the first week of August; they promised delivery before the beginning of September. However, two weeks later Bull advised their agent in Djibouti that there would be a delay in delivery of 4 weeks. No reason was given for the delay.

The UNDP representative in Djibouti asked the French Embassy to immediately telex Bull and to demand that they deliver the computer according to their original schedule. At the same time, the US Embassy in Djibouti was requested to ask the US Embassy in Paris to approve the export licence for the equipment without delay.

In the meantime, the UNDP loaned the Project one of their Bull Micral 30's to permit Villavicencio to at least set up the data files and check the program operation. The new Bull computer finally arrived at the end of September and is now being used by Villavicencio to run the MEDEE-S program.

6. OTHER RELATED ACTIVITIES

1. The amendment to the Project grant agreement was signed on September 14th by USAID and the Ministry of Foreign Affairs of the Government of Djibouti. The amendment increments project funds by \$400,000 and extends the PACD to September 30, 1987. PIL No. 19 was signed by ISERST the same day.

7. PROBLEMS AND ISSUES

7.1 None at the present time.

8. NEXT QUARTER ACTIVITIES

8.1 The National Energy Plan will be presented to the Government for review. The Plan will also present the energy sector development projects recommended by the international team of energy experts.

8.2 The National Energy Conservation Program should begin. The Project will provide technical assistance to this Government program.

8.3 The construction of the prototype energy-efficient houses will commence.

8.4 The first photovoltaic medical refrigerator in Djibouti will be installed in the dispensary at Hol-Hol.

8.5 The large windmills at Khor Angar and Asa Guenita will be moved to their new sites.

8.6 The three photovoltaic pumps for the villages of Medeho, Khalaf, and Sagalou will be installed.

8.7 The rest of the TED photovoltaic pumps should be received by ISERST and will be tested by the Project before being installed in the field.

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