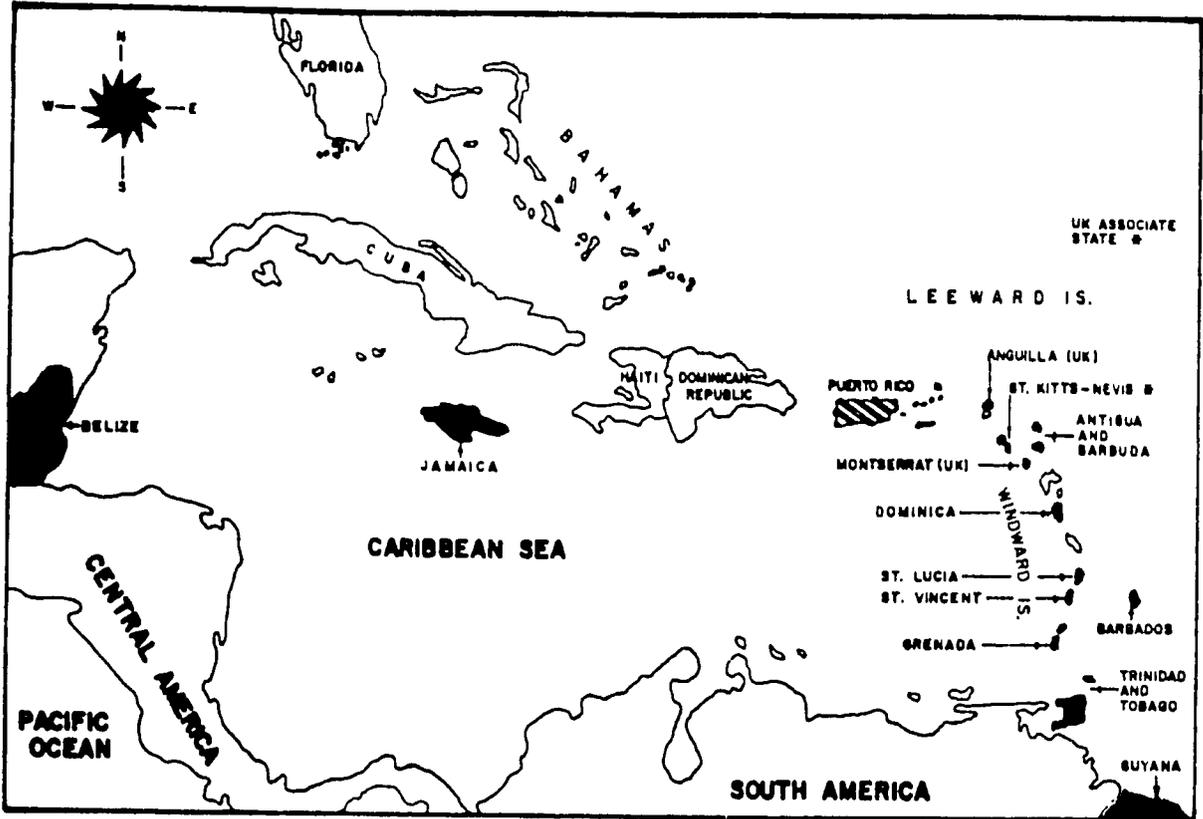


EVALUATION OF THE CARIBBEAN ALTERNATIVE ENERGY SYSTEMS PROJECT AND TECHNOLOGY COMPONENT OF THE EMPLOYMENT/INVESTMENT PROMOTION PROJECT



FINAL REPORT - DECEMBER 1981

SUBMITTED TO
CARIBBEAN COMMUNITY SECRETARIAT
GEORGETOWN, GUYANA
CARIBBEAN DEVELOPMENT BANK
WILDEY, ST. MICHAEL, BARBADOS, W.I.
U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
BARBADOS, W.I.



CENTER FOR ENERGY AND ENVIRONMENT RESEARCH
UNIVERSITY OF PUERTO RICO - U.S. DEPARTMENT OF ENERGY

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LIST OF ABBREVIATIONS

APUA	-	Antigua Public Utility Authority
BNSI	-	Barbados National Standards Institute
CAES	-	Caribbean Alternative Energy Systems
CARDI	-	Caribbean Agricultural Research and Development Institute
CARICOM	-	Caribbean Community (Secretariat)
CDB	-	Caribbean Development Bank
CEER	-	Center for Energy and Environment Research
CMI	-	Caribbean Meteorological Institute
DFC	-	Development Finance Corporation
DSI	-	Development Science Inc.
EAC	-	Energy Advisory Committee
GATT	-	General Agreements on Tariff and Trade
IED	-	International Energy/Development Inc.
ISO	-	International Standardization Organization
LDC	-	Less Developed Countries
MDC	-	More Developed Countries
R&D	-	Research and Development
RDO/C	-	Regional Development Officer/Caribbean
TE	-	Technology and Energy
TEU	-	Technology and Energy Unit
TIU	-	Technology Information Unit
TRF	-	Technology Research Fund
USAID	-	United States Agency for International Development
UWI	-	University of the West Indies

I THE CARIBBEAN ENERGY PROBLEM

All of the Caribbean countries except Trinidad-Tobago are petroleum importers, and the price increases on the international market during the last decade have had serious effects on the economies of these countries. The crude petroleum and refined products share of total merchandise imports increased from less than 9 percent in 1971 to about 25 percent in 1980.

In addition to sharing this problem, the Caribbean nations share several energy characteristics:

- (1) the subcritical sizes of most national energy systems limits the choice of solutions;
- (2) there are limited markets for indigenous fuels;
- (3) the use of indigenous fuels has been replaced by the use of imported petroleum;
- (4) commercially exploitable indigenous resources are few or are lacking;
- (5) there are few trained personnel to carry out energy assessments and develop alternative energy programs;
- (6) Some national governments have not yet accepted regional cooperative efforts as the best way to approach energy problems.

Realistic options include energy conservation, intensive development of certain indigenous energy resources, energy management, the structuring of energy institutions and sectors, and pricing policies. These options, though, require bilateral or multilateral support. Some progress in this direction has been

made during the last two years with the help and leadership of several regional and international agencies, but what has been accomplished is only a beginning.

This report focuses on a project concerning alternative energy solutions for the Region that has received combined support from USAID, CARICOM and CDB. In particular, this project (hereafter called the Project) is identified as the Caribbean Regional Project Paper for Alternative Energy Systems (AID/LAC/P-027, Proj. No. 538-0032, authorization date August 23, 1979) (hereinafter called Project Paper). The corresponding Project Paper states the goals and purpose as follows:

"The goal of the project is to develop a capability to utilize renewable energy sources in the Caribbean as alternatives to imported fossil fuels and to encourage energy conservation measures. This goal is achieved by introducing cost effective, renewable energy technologies and conservation programs through energy policy review, training of professionals and technicians, improved communications and testing of applications. The project responds to the desires of the MDCs and LDCs of the Region to achieve energy self-sufficiency to alleviate the balance of payments problems all of them, except Trinidad and Tobago, are facing because of rising petroleum prices.

"The purpose of the project is to establish an institutional capability in the Caribbean region for carrying out energy planning, including conducting country energy needs

assessments, and for designing, testing, adapting and disseminating alternative energy technologies."

Two years have now passed since the implementation of the Project began, and an evaluation is required by the terms of the project agreement. The major organizations, USAID, CARICOM, and CDB, will benefit greatly from a re-examination of the Project that focuses on the difficulties of implementation and on the weaknesses in the Project Paper. The following quotation is given to put this evaluation in its proper perspective.

"Energy planning must be an integral part of broader development planning and must be subordinated to wider goals and strategies. Energy supply and use are not ends in themselves; they are only means or instruments....the energy sector is more strongly linked to economic growth in the developing countries than in the industrial countries....there is no alternative development strategy offering an easy escape from the constraints of higher energy costs. Energy self-sufficiency is not to be pursued at all costs; for many countries, economic development will be better served by maintaining some level of imports....Nor are there any panaceas in the form of either cheap supply substitutes or dramatic conservation opportunities."

(Quote from National Academy of Sciences: Proceedings of International Workshop on Energy Survey Methodologies for Developing Countries, Jekyll Island, Georgia, January 21-25, 1980.)

II THE EVALUATION PROCESS

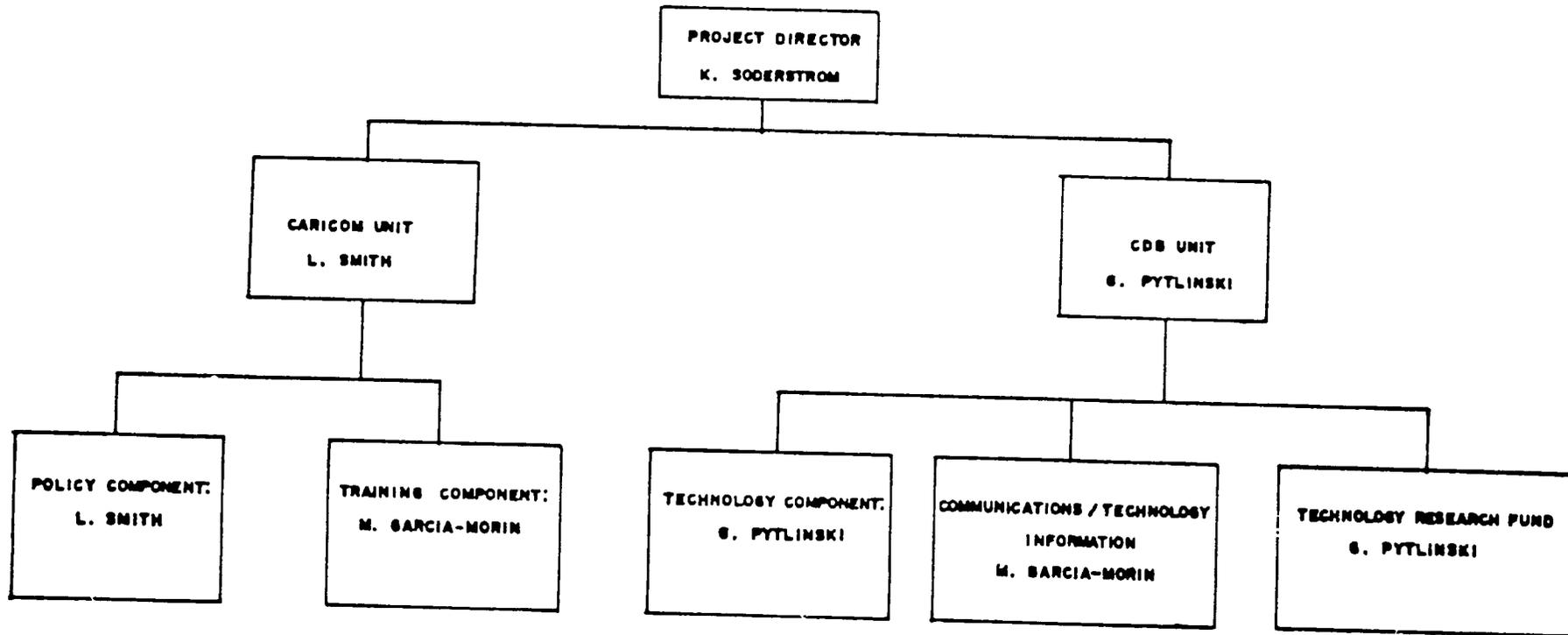
The Center for Energy and Environment Research (CEER) of the University of Puerto Rico signed a Consultancy Agreement with CARICOM and the CDB for the evaluation of the Technology component of USAID's Employment/Investment Promotion Project No. 538-0013 and for the evaluation of the Alternative Energy Systems Project No. 538-0032 on August 19, 1981. This consultancy agreement resulted from the acceptance of a proposal submitted to CDB and CARICOM for this evaluation. The proposal was accepted with modifications following a meeting on June 17, 1981, between Dr. Kenneth G. Soderstrom, Associate Director of CEER, Mr. Frank Granger, Head of Energy Unit of CARICOM and Dr. Jeffrey Dellimore, Assistant Director of CDB.

The evaluation team, composed of four members of CEER, was organized as shown in the organization chart in Figure 1. Figure 1 also shows the components of responsibility for this Project for both CARICOM and the CDB. Biographical information for each team member is found in Appendix A.

Pre-travel organization and meetings of the team began during the week of August 16, 1981, and visitations began on August 23, 1981. During that week visits were made to Barbados by Dr. Soderstrom, Dr. Pytlinski and Mr. Smith who met with Dr. Jeffrey Dellimore of CDB, Mr. Frank Granger of CARICOM, and officials of the USAID office in Barbados to discuss organizational matters.

FIGURE 1

ORGANIZATION OF PROJECT TEAM



The team also met with the CDB staff and other personnel involved with the Project. Dr. Soderstrom and Mr. Smith then travelled on to Guyana for meetings with Mr. Granger and his staff. Dr. Pytlinski stayed in Barbados for further interviews with the staff of CDB-TEU and the officers responsible for projects being administered by TEU.

The evaluation team met on Monday, August 31 at CEER headquarters in Puerto Rico. The following two weeks were spent by the team members in visiting the remaining countries. Travel information is given in Appendix B.

The team met together again on Monday, September 14 for an interchange of impressions and to plan the written report. Although there was still some material which the team had not received, it was decided to begin the individual draft reports based on the material on hand and to make further attempts to obtain the missing material.

After telephone conversations with both CDB and CARICOM it was agreed to hold another meeting in Barbados on September 25 and 26. Following this meeting the evaluation team met again several times. A final draft report was prepared and sent to CDB and CARICOM on October 23, 1981. This draft was reviewed by CDB, CARICOM and USAID and each organization submitted comments to CEER at a meeting in Barbados on December 4, 1981. The team reviewed the suggestions carefully, made appropriate revisions, and completed the final report in December, 1981.

The Terms of Reference of the Contract for this evaluation are included in their complete form in Appendix C. The main body of this report responding to the Terms of Reference corresponds to chapters III through VIII in which the five components of the Project as shown in the organization chart of Figure 1 are considered separately in chapter IV through VIII. Each chapter is a result of a combination of types of information retrieval such as: (a) review of pertinent documents of CDB, CARICOM, USAID and other organizations related to the Project, (b) personal interviews, (c) discussion with Project personnel, and (d) discussion and written interchange among the evaluation team members.

Basic to the overall evaluation is familiarization with the pertinent documents. The prime document for the Project is the Project Paper. The evaluation team addressed the key issues related to the Project that are raised in the Terms of Reference. Chapter III discusses these key issues and contain major recommendations on the overall Project. Chapter IV to VIII focus on the particular components of the Program that have to be evaluated and follow the format of the Terms of Reference. Consequently, assumptions, objectives, problems and situations are discussed first; recommendations are presented together under a separate heading.

III THE OVERALL PROJECT EVALUATION

INTRODUCTION

This chapter provides an overview of the Caribbean Alternative Energy Systems Project, a discussion of aspects which are common to its components and an evaluation of Project activities, taken as a whole. This evaluation uses the same guidelines from the Terms of Reference that are applied to the individual project components in the subsequent chapters of this report.

The purpose of the Project is to ~~establish an institu-~~
tional capability in the Region for

- (1) Carrying out of energy planning, including the conduct of energy needs assessments at the national level, and for,
- (2) Designing, testing, adapting, and disseminating alternative energy technologies.

Due to the complexity and scope of the Project, activities under it have been grouped in four components or "programs." Each of these programs has its own budget and is assigned either to the Energy Unit (EU) of CARICOM or the Technology and Energy Unit of CDB (TEU), according to the specialized abilities of these agencies. The activities corresponding to each program are discussed in detail in Chapters IV-VII of this report. Following is a brief summary of Project funding by program.

TABLE I
PROJECT FUNDING¹

<u>Program</u>	<u>5 year budget</u>	<u>Chapter</u>
CARICOM		
Policy	\$ 938,000	IV
Training	1,380,000	V
Energy Unit Staff	<u>1,115,000</u>	
Sub Total	3,433,000	
CDB		
Communications & Information	613,000	VII
Technology	2,646,000	VI
TEU Staff	<u>1,484,000</u>	
Sub Total	4,743,000	
Total	<u>\$8,176,000</u>	

¹From Table G, page 63 of Project Paper. This includes all contributions and activities except \$300,000 for bagass dryer in the Dominican Republic, which is outside this evaluation.

Note that the TEU has responsibility for other projects, as well as the Communications and Technology programs of the CAES Project. One of these projects is the Technology Research Fund (TRF) which is included within the scope of the evaluation and is discussed in Chapter VIII of this report because of its close relation with the technology Program of the CAES Project.

OVERALL EVALUATION

The countries of the Region obviously have serious energy

problems which can only be solved by an approach which is at once fundamental, long-term, resistant, regional and sustained. Moreover, continuous institution building in the energy field, at both a national and regional level, is an essential part of this approach.

Conceptually, the CAES Project fully addresses the [need for institution building] although its specific objectives are unrealistic. As implemented, the project has made significant progress to date in the policy and technology programs, although all programs are behind schedule. Useful outputs of acceptable quality have been produced in the form of needs and resource assessments, conservation studies, technology evaluations, etc. [Two energy units have been established, one in CDB and one in CARICOM, and have acquired an ability to carry out project activities.]

In brief, this Project is very much needed; it is functioning and should be continued with funding at least as great as that currently budgeted. Moreover, communications, information and training activities should be accelerated. The Energy Unit in CARICOM and the TEU in CDB should be made permanent parts of their respective parent organizations.

Nevertheless, there is an unbridgeable gap between Project objectives and Project resources which must be reconciled. Moreover, account must be taken of certain assumptions of the Project Paper which are questionable. Vague objectives must be spelled out.

Also, to improve Project performance, operational

deficiencies must be remedied. These include the failure of CDB (before October 1981) and CARICOM to provide the supervisors of the EU and the TEU respectively with the financial information which they need for management decision making and financial planning. Also, other than routine requests for reimbursement to USAID, no financial information system exists for the Project as a whole. Reports to USAID from CARICOM and CDB are late and those from CARICOM do not comply with standard procedures. [Indeed, despite repeated requests, orally and in writing, the team was unable to obtain from CARICOM even an estimate of expenditures by program to date.] Finally, there is very little coordination between USAID on one hand, and the two operating agencies on the other. ✓

Specific recommendations to deal with these problems at the Project level are found at the end of this chapter. These recommendations relate to the Project as a whole or to one of the operating agencies. Additional recommendations relating to specific programs are found in the corresponding chapters.

Given the lack of financial information, it is not possible to make recommendations for restructuring the Project budget and objectives, although such restructuring is clearly needed due to the gap between Project and Project resources. Therefore, recommendations for partial restructuring or for hiring additional personnel are those the Evaluation Team believes necessary and feasible under

any likely set of circumstances.

At this point the overall Project can be considered in terms of the guidelines set forth in the Terms of Reference. Four particular areas of discussion are used to organize the following chapters.

1. The movement towards the program objectives; the sufficiency of the technical and financial inputs; the validity of the original assumptions; regional and national constraints.
2. The effectiveness of CARICOM and CDB (whichever appropriate) administrative procedures.
3. The impact of project component and sub-project activities and the expected impact of individual planned activities.
4. Specific recommendations.

The first of these four areas merits a detailed analysis. Key questions must be raised and discussed, especially about the validity of the original assumptions, before a consideration of the other areas can be undertaken.

3.1 The movement towards the program objectives; the sufficiency of the technical and financial inputs; the validity of the original assumptions; regional and national constraints.

A. Are the original assumptions still valid?

There are a great many assumptions scattered throughout the Project Paper. Some of them are labeled as such. Others appear in the form of assertions about the course of future

events. Clearly most of them are still valid and require no discussion. However, comment on the assumptions found on pages 109 and 110 as "Important Assumptions" of the Project Paper is now necessary.

Page 109

1. "Cost of fossil fuel imports will continue to rise (consume foreign exchange earnings, thus making alternative energy technologies cost effective investments for the Caribbean countries)."

In a general sense, this assumption is still valid. The cost of fossil fuel imports for the Region will continue to rise indefinitely, for the following reasons, among others:

(1) Even with slow economic growth, widespread substitution of petroleum fuels and maximum efforts at energy conservation, world consumption of petroleum will grow at an average annual rate compounded of at least one percent, over the next two decades. This growth, plus the inevitable decline in the production from existing wells, will require the discovery of very substantial reserves if an energy crisis is to be avoided.

(2) In recent years, the cost of finding and developing oil has risen faster than the general rate of inflation and is expected to rise at least as fast in coming decades. This reflects both the technologically advanced equipment being introduced in the industry and the greater geological and physical difficulty of the areas being explored. At the same time we may expect reductions in the real (inflation-adjusted) cost of alternative energy technologies due to technological advances and increasing scales of production

and use.

(3) OPEC will continue to exert a controlling influence on petroleum prices.

(4) Petroleum supplies will be constricted from time to time by random shocks of a political nature.

The important question is when will a particular technology become cost effective for the Caribbean? This depends on several factors, especially on the rate of inflation in petroleum prices, the general rate of inflation in the Region, the energy pricing policies of national governments and the rate of technological improvement for the alternative in question. A further complication is the irregular pattern of changes in petroleum prices, which makes it difficult to project these prices, and hence the life-cycle rate of return, on investments in alternative energy systems.

Nevertheless, the evaluation team believes that:

(1) Over periods of five years or more, the prices of petroleum fuels will, on the average, escalate at a rate at least one or two points above the general rate of inflation for the Region.

(2) Some biomass, mini-hydro, solar and wind systems may already be competitive with petroleum fuels in the Region, provided countries price these fuels, and the conventional fuels replaced by them, at full economic cost.

(3) Other such systems will become economic within the next five years.

2. "Alternative energy technologies will permit the electrification of remote villages and households which could not efficiently be served by extending the traditional fossil fuel generated system."

This assumption is probably not valid, however one wishes to interpret it. At present levels of income in remote areas, extensions of the grid to the countryside is uneconomic, whether the grid depends on fossil or alternative fuels. Moreover, real incomes in remote areas are liable to rise so slowly, if at all, that grid extension will not become economically feasible in the foreseeable future. Finally, there are no stand-alone isolated systems which can compete on a cost basis with diesel-electric units, whether for residential or village use. As examples, stand-alone wind or photovoltaic systems require storage batteries to deliver a steady power supply; this can easily double the cost and make the system too expensive. The probability of extensive use of these systems would depend on their being incorporated into the electric grid with the provision for use upon an availability or "sell-back" basis so that there would be no cost for storage.

3. "Local communities will accept and use non-conventional energy technologies."

As the cost of petroleum rises, communities will accept these technologies since their cost is reduced.

4. "Countries in the Region will restrict future growth of consumption through more efficient energy use."

The validity of this assumption depends in part on the amount of communication, information and training carried out by the Project, and the public involvement in conser-

vation and energy planning.

5. "Countries will be willing to adopt a rational pricing structure for energy (i.e. petroleum products should not be supplied at lower than international prices)."

The validity of this assumption is critical to the success of the Project. At present, there exists in the Region a number of well-known cases of pricing of electricity and other fuels at prices significantly below their economic cost. Moreover, the question of energy pricing has not been dealt with adequately in the formal energy assessments prepared to date, and presents difficult questions of public policy for member governments. Hence, the validity of this assumption remains to be seen. However, if national governments do not move gradually towards a rational structure of energy prices, energy conservation will not be encouraged, the balance of payments problems will be increased and many alternate energy systems will be uneconomic. In this regard, note that one of two policy studies just begun by CARICOM deals with petroleum prices.

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1. "Countries will be willing to incorporate energy planning into macro-economic planning."

This too remains to be seen. Draft reports for energy needs assessments have been completed in only four countries and are still undergoing revision by the ministries concerned. However, based on the team's observations, if significant use is made of the assessments, it will probably include the incorporation of energy planning into macro-economic planning.

Follow-up and assistance in national energy policy planning and implementation by CARICOM will be important in this regard.

2. "An adequate number of human resources already exists in the area that can be trained in energy planning and non-conventional technologies."

Biologically speaking, there is no question that such resources exist. But unless the private sector and the governments give adequate priority to energy, it may be hard to pry these human resources loose from other activities. Moreover, in some countries there is probably an overall shortage of experienced people who are qualified to take the kind of training needed.

3. "Caribbean countries will be willing to cooperate and make human and technical resources available for developing their energy systems."

The assumption of a general willingness to cooperate is valid, but the analysis just given applies to this assumption also.

B. Are project objectives being met?

It is the consensus of the evaluation team that the project is behind schedule in all aspects; this point will be elaborated further in subsequent chapters. In general, the expectations expressed in the Project Paper are over-optimistic, especially for a complex, pioneering, experimental project involving 14 developing countries, none of which had ever approached energy in an integrated, comprehensive manner before. The following are four major reasons for the project being behind schedule:

(1) There were and continue to be difficulties in recruiting and retaining personnel of the calibre desired. How much of that is due to limitations of the resource pool and how much to locational factors has not been determined, but the evaluation team believes both factors are significant. Because of this situation, training is required both initially and throughout the Project's life to upgrade national and regional personnel.

(2) Both resource and energy assessments have taken longer than planned for a number of reasons. It was necessary to do a great deal of preliminary work to orient countries as to what assessments are, to assure them they would not be used against them by international lending agencies, and to obtain commitments to provide the resources and the information required. In both the public and private sectors, personal contacts were sometimes necessary to obtain required information.

(3) A number of local governments or organizations that were interested in cooperating with the Project had difficulty in deciding how they were going to deal with the energy problem in organizational terms. Moreover, in some cases, the organization of energy matters was delayed by reorganizations of unrelated government activities. There were also problems in identifying suitable people at the institutional and national level or in having them transferred from other activities.

(4) In some cases, energy functions were assigned as

additional duties to persons in existing positions in national governments and organizations. If the person was thereby overloaded or was led to consider this as only a temporary assignment, he might not dedicate enough time to these functions.

The following is a discussion of national and regional constraints which affect the project as a whole. The observations and conclusions represent a distillation of discussions and interviews with over 50 persons, of the contents of pertinent documents, and of observations of Project activities and related events.

C. What are the existing national constraints on Project implementation?

1. Small size of country, economy and energy systems.

Size not only is, but will always be, something of a problem because it limits the national, human and financial resources available for energy, causes diseconomies of scale (such as inability to develop desired specialized skills), and makes the local energy organization more vulnerable to the effects of turnover, political changes, brain drain, etc. However, once effective regional programs are in place and good energy and resource assessments have been prepared, the importance of this constraint should be substantially reduced.

2. Insufficient national priority for energy.

It has happened before, and may happen again, that the leaders of a country may consider certain other problems

to be even more serious than the energy problem. Consequently, they may decline to make sufficient human and financial resources available for the latter. This may occur even when there is a near term monetary benefit for the government in taking advantage of regional energy programs. Based on Project experience to date, this constraint will vary in seriousness from country to country and from time to time. Where operational, it will usually delay Project activities and increase the regional contribution required rather than abort the activities.

3. Conflicts between long-term and short-term needs.

Priorities may be dictated by the availability of funds rather than by the importance of the problem addressed, to the detriment of project activities. This situation reflects lack of financial resources, pressing short-term needs and the long-term payoff of many energy programs. It also reflects a failure to quantify, in the national planning process, the potential cost of supply cutoffs and sudden increases in the prices of energy products.

4. Lack of coordination between ministries.

This can happen in the most efficient countries, but is particularly hard on energy which requires an above-average amount of coordination. For example, for good reasons field tests and demonstrations of alternate energy technologies may be parceled out to different ministries. If coordination is poor, the ministry in charge of energy may lose control over program and budget priorities.

5. The "additional duty" problem.

In many countries, it is common to assign energy functions as additional duties to one or more persons rather than to hire full-time energy persons. However, if the persons so assigned are expected to perform their original duties as well with no increase in pay, morale is likely to be poor and some tasks are likely to be neglected.

D. What are the existing regional constraints on Project implementation?

1. The inherent complexity of the energy problem.

In a number of places, the Project Paper identifies the small size of the participating countries, their economies and energy systems as an important, and often decisive, constraint on national solutions to energy problems, and it makes a powerful justification for a regional approach. It certainly should be cheaper to deal with the energy problems of a group of neighboring small areas on a regional basis than on an individual basis, whether the small areas constitute separate countries or sub-divisions within one large country. But this approach will not be simpler; it will be more complex. The bigger the area, the greater the variety of equipment, site conditions and technologies that have to be considered. Unless this increased complexity is specifically recognized and taken into account, many of the "economies of scale" obtained by using a regional approach will be lost. Worse yet, poor solutions will then prevail throughout the Region. After all, if the energy problem were simple, a small LDC could

order a "solution" to its problem out of an equipment catalog.

2. The lack of coordination between international assistance agencies.

This is discussed in section 3.2 which deals with the effectiveness of CARICOM and CDB operational procedures.

3. The wide variety of conditions in the Region.

This is mentioned in section 3.3 which deals with the impact of the project component and sub-project activities.

4. The lack of experience with mission-oriented research.

5. Inadequate financial resources for the Project.

Because the expectation of the Project Paper are over optimistic, the financial resources required to carry out the Project are inadequate, both in total and by program. Under the circumstances, it would be desirable to revise the Project objectives, to recommend a new allocation of existing financial resources and, perhaps, to recommend a change in the overall level of project funds as well.

However, despite repeated verbal and written requests, the evaluation team has been unable to obtain from CARICOM expenditure data necessary for this task. Specifically, the team has been unable to obtain expenditures on CARICOM staff, total CARICOM expenditures and an estimated distribution of the latter by activity for the evaluation period.

The estimate of "outside" expenditures on assessments,

received from CARICOM by telex on October 17, is inadequate to the needs of the evaluation team for the following reasons.

(A) Expenditures for CARICOM staff cover two programs - policy and training - and are a significant part of the total budget for each program.

(B) Although total staff expenditures may be only moderately sensitive to changes in the "product mix" of the EU's output, total expenditures of all kinds certainly are sensitive to the number and variety of activities. Indeed, most activity costs are variable, not fixed. Hence, one must have an estimate of both staff and outside expenditures, by activity, in order to estimate the tradeoffs involved in changing program objectives and the EU's output mix.

(C) With regard to energy needs assessments in particular, it is clear that both the total cost of an assessment and its supporting studies and the ratio of staff to outside expenditures has varied, and will vary, from country to country. Therefore, the total cost cannot be meaningfully estimated from outside expenditure data alone.

(D) Finally, the team wishes to emphasize that, regardless of the foregoing, adequate financial information should be available both to project managers and to evaluation teams as a matter of course. In this regard, adequate financial information is included in CDB's "Progress Report" of August 1981 to USAID. Furthermore, since October 1981, the Head of the TEU has been receiving a monthly statement

of total expenditures and some other data for each TEU sub-project.

Note that the foregoing refers to financial information required for management decision making, planning and project evaluation and is not the type required to support requests for reimbursement to USAID.

Financial reporting and systems and recommendations are addressed later in this chapter.

6. Procurement

Item A of the Project Authorization requires regional or U.S. Procurement of goods and services, except for US \$500,000 which, per Section E, may be procured from countries included in AID geographic code 899. This waiver is fairly straightforward. However, at the only meeting of the Advisory Committee, the CARICOM secretariat stated that, "to qualify for this waiver, it had to be demonstrated that every effort had been made to obtain requirements from U.S. sources going elsewhere" (Report p. 3, item 11). Item A also requires that ocean shipping be procured in the U.S., regardless of where the cargo is procured, except as AID may agree in writing. These restrictions appear to have caused delay in only one significant case so far, the Guyana forestry study.

3.2 The effectiveness of CARICOM and CDB administrative and operational procedures.

Many multilateral and bilateral international assistance agencies are active in the Caribbean, and many

of them include alternative energy activities in their programs. Appendix II, page 2, of the Project Paper and "Caribbean Energy Survey," of the Interamerican Development Bank (Washington, April 1979), report that 19 agencies have on-going projects, have completed or have proposed projects of this kind. In the words of the Project Paper (p. 19) "coordination of these efforts has been generally lacking in the past" and "in few instances have (these programs) sought to involve international cooperation within the Region." Indeed, some of the agencies involved cannot even agree on the history of their relations, if we are to judge by the two versions (Project Paper, p. 21 and "Introduction" of the Survey) of the June 1978 meeting of the Caribbean Group for Cooperation in Economic Development.

Fortunately, based on verbal and written evidence, the situation seems to have improved somewhat during the past year. The roles of CDB and CARICOM in energy appear to be increasingly recognized by many agencies and institutions operating in the Region. CARICOM has a Functional Cooperation Division which is specifically dedicated to coordinating international assistance within CARICOM. CDB has an Information/Communication Officer to keep abreast of regional and international energy activities and to coordinate team information flow. The TEU and the TIU established in the CDB are recognized throughout the Region as important resource organizations dealing with energy and technology related activities.

Despite the apparent progress in this matter, there is still room for improvement. With 19 donor agencies, two Regional agencies, 14 governments and innumerable ministries in the picture, it is highly probable that significant cases of overlap, duplication or simple lack of coordination exist. Moreover, given the existing pattern of coordination and regional communications, it is highly probable that such cases will arise in the future. Problems are particularly likely in the areas of training and "hardware type" projects especially if certain donor agencies have preferences for particular educational institutions, manufacturers or technologies. Also, the number of field tests and demonstrations of a specific technology may be influenced more by the number of funding sources and manufacturers than by research design based on an analysis of a particular problem. In brief, existing arrangements invite persistence of the coordination problem.

Fortunately, a mechanism for improving coordination of energy activities in the Caribbean already exists - the Energy Advisory Committee - and offers a logical place to make the next attempt in this direction. In this regard, note that an important assumption of the Project Paper (p. 8) is that, "Tying the Project implementation together and providing policy advice to both the CDB and CARICOM will be the Energy Advisory Committee chaired by CARICOM...." Since the Committee has met only once, this assumption has not yet been fulfilled. However, the mechanism is there,

and the minutes of the first meeting indicate that the EAC had a good start.

According to the Project Paper, this Committee should develop general guidelines for Project implementation; advise on relative priorities for major program components, including budget allocation, and periodically review Project implementation. At its only meeting in the summer of 1980, the Committee did adopt these functions. The Committee also suggested, "all agencies involved should seek to coordinate their activities with the CARICOM Secretariat and the Caribbean Development Bank" (Report, p. 34, item 125).

Since the Committee will meet only occasionally, there is a need for a unit to provide continuity. The logical choice is CARICOM's Energy Unit, not only because of its functions but because the Chairman of the Advisory Committee is also the Director of the Sectoral Policy and Planning Division, of which the Energy Unit is a part. Therefore, the Energy Unit should act as a "secretariat" for the Advisory Committee.

However, for the Energy Advisory Committee to function successfully, the CDB, CARICOM and USAID must enjoy good communications with each other. The evaluation team thinks that communications between these key organizations is not very effective at this time. The situation can be rectified by reviewing the terms of the grants agreement and making the necessary changes. In fact, the evaluation team re-

commends that a steering committee made up of representatives from these agencies and chaired by the CDB representative should be created at once. This committee should meet monthly to coordinate energy activities, between meetings of the EAC. Finally, all reports should be prepared on time and shared with the other agencies.

Item E "Reports" of the Project Paper (p. 76) requires annual reports by CARICOM and CDB to RDO/C on an annual basis, beginning six months after signing of the Project Agreement. The Grant Agreement was signed on August 25, 1979. However, due to a number of factors, all of the conditions precedent to disbursement were not satisfied until July 1, 1980. CARICOM prepared an undated "Activity Report" in mid-1981 and CDB, an "Annual Report" for 1980 and a "Progress Report" in August 1981. There were many factors which led to these delays, including the desire of the agencies to hold the initial reports until they had some accomplishments to write about.

The Progress Report of CDB substantially complies with the requirements of Section E. The Activity Report of CARICOM is much more sketchy and lacks financial and budgetary data. The sketchiness is due in part to the nature of the training activities conducted up to the date of the report and to the fact that substantial assessment reports were still in progress at the time. Nevertheless, to give a few examples, supporting data should have been provided for the courses, in particular a description of

the curricula and the names and occupations of the instructors. Also, there should have been more discussion of the organization and methodology of the assessments and, if possible, a discrete but informative discussion of the "difficulties in collection data" and the "organizational snags" encountered. Also, the Head of the CARICOM Energy Unit carried out a considerable amount of background work in various countries so that the assessments could be undertaken with adequate local support and cooperation, yet this effort is not mentioned in the Activity Report. With regard to lack of financial and budgetary data the Activity Report does not comply with Section E and, in any case, is unacceptable.

3.3 The impact of project component and sub-project activities and the expected impact of individual planned activities.

Two comments must be made at this point. First, there is an unusual variety of conditions in the Caribbean, and the degree to which a given country can undertake energy work and the amount of regional assistance which it will require is liable to vary significantly from country to country. National energy organizations may vary from one to fifteen people and will have to be "custom designed" in each case. Also, regional assistance will have to be "custom tailored" to the needs of each country, and the two regional organizations will have to be prepared to offer a variety of services in different degrees of depths.

Second, there is a lack of experience with mission-oriented research through the Region. This is reflected in several ways, but two are critical. There is a shortage of the skills required in the preparation of project proposals and reports. Also, progress reports and final reports are often late and/or missing important information. These factors frequently cause considerable delays in the implementation of and reporting on Project activities, both to CARICOM and CDB and to USAID. This situation appears to reflect a complex of cultural, educational and economic factors, including the sub-culture of science within the Region and a reluctance of many people to discuss problems in writing for fear that they will be criticized. Meanwhile, CARICOM must continue to train personnel in numbers to "ask the right questions" and CDB must continue to spend time and money on pre-feasibility studies and the preparation of project proposals to itself.

3.4 Specific recommendations

(A) Project Priorities

(1) Notwithstanding the lack of financial information, it is possible to make the following recommendations as to budgetary priorities for the project assuming the present overall level of Project funding:

Priority #1

- (a) Energy needs assessments and supporting studies,
- (b) Resource assessments, such as wind, solar and biomass, which deal with obvious opportunities,

- (c) Training required to support (a) and (b) above, ✓
- (d) Technology evaluations related to obvious opportunities.

Priority #2

- (a) Policy studies and other activities at a regional and national level, which follow from the energy needs assessments,
- (b) Technology evaluations and energy activities demonstrations recommended by completed studies, ✓
- (c) Training required to support above,
- (d) Communications and information activities, especially as related to foregoing.

Priority #3

- (a) Energy conservation training.

Priority #4

All other.

- (2) The energy units should be made a permanent part of their respective parent organizations. ✓

(B) The organization of energy matters.

(1) CDB and CARICOM should continue to insist on an appropriate organizational recognition of energy and an appropriate resource contribution by each country as conditions of participation in regional energy activities.

(2) However, in recognition of national sovereignty, the importance of local knowledge and the great variety of conditions in the Region, the agencies should continue a flexible attitude as to the form of this organizational

recognition, in particular with regard to such aspects as:

- (a) The number of people in the unit with energy responsibilities,
- (b) Whether they work full-time or only part-time on energy matters,
- (c) The balance between technical, economic and other skills within the unit,
- (d) Coordination mechanism between the energy unit and the rest of the government.

(3) To the extent that the CDB and CARICOM are asked for advice in such matters, they should encourage the following organizational practices:

- (a) There should be a chief "energy coordinator" in each participating country, whether or not there is an energy unit or a unit with energy responsibilities.
- (b) That person should be a minister, a permanent secretary, or a top specialist reporting to one of the foregoing.
- (c) If there is an energy unit, it should be supervised by the coordinator and primarily concerned with analysis, assessments, budgets, coordination, policy planning, policy studies and program priorities.
- (d) Where logical and feasible, other energy activities should be assigned to existing organizations under conditions which

insure that they will keep the energy unit informed of their activities and that the unit has a say in determining the energy portion of the organization's budget. This will increase the problem of coordination on one hand; but, on the other, it should spread understanding of the energy problem, build a broader constituency for energy matters within the government and lead to more efficient use of human resources.

- (e) Energy functions should be assigned on a permanent basis, and energy personnel given the opportunity to make a career in the field. If energy functions constitute additional duties, workloads, salaries and priorities should be adjusted to secure adequate attention to energy.

(4) CDB and CARICOM should arrange with their normal country contacts (e.g. the ministry of foreign affairs or the ministry of finance) to permit direct communication between their energy units and the national counterparts.

(5) The training of country personnel whose work is related to energy in one way or another, the interchange of experience through workshops and the orientation of their supervisors should be given high priority in communication and training activities. Training for energy unit personnel

should include the rudiments of cost-benefit analysis so that they can at least make rough calculations as to the net benefits from energy substitution and conservation measures. Consideration should be given to orientation programs for top finance officers and even prime ministers.

(C) Approaching the energy problem at the national level

(1) CARICOM and CDB should encourage the participating countries to take the point of view that, in some sense or another, energy is everybody's business and is not just the concern of the national or regional energy units.

(2) National and regional activities in the areas of communications, information and training should aim at a wide variety of audiences and use a wide variety of media and materials, ranging from simple radio spots to sophisticated training courses. Assessment and study documents should be summarized at different levels of complexity and widely distributed to different types of audiences.

(3) These activities must involve both the public and private sectors and, within each sector, different groups within concerned organizations.

(4) Initially, priority should be given to the implementation of energy conservation measures:

(a) Near-term results can be achieved with benefits for organizations and people, countries and governments.

(b) Large numbers of people can be involved.

(c) Achievements are within the technological capability of the country in most cases.

(5) Second priority should be given to energy assessments and supporting studies. The preparation of high-quality assessments and studies should continue as fast as national and regional resources permit. These documents supply the data base and options which are the foundation of much activity in the areas of policy, training and technological applications.

(6) In countries where assessments have taken place, priorities will shift to policy studies and decisions and to training and technological applications. Communications, information and training activities should be increasingly oriented to supporting the other two.

(7) Where energy prices including electric rates do not reflect full economic costs, countries should increase the prices, unless, that is, cost benefit studies demonstrate otherwise. If governments do not move towards rational pricing structures, energy conservation will not be encouraged, the balance of payments problem will not be solved, and many alternate energy systems will be uneconomical.

(D) Approaching the energy problem at the regional level

(1) CARICOM and CDB should keep the development of their information activities on a par with the countries' needs for information and their ability to use it.

(2) To the extent possible, every program and sub-project should have some specific training aspects and objectives, even if it is not a training activity per se. For example, specific training objectives and activities should be included in work plans for country assessments. These objectives and activities should be worked out with the country concerned.

(3) The agencies must maintain the administrative and technical capacity to meet a wide variety of calls for assistance from the participating countries, at a wide variety of skill levels. For example, CDB should maintain a corps of experts in the different alternate energy technologies, as loan officers, project managers and/or consultants. Both agencies should be able to fund pre-feasibility studies and other low-level analyses, although one objective of the Project is to reduce or eliminate the need for such assistance.

(4) The responsibility for training of operating and maintenance personnel involved in application projects under the TE and TRF programs should be given to the CDB, which is directly involved in the implementation of these projects. Budget responsibility for this training should also be given to the CDB. As it is now, CARICOM is responsible for this type of training according to the Project Paper (p. 70).

(E) The Energy Advisory Committee

(1) The evaluation team understands that the next meeting of the Committee is schedule for the end of January ,

1981. The following documents should be considered at that meeting:

- (a) Recommendations of the evaluation team (final report),
- (b) At least one energy assessment,
- (c) Revised work plans for CDB and CARICOM (draft),
- (d) Adequate financial reports on Project activities.

For purposes of followup, a subsequent meeting should be held three months later and still another, six months later. After that, meetings should be held every twelve months or whenever one third of the participating countries request one. *not done*

(2) Consideration should be given to continuing the activities of the Committee beyond the life of the Project.

(3) CARICOM's Energy Unit should formally assume the responsibility of acting as secretariat for the Committee. Additional human resources, funded by the Project initially, should be provided to the Unit for this purpose.

(4) Participation of interested organizations and institutions in Committee meetings should be sent to all donor agencies active in the Region.

(5) Participants in the meeting, whether as representatives of participating countries, observers or guests, should be encouraged to describe the projects or activities they are contemplating or carrying out in the

Region.

(6) Special care should be taken to see that full and clear minutes of the meetings are circulated to all attendees as soon as possible afterwards. The necessary protocol should be observed in communicating and coordinating with the CARICOM Council of Energy Ministers.

(F) Steering Committee

A steering committee composed of the USAID representative and the heads of the TEU and the EU should be established immediately. This committee should handle all matters requiring coordination between the three organizations and, to the degree authorized, act for the EAC between its meetings.

Recommendations to improve operational and administrative procedures.

(1) The CDB, CARICOM and USAID should agree on specific delivery dates for the next set of progress reports. The period covered should be from the beginning of the Project to the end of the fiscal year. Financial reporting would cover the entire period. Narrative material would emphasize activities during the twelve months ending, in a mutually agreeable format. Each report would contain three appendices: a financial appendix, details of current projects and details of completed projects. Subsequent progress reports would be at twelve month intervals, for the period of twelve months. Delivery dates for these reports would be regarded as mandatory.

(2) As soon as possible, CARICOM should prepare for USAID information on its activities for the most recent date practicable, along the lines of those contained in the tables and comments of the CDB, "Progress Report" of August 1981.

(3) As soon as possible, a financial reporting system should be set up in each agency that will provide monthly for each program, subproject or other sub-program activity financial information along the lines described below. Project funds should be used to hire temporary help so that knowledgeable permanent staff can have the time to set up this system.

(4) There should be a monthly financial report for each program consisting of two tables - one for the current fiscal year to date, the other for the program life to date. Each table should have a separate one-line entry for each distinct study, sub-project or other program activity. Where necessary, "dummy" sub-project such as "overhead" or "unassigned funds" should be used so that all expenditures are accounted for and the columns add to program totals. The table for the current fiscal year should have the following columns: Current Year Budget (as revised); Expenditures - Prior Months; Expenditures - Current Month; Commitments - Prior Months; Commitments - Current Month; Balance Available. The "Commitment" columns would reflect only funds committed, but not disbursed. For each line, the figure in the budget column would equal the sum of those in the other columns. In the table for Program Life to Date, the words "Current Year"

would be replaced by "Cumulative" and "Month" by "Year",

(5) Once this reporting system is in place and
functioning, an effort should be made to allocate expenditures
so as to determine the total cost of each energy assessment
report and conservation report. The results will only be
approximate but should be quite useful for decision making
in the future.

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done.

IV POLICY

The objective of the countries participating in the Project is to develop an effective energy program which will solve the energy problem of the Region. This problem arises because the economy of the Region is at present heavily dependent on petroleum imports and on employment in energy-intensive industries. Specifically, the Region would like to achieve energy self-sufficiency while maintaining an acceptable rate of economic development.

The Project itself will not develop such a program nor solve the energy problem. However, it will contribute substantially to the attainment of this objective (a) by developing a capability to use renewable energy resources and (b) by encouraging energy conservation. The Project does this by developing various institutional capabilities throughout the Region, both at regional and national levels.

4.1 The movement towards the Program objectives; the sufficiency of the technical and financial inputs; the validity of the original assumptions; regional and national constraints.

The Energy Policy Program contributes to the Project objective by seeking to establish and strengthen institutional capability in energy planning. Although the objectives of the individual programs are repeated several times, never in quite the same words, the following discussion will be based on "Program Areas and Activities", which can be found on page 32 of the Project Paper. Specifically the Program seeks to:

- (1) Improve the data base necessary for energy policy formulation;
- (2) Undertake analyses of energy demand, trends and pricing;
- (3) Achieve the incorporation of energy planning into national economic planning;
- (4) Develop an understanding of the implications of economic development on energy demand; and
- (5) Identify energy issues that are best addressed on a regional basis.

Since planning should be a continuous, fluid and self-renewing process, its true results must be sought in the lives of the people whom the plans are meant to serve. However, for the process to be effective, every so often it must "coagulate" in the form of forecasts, plans, reports, mathematical models and studies which, hopefully, provide an intellectual launching pad for decision making. In the case of the Energy Policy Program, it was originally expected that the physical manifestations of the planning process would include:

- (1) Country energy assessments,
- (2) Country policy studies, and
- (3) Regional policy studies (Project Paper, pp. 32-34).

Although there are no such goals for the other two types of reports, quantitative goals for the preparation of country assessments are indicated by fiscal year as follows: (p. 111)

TABLE II
COUNTRY ENERGY ASSESSMENTS QUANTITATIVE GOALS

<u>U.S. fiscal year</u>	Number of assessments	
	<u>In period</u>	<u>Cumulative</u>
1979, 1980	3	4
1981	5	8
1982	4	12
1983	2	14

According to the "Implementation Schedule" on page 173, the preparation of country energy assessments was to begin in January 1980. According to the CARICOM Work Programme submitted at the Energy Advisory Committee meeting in July 1980, the first assessment was to begin in June 1980 and to take seven months. Ten more assessments were to be started before the end of the calendar year and take six months each (see Figure 3, p. 20).

Actually, this schedule was not followed. As discussed elsewhere, there were delays in getting the Project under way. CARICOM's Energy Unit was not staffed until July 1980 (See Appendix III of the Work Programme). Under the circumstances, it was decided to telescope the planned training of the assistant project manager and the two energy specialists, and to assign them to work on assessments, under the supervision of consultants, as soon as possible. In August 1980, all three went to the Institute of Energy Research at Stonybrook, New York, for an abbreviated, three-week version of the Energy Management Training Program. A ten-day training seminar was held for country assessment personnel in October

of 1980, in Barbados (See CARICOM Activity Report, undated, p. 3). Finally, four national energy assessments were begun: Barbados and Guyana in October 1980; Antigua in December 1980; and Montserrat in February 1981 (Activity Report, p. 4).

As of this writing, all four assessments are in draft and are being discussed with the corresponding national government, so that elapsed time for completion has been eleven, nine and seven months, respectively.

Moreover, although not specifically called for in the Project Paper, a sizable number of studies which support the assessments have been carried out simultaneously under the Policy Program. These include conservation studies in Antigua (1), Barbados (2), Guyana (3) and Montserrat (1), and a number of resource assessments (e.g. wood in Guyana). In this regard, it should also be noted that the CDB is sponsoring two regional resource assessments - Wind and Solar Energy Resources Assessment and the Biomass Resource Analysis - under the Technology Research Fund/TE Program. Other energy resource assessments are now being planned by CDB. In addition, CARICOM sponsored two energy audit seminars in the fall of 1980 and a workshop on energy conservation for the hotel industry in March 1981. These in turn lead to Guyana's own energy audit seminar this year. While these latter activities are, strictly speaking, training activities, they are nevertheless closely related to assessment work. Finally, two regional policy studies have been started by CARICOM. One of these deals with the history and supply of petroleum in the Region; the other, with its pricing and procurement.

Obviously, the expectations for this Program as stated in the Project Paper were too high, and CARICOM compounded the error by promising, in the Report to the Advisory Committee, more than it could deliver. Moreover, the start of the Program was delayed by such factors as delays in recruiting personnel and in obtaining cooperation and resources from participating countries. Finally, the assessments turned out to require more work than anyone had imagined, although much of this extra work was very fruitful. For example, the higher quality of assessments, the development of data bases and the preparation of supporting studies are all useful in their own right.

Nevertheless, the team is reasonably satisfied with the assessments progress to date and guardedly hopeful for the future of the overall Program. Because they affect a number of programs, the problems of delay, recruitment at national and regional levels, and creation of national energy units have been discussed elsewhere. The problem of excessive expectations has also been discussed elsewhere, but the team reiterates the following with respect to the Policy Programme. Given the number of countries involved, the variety of their economic and social conditions, the prevailing attitudes towards energy before the Project began, and the woeful lack of energy professionals, the expectations of the Project Paper and the Work Programme were simply unrealistic. Finally, the team agrees with the decisions to start some assessment work as soon as possible, to assign three people instead of two to

the assessment work, and to aim for quality and local involvement at some sacrifice of speed.

However, the combination of circumstances and decisions just described resulted in a learning experience for the personnel who worked on national assessments that was below their expectations. This was true for both classroom and work experience. The evaluation team cannot, of course, measure how much they learned, given the time and resources available for this evaluation. Nevertheless, it is clear that many of them wish they had learned more. This goes to the heart of the question of building institutional capability and indicates that future assessments should not be run in the same manner as the first four. Instead, much more attention should be given to the training aspects. The following is a commentary on the documents generated by the Program to date. Most of them exist in draft form, with the principal exception of the Montserrat energy assessment which was incomplete at this writing.

There is no question that the assessments and their associated studies have substantially improved the data bases in the countries where they were carried out, even in Barbados, where considerable data work had been done in previous years. Moreover, a properly done assessment includes analyses of energy demand, trends and pricing. A series of assessments may also identify energy issues which are best addressed on a regional basis. However, whether it initiates a process of energy planning, whether this process is incorporated into national planning and whether there develops an understanding

of the relation between economic development and energy is quite another matter. To a very considerable degree it depends on the national constraints on Project implementation, discussed elsewhere. But it also depends heavily on CARICOM follow-up and on programs of communication, information and training. In the final analysis, if planning is to be more than an academic exercise, the results of planning must produce change in society. The test of usefulness for any assessment is whether it is used as a basis for policy studies, policy decisions and programs of action; or whether it is filed away in a drawer and forgotten. To effect this change requires the understanding and cooperation, in many cases voluntary, of large number of people.

The team feels that there is a good chance that assessments will lead to positive action in at least two or three of the four countries participating in the Program to date, given the existing attitudes, enthusiasm and organization, once draft assessments have been revised and approved by the Ministries concerned. Needless to say, there is considerable variation between countries, and even more within individual governments. Hence, one cannot be certain of the outcome or timing of the results, especially on the basis of brief visits. However, in each country there are officials who are anxious to use the assessments as a basis for doing something about their country's energy problem.

Since the Project conditions preceding disbursement were not satisfied until July 1980, the first effective U.S. fiscal year of the Project is that ending October 31, 1981. By this

date, CARICOM will have assisted four countries to complete assessments, versus three shown on page 111 of the Project Paper.

The following is a commentary on the three draft assessments and on the various supporting papers submitted to the evaluation team taken as a group. Considering the constraints under which the team operated, it is not possible to express opinions about the appropriateness of the recommendations for specific countries.

- (1) In general, the quality of these reports varies from acceptable to excellent. Most of them are good or excellent.
- (2) None of the energy needs assessments is perfect. For example, they are uneven in coverage of the subjects which should be treated in such an assessment. Nevertheless, they are extremely useful documents, especially as sources of data, for identification of problems, and for descriptions of options. Considering how much has had to be done to create energy units in CARICOM and in participating countries and to develop sectorial data bases in four countries, the quality of the assessment work is impressive. Clearly too, the assessments benefitted from the extensive detail work done in the energy conservation and other supporting studies.
- (3) No judgement can be passed on the degree to which the methodology that had been applied previously in Jamaica was in fact applied (or even should have

been applied) in the preparation of the four assessments mentioned. (See Project Paper, pp. 130-133, and CARICOM Work Programme, pp. 16-21). We note however, that:

- (a) One of the joint consultants, Energy/Development International collaborated on an assessment for the Dominican Republic which followed a similar methodology;
 - (b) The Dominican Republic assessment was used in the three week Energy Research Institute course which three CARICOM staff members attended;
 - (c) A common methodology appears to have been more or less followed in three countries and, according to CARICOM, will be followed in the remaining ones;
 - (d) While not as detailed in some respects, because of smaller economies and less developed data bases, the assessments carried out under the Program appear to compare reasonably well with those produced under the U.S. International Energy Development Program of cooperative assessments. (See Cirillo, Klotz and Stajdoher, "The Assessment of a Country's Energy Posture," Technical Congress for the Investigation and Conservation of Energy Resources: San Juan, Puerto Rico, November 7-9, 1979).
- (4) Except in northern climates, energy is almost never consumed for itself. Rather it is an input to most

other goods and services and, as such, its use pervades all human activity. Consequently, the nature of the energy problem and the appropriate solutions for a particular country ultimately depend on the answer to the question, what is the "good life" to which the people of that country aspire. Thus the demographic and economic projections on which national planning is based, or in their absence, those which seem to bracket the most probable futures, are of great importance to any energy needs assessment. The Barbados Assessment asserts that it is not feasible to develop any national energy plan without high-level decisions on national goals and methods of implementation. In fact, there is two-way interaction between what kind of a society and economy Barbados wants and the energy plan which is best for those socioeconomic goals. One of the few apparent weaknesses of the preliminary draft of the Barbados Assessment is its limited treatment of these matters. In the particular case of Barbados, this may not be crucial because, for example, population growth is very low. However, in most country assessments, a thorough discussion of alternate futures, desired or possible, and their energy significance is absolutely necessary. (See Executive Summary, Barbados Assessment, p. 4.) By way of contrast, the Antigua assessment contains a discussion

of that country's energy future (p. 48 ff), and the Guyana assessment has a reference case and four scenarios (p. 28 ff). This latter assessment also contains something akin to the sensitivity analysis possible with systems modeled mathematically but frequently omitted from energy assessments.

- (5) All three assessments provide very limited treatment of oil, gas, electric and other energy pricing. In the case of Barbados, this may be partly justified by the large body of work done recently with the assistance of the United Nations Development Program. Also, oil pricing is the subject of a new regional policy study. However, because of the overwhelming importance of petroleum import substitution and the effect of energy pricing on energy use, conventional energy sources must obviously be given due consideration in the typical assessment. Moreover, energy pricing deserves explicit, detailed treatment in assessments and/or policy studies. Next to physical measures, changing energy prices are one of the most effective means of raising energy consciousness and stimulating conservation and substitution. In many countries, most types of energy are substitutes in some uses, and existing pricing structures are seriously obsolete. They reflect historical circumstances which never will be seen again. Moreover, for purposes of optimization, many categories of energy prices must be determined simultaneously, regardless of substitution possibilities. For example, the

prices of all petroleum fuels locally produced should be determined simultaneously. Likewise, all electric rates. In both cases, the energy outputs are joint products characterized by variable joint costs. Under the circumstances, traditional accounting techniques of cost allocation to determine the "profit" or "loss" on each product or rate will only give optimum prices by accident. In any case, an incompatible energy price structure can substantially impede, if not frustrate, implementation of the best conceived energy plan. Finally, the problem of shifting from an obsolete price structure to one which is both rational and supportive of the plan is a problem of considerable difficulty in political, economic, financial and social terms. It deserves careful consideration and analysis.

- (6) The overriding goal of the Project is building institutional capability. To what extent has the experience of producing four country assessments and associated studies built institutional capability at the regional and national level? Time did not permit the team to make a systematic evaluation of this question. However, based on an extensive experience in energy matters and discussions with a considerable number of participants in the assessment process, the following observations can be made:
- (a) The energy needs assessment process was a significant learning experience for those

- who had limited experience in such matters.
- (b) More was learned at the regional level than at the national, and more about data collection than analysis, especially at the national level.
 - (c) National and regional participants wish that they had been able to learn more, in particular to receive more formal training than they did.
 - (d) That they did not learn more was due to many factors, among them the national constraints on Project implementation discussed earlier and the problems in meeting the objectives of the Policy Program.
 - (e) Some of the four countries in which assessments were made will not be able to update these assessments two years from now without substantial help from CARICOM, due to the above and to national constraints.
 - (f) Significant input from experienced consultants and the use of at least three qualified CARICOM personnel will be required for the next round of four assessments.
- (7) The following are additional comments on individual reports, although no evaluations are called for:
- (a) Barbados assessment - Serious resource constraints led to a number of assessment areas being left incomplete, according to the document (See "Background"). However, this was probably the best report in terms of raising policy

- questions, pointing out uncertainties and making recommendations of an institutional nature. Although widely scattered throughout the report, most of the recommendations for action were comprehensive and well thought out. (Draft report)
- (b) Antigua assessment - More readable than the Barbados one. Although it included an energy future, it was very sketchy in its discussion of alternative fuels (p. 65). (Draft report)
 - (c) Guyana assessment - When making recommendations, it does not adequately address institutional and human resource questions (p. 27), despite numerous comments throughout text that seem to call for such an approach. (Draft report)
 - (d) Conservation studies - The Antigua one is by far the best, although the others range from satisfactory to good. Such studies can be very worthwhile as a means of influencing industry and government, helping to develop conservation objectives and showing where some fairly quick results in energy and import saving can be obtained. However, they are not designed to tell people what to do to save energy. On the basis of every report, it is important to develop "next steps," including detailed enterprise energy audits. Conservation in developing countries, in the opinion of the evaluation team, can make a greater relative contribution

to the solution of national energy problems than in highly developed countries.

- (e) Guyana Forestry Study - This is an excellent final report, especially considering the time constraint and the severe data problems. The authors obviously have a great deal of experience. However, there is no sensitivity analysis in the report. This would be particularly useful since the true values of the critical parameters may vary within such a wide range. Finally, the cost of the long-term investment is reflected only by a depreciation charge based on the original currency units of the investment. Thus the fixed investment component of the lifecycle cost of the project is significantly understated. In general, regardless of who owns an economic enterprise or supplies the funds, there is a real cost and a wide variety of risks associated with tying money up in an enterprise for a long period. Thus the investor should not only seek to get back his original currency units, but also an additional amount which compensates for opportunity cost, for inflation, for risks of various kinds, for taxes, etc. This can be expressed as an annual capital recovery charge which, over the life of the project, recovers the nominal investment plus a specified percentage return on that

investment. On an annual basis, this charge is always greater than the straight depreciation charge and only approaches it asymptotically for long project lives or low rates of interest.

- (8) One of the banes of energy work is the problem of finding a common denominator for a wide variety of fuels in order to strike an energy balance or talk about energy supply and demand in general. Unfortunately, the energy balances shown in the energy needs assessments do not always use the same methodology nor give the rationale behind the equivalences. The evaluation team understands that this problem is being corrected.
- (9) In addition, it would be useful to include in the assessments or in policy studies the foreign exchange consequences of perpetuating the existing pattern of energy use and of alternative energy futures, since this matter is so critical to the participating countries.

The evaluation team is especially concerned about the insufficiency of technical inputs for the energy Policy Program. Assessments are vital to an integrated approach to energy and are the basis for much training and technology applications. At present, CARICOM's Energy Unit has six positions, of which one is supervisory, one administrative, three policy and one training. However, one of the policy positions is temporarily vacant, and the present two policy

professionals will be away part of the year for promised training. Moreover, at least three policy professionals will be required for the next round of four energy needs assessments. Also, the Energy Unit has begun two regional policy studies and soon must undertake followups and assist with national policy studies in the four countries where needs assessments are being completed.

Financial inputs for the policy program are also insufficient, but this is not immediately obvious because of the way that the Project Paper is structured and because of the lack of financial reporting for the Project.

The problem with the Project Paper is the following. In the narrative sections, the Project is described in terms of four programs. However, the financial tables have six components - the four programs plus the two energy units. The latter two categories have some items which relate directly to specific programs and others which are overhead in the sense that they relate to more than one program. In the case of CARICOM, Table II attempts to reallocate the overhead items. The basis of allocation is explained in the footnotes for major items. This gives an estimate of \$1.6 million in total resources for the Policy Program. Allocating these funds proportionately among the three types of studies originally conceived for the Program (Project Paper, p. 135), gives the following breakdown:

Country Energy Assessments	544,000
Country Policy Studies	750,100
Regional Policy Studies	<u>313,200</u>
Total	\$1,607.300

TABLE III

DISTRIBUTION OF FINANCIAL RESOURCES ASSIGNED TO CARICOM PER PROJECT PAPER¹

	Source		Function			Total
	CARICOM	USAID	Overhead	Policy	Training	
Energy Unit						
Head						
Salary	\$ 29,200	\$ 92,800	\$ 122,000	-	-	\$ 122,000
Overhead	-	121,800	121,800	-	-	121,800
Subtotal	\$ 29,200	\$ 214,600	\$ 243,800	-	-	\$ 243,800
Reallocation						
People basis ²	-	-	(121,900)	\$ 91,400	\$ 30,500	-
Dollar basis ³	-	-	(121,900)	50,500	71,400	-
Assistant Program Manager						
Salary ²	40,000	21,000	-	61,000	-	61,000
Overhead	-	61,000	-	61,000	-	61,000
Training Coordinator						
Salary	36,300	43,000	-	-	79,300	79,300
Overhead	-	79,300	-	-	79,300	79,300
Energy Specialist						
Salary	-	146,500	-	146,500	-	146,500
Overhead	-	61,200	-	61,200	-	61,200
Joint Consultancy						
	-	250,000	250,000	-	-	250,000
Reallocation						
Dollar basis ³	-	-	(250,000)	103,700	146,300	-

TABLE III (Continued)

	Source		Overhead	Function		Total
	CARICOM	USAID		Policy	Training	
Travel						
Program	-	\$ 55,000	\$ 18,400	\$ 18,300	\$ 18,300	\$ 55,000
Energy Specialists	-	50,900	-	50,900	-	50,900
Reallocation	-	-	(18,400)	10,700	7,700	-
Communications	-	27,500	9,500	9,000	9,900	27,500
Reallocation	-	-	(9,500)	5,500	4,000	-
Subtotal	\$105,500	\$1,010,000	- ⁴	\$ 669,700	\$ 445,800	\$1,115,500
Policy Program						
Subtotal	-	937,900	-	937,900	-	937,900
Training Program						
Subtotal	-	1,324,000	-	-	1,324,000	1,324,000
TOTAL	\$105,500	\$3,271,900	-	\$1,607,600	\$1,769,800	\$3,377,400

Notes

¹pp. 134-135 (Annex II, pp. (0-11))

²Assumes Assistant Project Manager Works as Energy Specialist

³In proportion to Policy and Training budgets

⁴\$521,700 before reallocation

For the first type of study there is a quantitative goal of fourteen studies (Project Paper, p. 111). This yields an average budget of \$38,900 per assessment. While no estimate exists of what has been spent on each individual study, the four assessments almost completed to date have cost a good deal more than four times the above figure or \$155,600. Future assessments should cost less, but there will still be a big overrun. For example, excluding CARICOM Staff, "outside" expenditures above are estimated at \$310,000 as of recent date (CARICOM Telex, Oct. 17, 1981). If policy expenditures on CARICOM staff were \$100,000, then the average cost would be \$103,000, for a total of \$410,000. Assuming other countries can be done for 85 percent of this, i.e. for \$88,000 each, then \$880,000 must be spent to cover ten more countries, for a total of \$1,290,000 for energy needs assessments. This is 137 percent over the original budget. If there are overruns of only 10 percent on the other kinds of studies, the Program budget is under-funded by about \$852,000, in terms of its original objectives. To be more optimistic, suppose the remaining ten countries can be done for 50 percent less, i.e \$52,000 each. There is still an overrun of \$492,000 for the Program. These are only estimates, of course, but they give an idea of the magnitude of the problem. Needless to say, with no information as to how the second and third categories of studies were budgeted nor quantitative goals for each, the Program objectives are extremely ambiguous in financial terms. The basic point, however, is fairly straightforward. One cannot spend \$750,100 on something called country policy studies and

\$313,200 on something called regional policy studies and still have enough money left over to do ten more country assessments. The program has to be changed or more resources have to be obtained.

The next major concern has to be about the validity of the original assumptions. Those which are specific to the Program (Project Paper, pp. 32-34) will be considered. Several are noted here.

- (1) Country policy studies will assist countries in developing an overall policy framework and analytical methods. No such policy studies have been started as yet, so this remains to be seen.
- (2) Regional energy policy studies will play a major role in the wide-spread application of renewable energy resource technologies. Two regional policy studies have been started.
- (3) The schedule on page 173 of the Project Paper will be met. It clearly has not been met, as is discussed extensively elsewhere.
- (4) It will be possible to hire promptly personnel of the depth and type of experience such as described on page 3 of Annex II to the CARICOM Work Programme and on page 163 of the Project Paper. Personnel currently staffing the CARICOM Energy Unit are of high calibre, but they do not yet have the depth and variety of experience desired by the authors of the Project Paper. This situation reflects, among other things, the regional shortage of qualified

personnel, problems with getting persons from one country to live in another, and the newness of the energy problem. It means that CARICOM will have to rely on hiring bright, inexperienced personnel and then upgrading their skills by a combination of work experience and formal training.

There are both national and regional constraints that will have a definite influence on the implementation of the Program. They can be considered briefly as follows:

- (1) The biggest single constraint on the implementation of the policy program is the question of followup at the national level once the energy needs assessment has been revised and approved by the ministry responsible. The question is, will there then be enough priority for, and interest in, energy; and will the national energy coordinator have enough influence to keep the energy planning process evolving. If the assessments are merely distributed and filed away, the Program has failed, irrespective of the quality of the reports. CARICOM assistance and follow up will be necessary.
- (2) The Program is also affected by those constraints discussed under national constraints on Project implementation.
- (3) The regional constraints are primarily ones affecting the Project in general, particularly (2) "Lack of coordination between international assistance agencies".

4.2 The effectiveness of CARICOM administrative and operational procedures.

The evaluation team has found that the operational system for the Program is adequate, given the regional and national constraints under which it must operate. Financial reporting is a glaring exception. Breakdowns in operational procedures are more likely to be caused by shortages of human resources and by administrative behavior at the national level than by defects in the procedures themselves. Moreover, the inadequacies of telephone systems and airline service in the Region will continue to waste a great deal of time, reduce productivity and delay implementation of plans. With regard to the criteria for helping countries to make assessments and other studies, enthusiasm on part of the country is highly desirable. However, interest, a contribution of human and other resources, and a commitment to use the assessment or study effectively are absolutely essential. CARICOM should always insist on these.

The effectiveness of operational coordinating efforts has been discussed with regard to CDB and international agencies in an earlier chapter. If a country has its energy organization in place and functioning and is not involved in a major governmental reorganization, the coordination between CARICOM and the country do not seem to cause many problems. The major problems arise when people do not do what they said they were going to do when they said they were going to do it. Again telephone service, airline service and patterns of administrative behavior (which leave a vacuum when

a particular individual is absent or a particular position vacant) can cause delays and malfunctions.

4.3 The impact of project component sub-project activities and the expected impact of individual planned activities.

The regional replicability of the Program has been discussed extensively earlier. In brief, if the countries are willing, if the resources are provided, and if sufficient training takes place in connection with the assessment process, the Program is entirely replicable throughout the Region.

Concerning the changes in capability that have taken place as a result of on-going activities, the team has noted that a very substantial one took place in CARICOM, which now has a promising energy unit of its own. However, the degree and pace of change is not yet sufficient at either the regional or national level to ensure the attainment of the Project objectives.

Much of the effectiveness of the Program in the participating countries will depend on what is done with the documents that have been produced to date. CARICOM has an important role to play in stimulating their use.

4.4. Specific Recommendations

The following eleven recommendations are made to improve the Program as a whole. They are followed by four recommendations that relate more specifically to operational procedures and Program planning.

- (1) Priority should be given to energy assessments and supporting studies, and then to the policy studies

that follow from them.

- (2) The preparation of high quality assessments and studies should proceed as fast as national and regional resources permit. Assessments should be made in all countries where adequate interest and cooperation is attained.
- (3) Prior to the preparation of a country energy assessment,
 - (a) The CARICOM Energy Unit and the country should agree in writing on what kind of training is going to be accomplished in the course of the assessment, classroom, on-the-job or informal, and for whom.

Some measurable results should be included. They should also agree in writing to the work plan and to the country's contribution to the assessment.
 - (b) CARICOM should continue to insist on an adequate country recognition of the energy problem in organizational terms and an adequate participation in the assessment process, both in terms of human resources contributed and in terms of shaping the process and the recommendations which result from it. The country must feel that the report is its report, prepared with the assistance of CARICOM and consultants, and that the country wants that report as a basis for policy studies and policy decisions.

- (c) CARICOM should alert the country energy coordinator to what is needed in the way of data, contacts, existing reports, etc., well before assessment personnel arrive. Countries should collect as much secondary data as possible before the assessment personnel arrive. With due respect to previous efforts, there is some room for improvement in this regard on the part of all concerned.
 - (d) More emphasis on analysis and development of recommendations should be included in the learning experience of the assessment process.
 - (e) A formal work plan for each assessment process should be developed in close collaboration with country personnel.
- (4) After the assessment is in draft, it should be thoroughly discussed with country personnel who have participated in its preparation before it is submitted to country officials or CARICOM for review. Time should be specifically allowed in the process for this review. This has already been done in some cases.
- (5) After the assessment is final and approved by all concerned, various summaries should be prepared at different levels of sophistication and widely distributed to appropriate audiences.
- (6) After the assessment has been approved, the CARICOM

Energy Unit should shift its emphasis to followup. Specifically, CARICOM should encourage and assist in the development of an implementation plan based on the assessment, policy studies, the incorporation of energy planning into national planning and enterprise energy audit programs.

- (7) In terms of its own internal operations, the CARICOM Energy Unit should give top priority to recruiting and training two additional persons to work on assessments, one to fill the existing vacancy and the other to fill an additional policy position. This will permit four assessments in 1982 while policy personnel are trained. It will also hold down "outside" expenditures. An evaluation of all regional assessment personnel's capabilities should be made and additional short-term training programs be identified or developed that will upgrade these capabilities and fill gaps in their knowledge and understanding.
- (8) CARICOM should also hire two policy specialists in early 1982. These would work primarily on national policy studies in the countries where the initial assessment process is being completed. Assessment personnel would be gradually shifted to policy studies, as the Energy Units workload changed. This is necessary to overcome national constraints. Moreover, an assessment is not an end in itself, but the basis for further action and

- planning. CARICOM must seek to maintain the continuity of the energy planning process and the momentum generated by the assessment.
- (9) The Energy unit should consider holding orientation seminars for ministers and permanent secretaries who supervise energy coordinators, and for financial ministers and others with a major influence on energy matters.
- (10) Due to the failure of CARICOM to provide financial data to the evaluation team and to USAID, and to provide the Head of the Energy Unit with the financial information which he needs for managerial purposes, the evaluation team declines to make any recommendations as to changes in the total amount budgeted for the Policy Program or for its components. As noted, in recommendation four, as soon as this situation is rectified, the Energy Advisory Committee should take up the matter of restructuring Project and Program priorities. However, no one can do this rationally without accurate, up-to-date financial information such as to costs expended on each activity in each country.
- (11) Participating countries should be encouraged to send energy personnel to CARICOM for on-the-job training for one year or six month periods so that these persons could work on assessments involving the Region as a whole and countries other than their own. Training funds should be used for travel, per diem and some salary support.

The following recommendations and comments relate to operational procedures and program planning.

- (1) Monthly financial reports in the same detail as found in Tables I and II of CARICOM's Work Programme are necessary. However, without time to study the accounting and financial reporting system of the agency, the team is reluctant to recommend them. They might prove an expensive burden on the Project and CARICOM, although a computerized system could readily produce that and more. Therefore, in Chapter III, a simpler type of report has been recommended.
- (2) Since some of the expenditures relating to the Policy Program and the Training Program are included in the "pseudo-program" Energy Unit, arrangements should be made so that these expenditures are distributed monthly to the respective programs by fixed rules of allocation. However, items of overhead, which can be identified with particular programs without much difficulty, should be charged directly to those programs and not distributed by formula.
- (3) Top priority should be given to updating expenditure information and to estimating the cost of each assessment and supporting report worked on to date. This information is essential for making and revising budgets and work programs, for Project policy decisions and for developing a simple

methodology for allocating expenditures to activities in the financial reports recommended in Chapter III.

- (4) The Energy Unit should prepare a revised Work Program and Budget to submit to the next meeting of the Energy Advisory Committee. Specific recommendations and justifications for restructuring the CARICOM portion of the Project budget should be included.

V TRAINING

The Project Paper recognizes the importance of training as a means of achieving its general goal. It recognizes the fact that there are few trained people in the area who can contribute to the attainment of the project goals. It adds that there are institutions that can develop a capacity for training both energy policy makers and technical personnel.

Detailed programs are outlined on pages 38 and 39 of the Project Paper and emphasis is given to the fact that the special objective in this component pervades all other activities.

Considering the expanse of the geographical area where the participating countries are dispersed and the burden that this poses for the installation of a successful training system, one can appreciate the hope that every program and every subproject should have some specific training aspect and objective, even if it is not a training activity per se.

5.1 The movement towards the program objectives; the sufficiency of the technical and financial inputs; the validity of the original assumptions; regional and national constraints.

The program objectives are not being met, at least quantitatively speaking. According to the Project Paper (p. 111), by the time of the evaluation, the Project should have trained a cadre of 362 trained specialists in energy planning, assessment and renewable energy technology design. However, during the first two years of the Project, only three 2-week workshops had been held. Such limited activities can hardly

produce the desired output. Furthermore, at the end of two years, ten technical and analytical training courses in energy management and technology development should have been organized. The evaluation team could not identify any training course of long duration that had been developed through the Project.

During most of the first two years of the Project, there was no energy training coordinator. Only a few months before the end of FY 80-81, a coordinator was appointed to this position in the CARICOM Energy UNit. Technical input, therefore, has been insufficient. Disbursements for training activities during this period, about half way into the life of the project, amounted to less than one-tenth of the total allocated for this purpose. Financial input was less than projected and insufficient for a normal attainment of Project objectives.

The coordinator has prepared a one-year training plan for FY 1981-82. It is encouraging that the plan prescribes certain criteria for funding energy training programs. One criteria is to enhance the capability of solving national energy problems. Projects funded thus will be "policy oriented or directed toward resolving specific energy related problems." The other criteria is to assure a multiplier effect within the Caribbean region.

While these criteria are adequate and concordant with the objectives of the training component of the Project, the basic premise was stated that "Solutions to energy problems

must be country- and location- specific, but regional coordination precludes unnecessary and costly duplication of efforts in the solutions of recognized common problems" (Project Paper, p. 18).

Then, in the selection of training projects for funding, it is right to select those that are addressed to solve national energy problems as long as a priority is given to those national problems which are common to more than one nation. National energy assessments will be useful to design the training projects and to maximize the regional character of the activity.

The proposed activities seem acceptable although somewhat grandiose because of the limited supporting staff available. It is important that the workshops scheduled be practical and well organized. Operational objectives should be determined "a priori" and sent to the participants. In this way, an objective and valid self-evaluation of the activity will be assured. Also, lecturers and group leaders should be selected with emphasis on their expertise as educators. If possible, the personnel should be acquainted with the national scenarios of the prospective participants so that educational material relevant to the energy problems in these countries be chosen.

Also, there is some consensus within the energy units that workshops or seminars are needed in the Region on the following subjects:

- (1) Energy conservation seminars for electric plant and hotel industry maintenance personnel;

- (2) Technical workshops on electric plant and hotel industry maintenance;
- (3) Seminars for management personnel of various sectors to show dollar benefits and the return on investments in the area of energy conservation.

The LDC's also need assistance in the formulation of ideas and the identification of energy projects. The national and regional impact, however, will not be immediate because of the limitations and constraints discussed in this assessment and because of the long duration, continuous technical and financial efforts required to build an alternative energy sources infrastructure.

In reference to the funding for the curriculum development, an effort must be made to monitor the experience found in the actual teaching of these courses to assess their input in relation to the objectives of the training component of the Project.

Concerning the level of funding for the training component, it is obvious that considering the scope, complexity and experimental nature of the training requirement, the amount of US \$1.3 million is completely inadequate. If 1,400 trainees (Project Paper, p. 39) are required--and this number may be rather small considering a total of approximately five million people in the participating countries--the cost per trainee is around US \$900. If we take into account the high cost in transportation alone, the amount of US \$900 is completely inadequate.

Engineers were to have been trained in the design of commercial scale systems for solar water heating and technicians were to have been trained to install these systems to develop an infrastructure for the commercialization of solar heating (Project Paper, p. 2). This has not been done. Solar water heating for public buildings such as hospitals and schools should be one of the priorities for direct solar energy demonstrations. In schools such a program could be interrelated with the curriculum and could be implemented in spite of limited resources by using the combined efforts of TEU staff, solar water heating manufacturers in the Region, and consultants.

In the opinion of the evaluation team expected outputs such as developing a CADRE of trained specialists in non-conventional energy technology including design, implementation, maintenance, and field tested research projects are far from being attained.

A complete reevaluation of the training component must be made in order to get the data to support a petition to USAID for a supplementary grant to support the training program.

The desirability of a central training facility should be evaluated in this study. In general, a central training facility is highly desirable but, politically speaking, it will be very difficult to establish. In part, this is due to the large impact such a facility is going to have on a small economy. There will be pressure to spread the benefits of this impact around at the expense of lower effectiveness.

The role of research institutions and technical colleges in the Region is indicated in the Project Paper (p. 31) in relation to various functions such as contributing to the training and communications program, and providing a broad range of needed capabilities for energy policy, energy assessments and alternative energy technology applications. At the time of the evaluation, some of these institutions were already involved with this Project. Some have had projects funded through CDB and some have representatives on the Energy Advisory Committee.

Several of these institutes were visited by members of the evaluation team and the team recommends that the following institutions could be considered for training activities:

- (1) the University of the West Indies (UWI) in Trinidad is where the engineering school is located. (UWI also has campuses in Jamaica and Barbados.) This engineering school was established 20 years ago and today has an enrollment of approximately 700 students of whom approximately 140 are graduate students at the MS or PhD level. There are 60 regular faculty members of whom 40 have the PhD. The undergraduate curriculum admits students of A level (equivalent to US standards of sophomore standing) who pass an entrance exam, The BS degree is obtained in three years.

The evaluation team believes this institution has the potential to participate in the training program. However, being an excellent engineering school does not qualify an institution to be able automatically to set up instant training programs. This requires coordination for the use of manpower and facilities, and more often than not the laboratory facilities there are not adequate for a short term training program. It is recommended that additional dialogue be conducted between UWI and CARICOM and/or CDB concerning specific programs. In particular the evaluation team noted that "alternative energy" laboratory facilities that would be needed for short course training programs are not available. There are two competing solar energy laboratories. They were built up on long term research projects and no doubt served that purpose well; they are not suited for short term training courses for engineers. Other laboratory facilities were difficult to evaluate because of current expansion programs. Because of this, it was not possible to get the comprehensive evaluation that the team would have liked to gather. It is recommended that any project that UWI proposed to undertake for CDB or CARICOM should be clearly documented about time, budget, specific facilities to be used, faculty members that will be involved and their qualifications in a formal proposal, and that the proposal should be peer reviewed.

(2) St. Kitts Technical College in St. Kitts -

This is a school for training technicians at the

trade school level. For this level of training the classroom and laboratory facilities appeared to be adequate for both long and short term training courses. Other schools of this type were originally set up on various countries throughout the Region. It is important that an effort be made to involve several of these schools throughout the Region. These schools are most important for training at the trade school and technician level so that each country will have personnel trained, not only in the building and installation, but also in the maintenance of the equipment. In general, proper training in maintenance is severely lacking in the Caribbean, so this would be a good start for the new program.

5.2 The effectiveness of CARICOM administrative and operational procedures.

Although only a limited number of training programs have taken place during the first two years of the Project, the coordinator has given direction to the training program. His plan for FY 1981-82 will move the training component towards the achievement of its goals.

It is unfortunate that the Project's design has separated the training component, which is placed under CARICOM, from the communication component, which is assigned to CDB. Training and communication activities are impossible to separate from one another. In fact, there is a cause and effect relationship between the two. The need of training is the result of the lack of communication, and vice versa.

It is necessary that, if the Project is to maintain its integrity of purpose, a great effort be made in coordinating these two components so that they could function as if they had been placed under a single administrative unit. Programmatic structures of these two components should correlate so that they respond to the general objectives.

5.3 The impact of project component and sub-project activities and the expected impact of individual planned activities.

The work done so far by the training component has had little impact on capability development because of the small scale of the operation.

Four members of the CARICOM Secretariat received training at Stony Brook and have been working for the Project. The expertise acquired by the staff has been essential in the implementation of the Project.

5.4 Specific Recommendations

- (1) The coordinator should be sent to a university or research center outside of the Region for a short training course on alternative energy systems.
- (2) The possibility of increasing the number of staff members must be studied if the objectives set forth in the training component are to be met before Project termination.
- (3) In the future a complete record of each activity

should be prepared and filed. This record should contain, in addition to the obvious information about date, site, number of participants, country of origin of each participant, costs, etc., other important data like CV of teaching personnel, participants' evaluation forms, a statistical analysis of the self-evaluations, the educational materials used, and an account of the reason why the activity was funded. A review of the potential effect in changing the national or regional capability for solving energy problems should also be included.

- (4) Training required for the implementation of field activities/projects under the CDB responsibilities should be delegated to CDB; the budget for this training should come from the overall budget for the training program which is being administered by CARICOM.

VI TECHNOLOGY AND ENERGY

According to the Project Paper (p. 23), "the project will institutionalize within the CDB a capability, first, to design and manage a communications program to promote technical cooperation in energy, including an information clearing-house alternative energy applications, and second to finance and evaluate technology field test projects for establishing the commercial feasibility of widespread applications of technologies using renewable energy resources." This chapter will discuss the Technology and Energy (TE) component of the Project.

The Technology and Energy Unit (TEU) was organized at the bank in August 1979 and is responsible for TE activities. Areas in which TEU operations need to be reviewed, improved or strengthened are identified in the report. This task has been done in great detail because the evaluation team believes that an excellent opportunity is provided to improve TEU's effectiveness, and by doing so to enhance the CDB's role in the Caribbean.

6.1 The movement towards the Program objectives; the sufficiency of technical and financial inputs; the validity of the original assumptions; regional and national constraints.

Neither the CARICOM nor the CDB programs have so far contributed significantly toward the development of a cadre of experienced energy professionals at various institutions

in the Region for renewable energy resource development or toward the design, maintenance, and operations of alternative energy systems in accordance with the stated objectives. This is due to the too ambitious nature of the overall program, which is in operation in fourteen project countries using the limited personnel of the energy units of CDB and CARICOM and working under the constraints of newly organized staffs and activities.

However, the positive aspect of the programs is that they stimulate various institutions to initiate action. The programs contribute toward providing on-the-job training in some instances (CMI wind and solar energy resource assessment activities) and providing professional development. At CADEC, funding of the Caribbean Appropriate Technology Centre Feasibility Study by CDB has led to the appointment of a coordinator for the Centre and, on the basis of the study, CADEC has attracted funds from Appropriate Technology International (ATI) and Volunteers in Technical Assistance (VITA) to implement a pilot phase of the project. In the opinion of TEU, as a result of participating with the TEU in the development of the biomass resource assessment sub-project, CARDI has formulated a US \$2.0 million, six-year biomass resource development project which will use the results of the CDB biomass resource assessment. The CARDI project plans to evaluate species, develop production and harvesting systems for industrial-scale

biomass production, and demonstrate and evaluate farm woodlots.

The increase of CDB technical assistance to the field institutions is of paramount importance for the success of the individual activities, for the success of the overall USAID program, and for keeping the program within the scope outlined in the Project Paper. This may require an increase of the project budget to permit TEU to increase its technical manpower, or it may mean a curtailment of some of the field activities, or it may mean delays in individual project implementation.

The TEU should make sure that an institution requesting a grant under the USAID Program will receive adequate technical assistance to implement the activities before the grant is approved. The lack of field technical assistance often results in project delays which originate in the field countries. Field visits to assist the ongoing activities should be made more often by TEU project officers. The liaison should be a continuous assignment performed by the TEU communication unit to assist the technical staff members in their duties.

It was, however, unrealistic to make such demands on CDB and CARICOM in the Project Paper in view of the limited budget, project timetable, local constraints, and very broad scope of the program. A few, clearly identified priorities should have been selected on the base of the available data on energy needs and energy resources for each country and for the Region

as a whole. Various phases of the projects should have been studied with each successive phase being supported by the data and capabilities developed during the previous phase. During the first phase of the program, the energy needs and the available energy resources should be assessed country by country. The results should be analyzed to identify the alternative energy sources to be matched with the energy needs of each country and to establish an order of priority for the development of these alternative energy sources. Such factors as a country's technical capability, training needs, economic situation, and available financing resources should be taken into consideration. This would be a well-planned way to approach the energy problems of the Region. As it stands now, the energy needs and resources assessment, the energy conservation plan, the demonstration, the implementation, and the testing and other related activities are being done at the same time, without the proper training of field personnel and without the technical "know-how" to implement the field activities properly.

This situation is at the root of many of the difficulties over project implementation faced by the TEU, because it precludes a well-planned approach in the field testing program and communications necessary to alleviate the energy problems. The TEU could only maximize the impact of project funds if and when information on energy needs, energy resources and the countries technical resources become available.

In this situation, the CDB staff and CARICOM are trying their best to execute this overambitious program which even a well-prepared Region might have difficulty executing effectively. It is unrealistic to expect that all of the objectives outlined in the Project Paper can be attained even though they certainly are needed.

Two major aims for institutional development under the Project are:

- (1) To build upon existing technical, managerial, communications and training expertise in the Region;
- (2) To develop the technical capabilities of participating institutions in energy areas (Project Paper, p. 56).

Concerning the energy activities being implemented by CDB, the evaluation team believes that the overall program and the individual projects have had very little impact so far on developing the technical capabilities of participating institutions in the field countries. Most often these institutions assign energy activities to staff who have other duties, usually of major importance since they are associated with the daily operation of the institution. For example, two engineers who are associated with the CDB wind project in Antigua are in charge of electricity, water and telephone services for 70,000 people for the Antigua Power and Utility Authority. They are the only engineers in the Authority. With such situations it is not surprising that field energy activities are behind schedule and are not being implemented

as effectively as CDB, CARICOM and USAID might expect. The potential for the development of the technical capabilities at participating institutions is there; however, it will take time, training, funds and the continuous commitment of the Region and of the outside funding organizations to develop the alternative energy resources of the Region and to obtain significant results.

According to the Project Paper (p.23), "The goal of the Project is to develop a capability to utilize renewable energy sources in the Caribbean as alternatives to imported fossil fuels and to encourage energy conservation measures. This goal is to be achieved by introducing cost effective, renewable energy technologies and conservation programs through energy policy review, the training of professionals and technicians, and improved communications and testing of applications."

Some progress toward achieving this goal is being made. Lists of Energy Program activities by the TEU are given in Tables IV and V. According to these tables it appears that less than ten percent of started TEU Energy Program Activities were completed by December 1981. However, one should also keep in mind that the TEU energy program is only about two years old.

Solar water heating for public buildings such as hospitals and schools should be one of the priorities for direct solar energy demonstrations in the Region. The regional replicability of such projects is exceptionally good.

TABLE IV

ENERGY PROGRAM ACTIVITIES COMPLETED BY TEU

<u>Activity</u>	<u>Type</u>	<u>Country</u>	<u>TE Funds (AID)</u>
Peat Resource Assessment	Analytical Study	Belize	\$10,000
Study of the Commercial Viability of Non-Conventional Water Heating in the Tourism Sector	Analytical Study	Grenada	10,000
Integrated Energy Program/ Orange Hill Estate/Preliminary Evaluation	Analytical Study	St. Vincent	1,250
Chemical Lime Analysis	Analytical Study	Antigua	18,000
TEU Passive Solar Building	Project	Barbados	30,000
Preliminary Site Assessment/ Photovoltaic Pumping	Analytical Study	Grenada and Antigua	10,949.50

TABLE V
ENERGY PROGRAM ACTIVITIES STARTED BY TEU

<u>Activity</u>	<u>Type</u>	<u>Country</u>	TE Funds (AID)
Solar Water Heating Test Facility	Project	Barbados	\$16,000
Environmental Monitoring of TEU Building	Analytical Study	Barbados	14,750
Regional Wind and Solar Resource Assessment	Analytical Study	Regional	512,420
Solar Drying of Chilli Peppers	Project	Guyana	49,500
Wind Power Demonstration	Project	Antigua	271,850
Testing and Demonstration of the Use of a Solar-Powered Photovoltaic Pumping System in Irrigation	Project	Antigua	47,270
Recovery of Fuel and Feeds from Arrowroot Processing Wastes	Analytical Study	St. Vincent	46,508
Integrated Energy Program/Orange Hill Estate-Detail Feasibility and Design	Analytical Study	St. Vincent	33,439
Energy Audit/Tempe Manufacturing Co.	Analytical Study	Grenada	n/a
Energy Audits/Hotels (6)	Analytical Study	Grenada	22,909
Hotel Energy Managers Manual	Analytical Study	Regional	n/a

The Project Paper notes that numerous hotels, hospitals and restaurants throughout the Region offer a ready market for this application of solar technology (p. 70).

The evaluation team noticed that after two years of the Project, only one field demonstration, the TEU Passive Solar Building, had been completed by TEU. However, according to TEU, the effective work on the project started one year after the Project Agreement was signed with USAID.

According to the Project Paper (p. 26), "The CDB will finance and manage an energy communications program involving collection and dissemination of information, conferences, seminars, workshops and a public information program for all participating countries, and a technical program including renewable energy resource assessment and field tests of identified alternative energy technologies." The first program has a budget of \$612,500 and the second \$2,325,800.

The distribution of funds as stated by the Project Paper (p. 55) is:

(a) Windpower	\$680,000
(b) Biomass	\$490,000
(c) Hydropower	\$380,000
(d) Direct Solar Energy	<u>\$265,000</u>
Total	\$1,815,000

In addition to Haiti, Dominica, St. Vincent, Dominican Republic and Jamaica, hydro potential has been identified in Belize, Guyana and Grenada. Available data shows that there may be good wind potential in Barbados, Antigua, Anguilla and Montserrat.

Taking into consideration the potential for hydro and wind power alternative energy sources, the locally available know-how, the distribution of USAID energy program funds between LDC's and MDC's, the creation of employment opportunities for people, the proven reliability and durability of equipment operation which is important to an electrical utility, and the perspective for private ownership versus state ownership, the evaluation team recommends that the funds be distributed equally between wind and hydro activities, \$530,000 for each. According to TEU, as of December 4, 1981, U.S. \$650,000 has already been allocated, and only US \$30,000 remains which could be reallocated.

Technologies such as large-scale biogas production to generate grid-fed electricity and the development of an alcohol fuel industry for transportation use are long term enterprises. They are most often large, capital intensive, and expensive to demonstrate. The development of the paper industry in some countries may be more economically justified than the use of the same biomass as combustion fuel. Wood and charcoal, biomass fuels, provide significant amounts of energy

in heavily rural or forested countries like Haiti, Belize, Dominica, Dominican Republic, Grenada, Guyana and St. Lucia. The increase of this use must be accompanied by integrated re-forestation programs to avoid further ecological damage, as in Haiti. This will demand increasingly higher transportation costs and road infrastructure development since most of the biomass available close to existing road systems has already been used, as in Belize. Also, because of the requirements for land or containment of animals, biomass resources may not be generally applicable to some Caribbean territories.

The development of solar cooling technology, solar desalination, solar process heat generation, solar water pumping, solar drying, solar cooking, solar electricity and mechanical power generation could have widespread applications in all the countries of the Region. The development of manufacturing capabilities and the setting up of local industries to produce solar equipment or the bringing in of foreign industrial companies to manufacture solar thermal devices and photovoltaic cells should be interrelated with the solar energy demonstration. The creation of employment opportunities will follow. More effort should be made to orient the direct solar energy use toward poor people to improve their living standard.

Concerning the biomass and direct solar energy potential, it is the opinion of the evaluation team that the available funds should be distributed in a way which reflects the near

term potential of both technologies in the whole region. This distribution should be that each receives \$377,500.

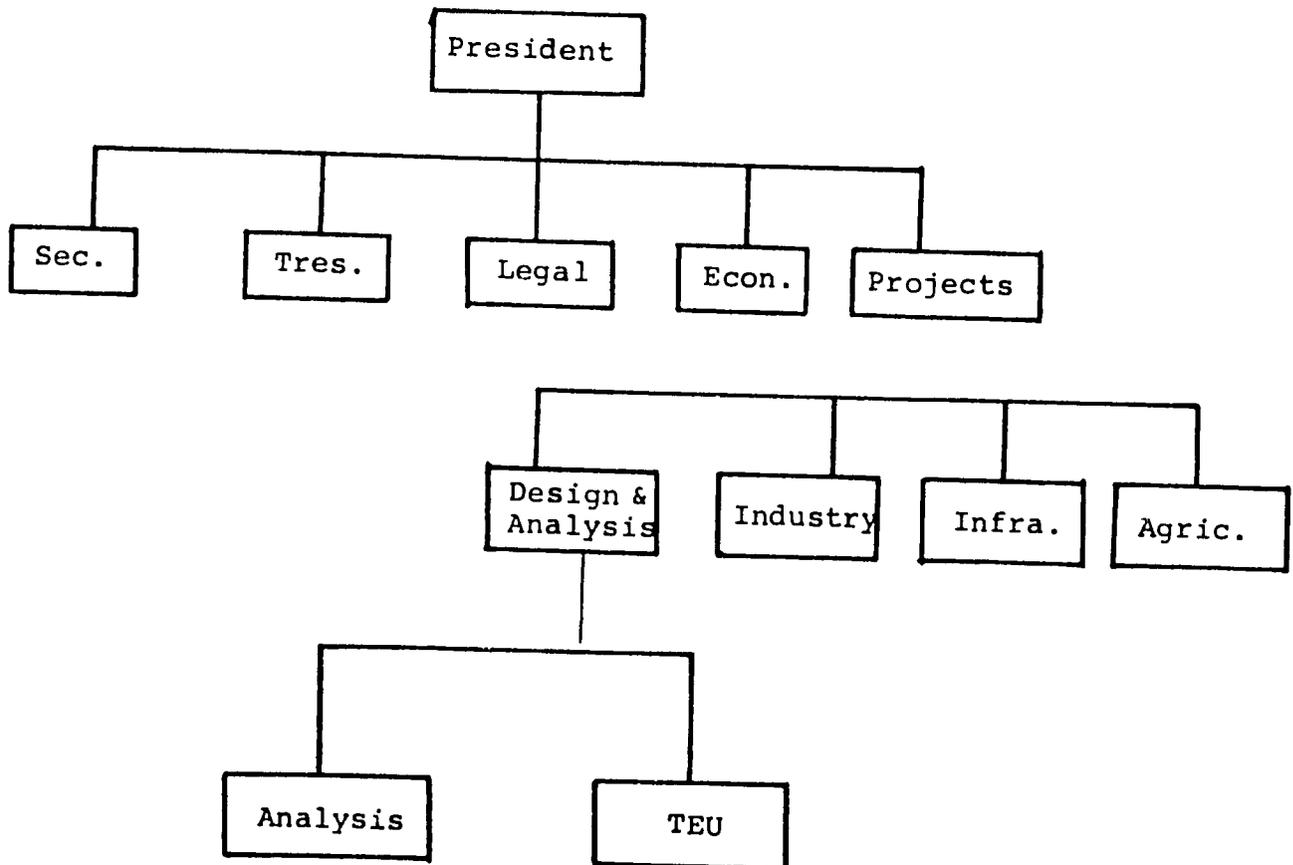
Since most of the activities are not completed and many are behind schedule, it is possible to say that some objectives of the Energy Program are not being implemented according to schedule. However, it should be kept in mind that field work started one year after the signing of the Project Agreement. Other activities which have not yet been started may not reach their objectives within the time frame of the Program. The evaluation team believes the scope of the program is too broad and the means to execute it too limited; also, other numerous constraints make all the objectives impossible within the present budget and timetable.

6.2 The effectiveness of CDB administrative and operational procedures.

Neither CARICOM nor CDB has appreciable experience in alternative energy work. Both organizations will need to hire staff to implement the Project as mentioned in Project Paper (p. 26). According to the Project Paper (p. 25), the CDB as grantee will receive US \$4.0 million to establish an Energy Group and to implement various projects. Within this \$4.0 million are included funds to implement the technical program (\$1,032,000) and the communications program (\$637,000) modeled after the Technical Information Unit. Also included are \$1,017,000 for salaries, \$998,700 for resource assessment and analytic support, and \$48,000 for travel and per diem expenses.

As a result of the Project, the TEU was established at CDB in August, 1979, to implement the project activities. The TEU position in the CDB organizational structure is shown in Figure 2. (TEU Development and Operation Plan, p. 23).

FIGURE 2
CDB ORGANIZATIONAL STRUCTURE



According to the Project Paper (p. 29), "The Project Design and Analysis Division of the CDB will have the staff needed to carry out its role. Four full-time professionals will be added to this staff to form the Energy Group. This staff will be headed by a program manager at the

assistant director level who will report to the deputy director of the Project Design and Analysis Division. The staff will include a technical officer, most likely an engineer with experience in environmental analysis, a communication/information officer, and a financial or economic specialist. These positions will be absorbed gradually by CDB beginning in the third project year and by the end of the project be fully institutionalized and financed by CDB".

In September 1981, the TEU had the following staff:

<u>Position at TEU</u>	<u>Specialty</u>	<u>Degree</u>
Head of TEU	Biophysics	Ph.D., 1971
Project Officer	Transportation Engineering	M.Sc., 1974
Project Officer	Electrical Engineering	B.Sc., 1967
Project Officer	Industrial Engineering and Operation Research	M.Sc. 1979
Project Officer	Sociology and Management	B.A., 1978
Project Officer	Library Studies	B.A., 1978
Project Supervisor	Senior Technical Assistant	N/A
Secretaries (three)		

There is no expert in environmental analysis, no financial or economic specialist, and the impact capabilities in communication/information are very weak. The CDB is expected to begin financing two of the four positions in the third year of the project so that by the fifth year project

funds will finance only consultant costs (Project Paper, p. 73).

The evaluation team was not shown any document treating this subject from the CDB position. According to the document "Technology and Energy Unit/Development & Operation Plan," May 1980, (p. 24): "For the present programme staffing is expected to consist of a Head, seven Project Officers and two Clerical Officers. The Project Officers will be drawn from the following broad specializations:

- one documentalist
- one communication officer
- one industrial technologist
- one agricultural engineer
- one alternative energy engineer
- one economic analyst"

In the opinion of the evaluation team, each of the project officers should have expertise in one or more of the alternative energy activities under his/her supervision. A single alternative energy engineer will not have the time, knowledge and freedom within the TEU structure to provide effective assistance in areas outside of his direct responsibility. The document should also outline in detail the expertise required from each project officer according to his many responsibilities. The same document states that: "For at least the first year of the TEU operations, two specialist consultants - an alternative energy engineer and an industrial

engineer - and an audio-visual specialist will be hired under long-term personal services contracts to assist in the rapid development and implementation of the Unit's operations" (Project Paper, p. 24).

So far, two long term consultants have been used under the Joint Consultancy Contract, one electrical engineer (energy specialist-wind energy) and one marine biologist (biomass/bio-gas energy). Several short term consultants were also used. Some of the hired consultants had expertise more on the level of appropriate technology (biomass/biogas) than on the technology level required by TEU activities. One audio-visual technical assistant was used at TEU until June 1981. An audio-visual specialist should still be hired.

The Project Paper (p. 26) says that "as advisors to the CDB and CARICOM energy units, the consultants will, for example, assist in the development of final selection criteria for technical sub-projects, institutional grants, contractors, training institutions, and participants; assist in assuring the technical and economic soundness of technical proposals; insure that Grantee personnel are aware of relevant research findings, training opportunities and sources of technical support; assist in the preparation of annual work plans; assist in the development of information feedback systems for monitoring and evaluating; assist in identifying technical assistance needs; and encourage and assist in the development of coordinated and complementary programs by the two Grantees".

Two consultants, one with a specialization in wind energy conversion and the other in the area of biomass/biogas energy, covered the activities related to their primary expertise, although the wind energy expert also assisted in projects related to direct solar energy conversion. They could not effectively cover all the technical and analytical activities in these areas and perform, at the same time, all the tasks outlined above in addition to their administrative duties.

During the Project's initial two years of implementation TEU used 2.5 person years of long term consultant services out of the five person years stated in the Project Paper (p. 8). At least one more person year should have been used during these first two years of the program, and a professional staff with appropriate technical expertise should have been hired.

According to the Project Grant Agreement between the CDB and USAID of August 25, 1979, the CDB should provide:

- (1) Evidence that the Grantee has planned for an adequately staffed energy unit or group and has a detailed plan governing its operation including permanent staffing arrangements, and a time - phased work plan governing the use of project funds for the Policy, Training, Communications and Technical Programs.
- (2) A contract for technical services to provide both CARICOM and CDB with expertise necessary for program development and implementation.

As far as the evaluation team can ascertain, no replacement for the current consulting services is planned. The team recommends building up strong institutional expertise at TEU in energy and technology in accordance with the Grant Agreement (Annex 1) which provides about twenty person years of staff (the other twenty person years is the overhead) and nine person years of consultant services (see also Project Paper, p. 8). TEU uses six project supervisors in addition to the Head of TEU and the secretarial staff. The evaluation team recognizes that the core of TEU consists of some dedicated staff members with good potential for the future professional development; however, the TEU unit is not adequately staffed in expertise and manpower. Several experts should be hired by TEU to strengthen its institutional expertise in thermal solar energy, wind power, biomass/biogas, information/communication, energy management/conservation.

Some difficulties of the USAID energy program and the lack of definite progress in some areas arise from the lack of institutionalized technical expertise in alternative energy sources at TEU, at CARICOM, and in the field institutions.

It is also of paramount importance that the additional TEU staff be hired to further the successful execution of the USAID program in the near term and the successful role of TEU in the long term. The institutionalization of energy expertise at TEU is very critical for the unit's operation since such expertise does not exist in other Divisions within the Bank.

The Bank may also consider hiring faculty with appropriate experience on sabbatical leave from the universities of the Region to strengthen the technical capabilities of TEU. However, the Bank should seek to obtain experienced, highly qualified staff to assist in quickly establishing TEU's role as an effective, permanent unit within the Bank. The TEU Head should be given the responsibility of playing a major role in the selection and recruitment of the TEU staff.

"The CDB and CARICOM will have day to day management responsibility in their respective areas" (Project Paper, p. 27). The management's effectiveness can be increased by increasing manpower and technical expertise at TEU.

According to the Project Paper (p. 29), "The CDB will coordinate the activities of the local and regional institutions involved in implementing individual sub-projects, including providing technical assistance to participating organizations. The CDB will directly evaluate the technical, economic and social feasibility analyses of demonstration projects to be field tested and develop the selection criteria for future demonstration projects. The CDB staff will also evaluate the results of the field tests." With adequate staffing and institutionalized technical expertise TEU could provide direct technical expertise to smaller communities, could point out areas for alternative energy applications and research, and could demonstrate and test new energy devices in the Region. There is no doubt that the Bank/TEU has made serious efforts to implement the USAID Project components and these efforts are being recognized

by the evaluation team. The difficulties encountered by the Bank/TEU are being compounded by the number of countries involved, the variety and nature of the economic and social conditions, the prevailing attitudes towards energy professionals. Although all this has produced some operational difficulties, TEU has made a good start and the Project evaluation is a part of the process to deal with these difficulties. There are good prospect in the long run that TEU will make a visible impact on technology and energy development in the Region since it is fulfilling a much needed role for the Caribbean. The Bank's management should be complimented for its foresight in accepting the responsibility for implementing the projects on behalf of the Region and for contributing to its financing. Many of the governments interviewed in the member countries recognized this and wanted TEU's role to be expanded and strengthened.

An official Bank document should be prepared by the management concerning the role and the timetable for the permanent integration of the TEU into the Bank structure as soon as possible. TEU capabilities should be increased for easier integration into the Bank's structure.

A time will come when new projects and ideas will be developing from the TEU activities, especially from the field testing projects and from the TRF program. These ideas should be fed into the Bank system to generate new investment activities in the fields of technology and energy. The TEU field testing and assessment activities should be seen as part of the Bank's pre-investment program to identify the

best technology for specific investments.

The public relations person who will soon be hired by the Bank can assist TEU in identifying subjects for proposals.

The TEU should assist the project officers of the other divisions in the choice of technology when the capital/labor ratio is very high or very low. The TEU should be involved in electricity generation projects of the Infrastructure Division to make sure that renewable energy is used there in the most effective way; energy related activities of the Infrastructure Division should be shared with TEU as joint projects. The TEU should provide technical assistance to the Bank in general, and, in particular, in the area of power generation projects to assure that new energy sources receive serious consideration as alternatives to fossil fuels. Closer and more effective collaboration between TEU and other divisions should be promoted by the Bank management to use the human technical resources available at the Bank in the most effective way. If TEU makes the right impact on the Bank, this will automatically have a positive regional impact because of the important role of the Bank in the Region.

Since TEU activities are interrelated with the development activities of the Bank, most of the TEU forms have the word loan on them. The opinion was expressed that people have the tendency to think differently when loan appears on a document which deals with technology or energy matters. Some misunderstandings may arise from this situation. It seems advisable, therefore, to change the wording on some documents and to improve the mechanism for processing them at the Bank.

Some internal procedures at CDB could be made more effective if the technical structure of TEU and its specific role at the Bank were recognized. Experts should review TEU activities to provide technical assistance and operational advice on a quarterly basis.

TEU seems to have a flexible budget system. The disbursement schedule for the two USAID Project activities TE and TRF is being revised during the program and appropriate schedule changes made if warranted. Funds are spent and then reimbursed by USAID. Disbursement by the Bank takes two weeks on an average, although some payments have been delayed up to a month. The TEU budget at this time is as follows:

- (1) Energy Program, US \$4,002,700
- (2) Technology Research Funds, US \$1,173,000

For individual activities, it is the duty of the project officers at the Bank to keep track of the project budget. The project officer's responsibility is mainly technical during the preparation phase and mainly managerial during the implementation phase.

The CDB Finance Department controls only the total amounts of USAID and CDB funds. It is the responsibility of the project officer and of the Head of TEU to check the disbursements in each category against the project agreement. The Finance Department does not keep record of how much money is spent in sub-categories such as equipment or supplies. According to the Finance Department, it is physically impossible to keep track of sub-categories since the Bank does not, at present,

have a computer fully operational. The financial records of disbursements by categories are available to project officers if they ask for them. Since October 1981, the Head of TEU is also getting a monthly statement of expenditures on each of TEU's sub-projects and activities which contains information such as amount approved, project beneficiary, date of approval, date agreement signed, CDB contribution, donor contribution, amounts disbursed and amounts not disbursed. Salary expenditures are also listed. The evaluation team thinks that the Finance Department should also keep a record of all relevant sub-categories for each project. Each financial file also contains other pertinent information such as the project agreement, activities, memorandums and cables. These files are very extensive and cover financial, legal and technical matters.

The following files were provided by the CDB Finance Department for reviewing at the request of the evaluation team:

Energy Program

1. Passive Solar Building in Barbados
2. Wind and Solar Energy Resources Assessment
3. CDB/CCS Joint Consultancy - Alternative Energy Program

Technology Research Funds

1. Banana Defibering Pilot Plant in St. Lucia
2. Control of Crop Damage by Monkeys in Barbados
3. Solar Drying of Chili Peppers in Guyana

It usually takes from six to eight months from the day an idea becomes known to the Bank to the day when an agreement is signed with the project executing agency. Although some projects take less time to go through the Bank review and preparation cycle, speeding up the process for project preparation and implementation should be introduced. The administrative processes in general and the information and communication services in particular should also be made more efficient.

The project officers' duties should be organized so that they can spend more time participating directly in the supervision of field activities and less time filling out papers.

The role of CDB Project Officers during the project activities preparation and the implementation should be made clear to the countries and institutions participating in the program. Some of the institutions expect the Project Officers to be involved in the field projects implementation. The perception of the role of TEU Project Officers by project implementing institutions is incorrect; some material defining the present role of TEU should be prepared by CDB.

The energy units of the countries visited need to institutionalize their energy expertise and hire permanent full-time staff to take care of the ongoing and planned activities. Many personnel who work on energy are part-time staffers borrowed from other departments. There is a lack of technically skilled personnel needed to implement energy activities in the field;

a critical lack of expertise in various energy areas, especially on alternative energy equipment/systems, also exists.

Staff in implementing institutions are being assigned to projects as an addition to their normal duties. This situation does not help the effectiveness of the CDB field activities, considering the general manpower and technical capability shortage which exists at these institutions. In some institutions in the Region there is also manpower instability and a lack of continuity of work on USAID/CDB energy activities.

"CARICOM and CDB will fund regional and extra-regional research institutions, national technical institutes, or other appropriate national organizations for carrying out specific program activities" (Project Paper, p. 74). TEU is doing this by funding organizations such as CMI, BNSI, CARDI, UWI, CEER, DSI, EDI, and other state and consulting agencies to perform some of the activities under the USAID/CDB program.

Reports, including draft reports, and other documents treating the energy and technology activities should be exchanged speedily between CARICOM and CDB for their mutual benefit. The responsible officers at both institutions, should act immediately to correct the existing situation. Better coordination of activities between CARICOM and CDB is needed as a necessary ingredient for the successful implementation of the USAID program.

USAID representatives should be informed continuously through detailed technical and financial reports and other documents treating the progress of the individual activities under the USAID program. The liaison of CDB and CARICOM with USAID is not satisfactory as it is now. The technical staffs of TEU and CARICOM should meet twice a year to strengthen coordination activities.

The Project Paper states (p. 69) that "social and cultural feasibility analyses will be carried out concurrently with the engineering analyses for each site - specific field test". These analyses were not done; according to the Project Paper, they should be performed routinely. In the opinion of the evaluation team the feasibility analyses should be done prior to the financing of field tests. Generally speaking, the social, cultural, and environmental analyses are not being given the attention requested by the Project Paper. However, in TEU's opinion, it is expected to follow only the CDB Implementation Plan and Operational Procedure concerning the USAID Project.

According to the Project Paper (pp. 103-105), "It will be the responsibility of the Project evaluation staff (CDB, participating research institutions and outside contractors) to ensure that specific criteria for prevention of significant environmental impact are met. As with charcoal, careful ecological analyses must accompany large-scale biomass strategies. The major environmental impacts are those associated with the utilization of micro-hydro and biomass energy technologies."

The evaluation team is not aware of any environmental impact studies being done under the Project in relation to biomass or micro-hydro use in the Region, although micro-hydro sites were identified for future implementation in Belize, and a biomass resource assessment project will soon be implemented. The team recommends that, as outlined in the Project Paper, an environmental impact study be considered as one of the tasks to be performed when implementing biomass, micro-hydro and large wind power projects. In addition, with biomass energy plantations, charcoal productions and micro-hydro sites, the ecological balance at the sites should also be investigated.

In the opinion of TEU the economical/financial analysis and the environmental impact studies for pilot projects should be done as part of the completion reports in advance only in the case of démonstration projects. The evaluation team believes that such analyses are possible to do.

"CDB will have the responsibility for supervision reviewing, evaluation, and approving technical program sub-projects. In some cases, governments may have a sub-project identified but be unable to submit the required quality proposal. In such cases, CDB Energy Group Staff will use normal CDB procedures to provide technical support to assist them in proposal definition and preparation" (Project Paper, p. 49). This is now being done by TEU Project Officers.

The two stage project review process (Project Paper, p. 53) assumes that a country has the capability to provide details about the project such as the performing group's identification and qualifications, and an estimated time-line

description of costs and available resources. In practice, however, CDB is identifying the project and working out the details, and this puts a time and manpower demand on the TEU staff.

"Reports will be submitted by CARICOM and CDB to RDO/C on a semi-annual basis. These reports will form the basis for the annual project evaluations and will provide the necessary baseline data for the individual program and the overall project evaluations" (Project Paper, p. 77). Although four of them should be available according to the scheduling in the Project Paper, the evaluation team was provided with only the last one of these reports (the third one); according to the Head of TEU the other reports are in the TEU file.

"A quarterly review of ongoing technical projects, as specified in the Implementation Plan of the Project Paper, will be performed by the TEU staff (p. 55). This will provide an assessment of progress toward objectives to indicate poorly performing projects and to monitor cost accounting and budget details." TEU's "Draft of Progress Report" covers all aspects of the ongoing technical projects. A separate quarterly review of all ongoing TEU activities should be available, as stated in each project agreement.

No reports were available on the following activities which were selected for the review:

Energy Program

1. Passive Solar Building in Barbados.

Comment of TEU: Report not prepared and is therefore not available.

2. Solar Water Heating Test Facility at BNSI in Barbados,

Comment of TEU: Reports are due on a quarterly basis; the first report was due July 1981, but it is not available.

3. Integrated Energy Program at Orange Hill Estate in St. Vincent/Detailed Feasibility and Design,

Comment of TEU: Contracting organizations (EDI/DSI) are delaying the reporting; the report was due Sept. 1981, but it is not available.

4. Wind Power Demonstration in Antigua,

Comment of TEU: Funds were approved but the Agreement has not been signed yet; therefore the report is not available.

5. Preliminary Site Assessment for Photovoltaic.

Pumping in Antigua and Grenada,

Comment of TEU: Report is on file.

6. CDB/CARICOM Joint Consultancy - Alternative Energy Program.

Comment of TEU: Reports are not available.

Technology Research Funds

1. Banana Defibering Pilot Plant in St. Lucia,

Comment of TEU: Reports are on file but were not available.

2. Testing and Demonstration of a Solar-Powered Photovoltaic Pumping System for Irrigation,

Comment of TEU: Report is not available.

The evaluation team recommends that each project file be reviewed in detail according to the CDB Loan Supervision Manual of May 23, 1980, because the procedure in many instances is not being followed by the project supervisors.

It may simplify operations, however, if a special manual for TEU is institutionalized. An example of the Project Completion Report should be included in the CDB Loan Supervision Manual for TEU use. A Basic Data Sheet for TEU projects and an example of the Project Reporting Requirements from Borrowers should be included. For TEU projects, an evaluation of the technical criteria of the project should play a role equally important to that of the economic and financial criteria which are used by the Bank to rate a loan's success.

An overwhelming amount of preparatory work and documentation was done for the field work actually accomplished. During the next phase of the program, TEU should concentrate on field applications to bring the already initiated activities to successful conclusions.

Operational Procedures for the Technology Development Program, May 1980, states the following broad goals for TEU

(Annex 1):

- (a) to facilitate increased and more effective use of local manpower and material resources, and exploit any special advantages available to local entrepreneurs at all scales of operation with the aim of increased regional self-reliance;
- (b) to reduce dependency on imported fossil fuel through conservation and increased utilization of alternative sources of renewable energy;

Comment of TEU: CDB did not get any funds for energy conservation under the field test component of the USAID Project.

- (c) to facilitate increased participation by and benefits to small productive enterprises serving local and export markets;
- (d) to direct benefit as far as possible to the lowest income groups through increased employment and/or incomes, access to housing and other basic needs, and reduced cost of essential goods and services.

The evaluation team believes that point (d) is not being implemented. The energy conservation activities such as Study on Non-Conventional Water Heating in Tourism Sector, Caribbean Electric Utility Conference, Energy Audit - Tempe Manufacturing Company, Energy Audits of Hotel, and the preparation of Energy Conservation Manual for Hotel Managers,

were done by TEU with the objective of generating inputs for the TEU communication program and not as energy conservation activities per se. However, in view of the fact that no funds were allocated for energy conservation activities under the USAID project, the Bank/TEU should be commended for making an effort in this area.

Future TEU energy conservation activities should be coordinated with the energy conservation activities of CARICOM under the USAID Project.

The use of off-the-shelf devices and systems should be intimately connected to the efforts of bringing the manufacturing of these devices and systems to the Region. The activities related to point (a) need to be strengthened. Point (c) is being implemented, although it seems desirable to speed up the loan processing mechanism at the Bank.

Project selection criteria such as (Project Paper, p. 54):

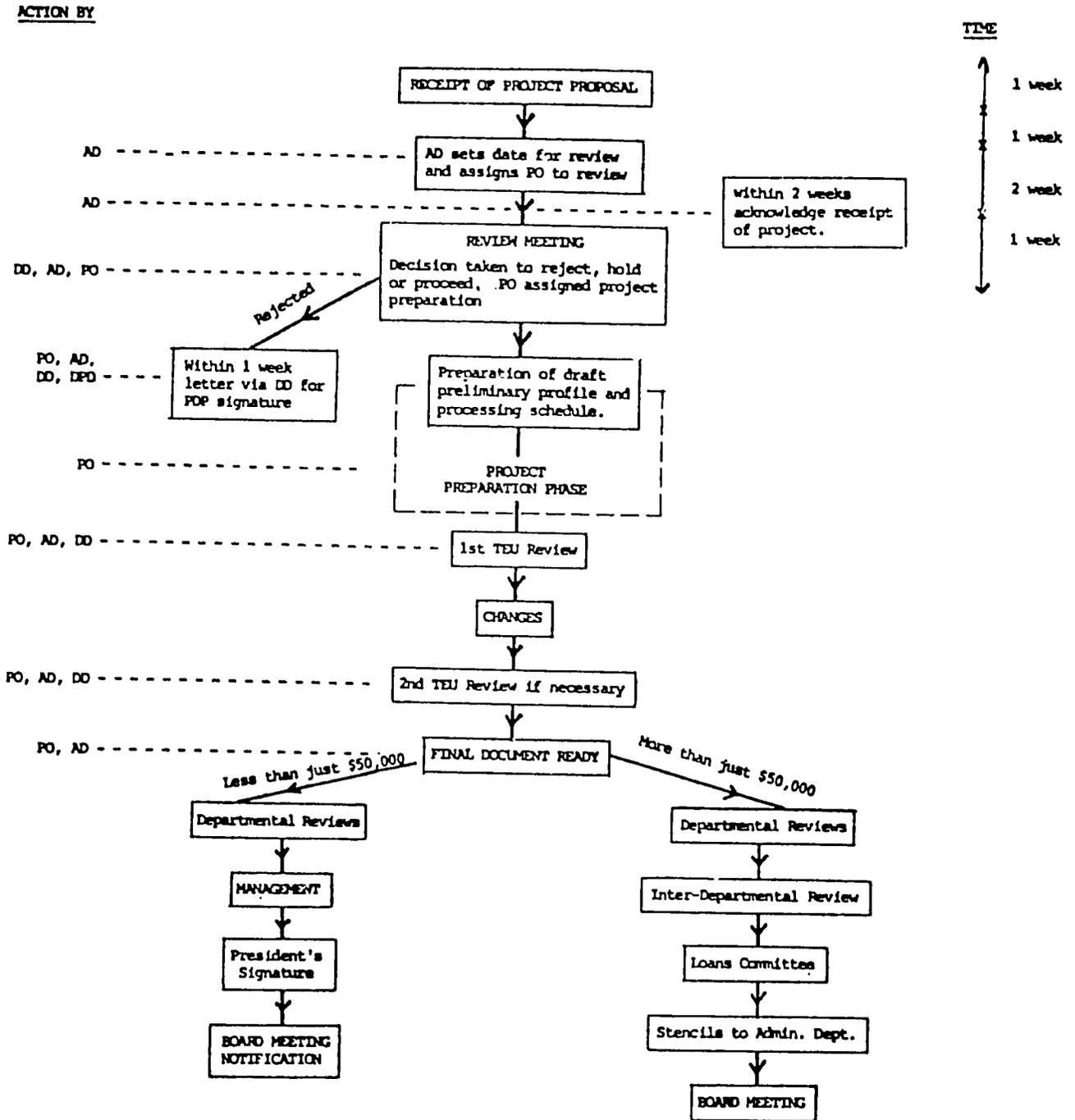
- (1) impact on the poor,
- (2) environmental acceptability of project,
- (3) net value fossil fuel consumptive effects, including consideration of technology, manufacture and transport, and
- (4) capability of employment generation is not always satisfied, especially when off-the-shelf devices and systems are used, and when demonstration sites and enterprises privately owned by well-to-do

entrepreneurs are selected.

For example, the first criteria was not satisfied in the case of the selection of Orange Hill Estate in St. Vincent for an alternative energy sources demonstration; the second criteria was not investigated concerning the lime and wind demonstration projects in Antigua and the peat resource assessment project in Belize; the third criteria of net fossil fuel consumptive effect should be investigated before the cement industry in Antigua and Belize is promoted; the fourth criteria should go in parallel with alternative energy sources implementation under the condition that an alternative energy system is built on the site, and/or manufacturing capabilities of alternative energy equipment are set up to create new employment opportunities. Buying off-the-shelf devices and equipment does not create new employment opportunities without bringing the manufacturing of this equipment to the Region or creating new industries on the base of the generated energy. In the opinion of TEU at least 50 percent of the field projects involve some locally fabricated devices.

Concerning the investigation of new ideas for proposals by Project Officers at TEU, there may be several new ideas to investigate for proposals, but since a Project Officer does not know which one of them will be approved and put through the evaluation process (see Figure 3), he has to spend the same amount of time investigating the merit of each one.

FIGURE 3
TEU PROJECT PREPARATION SCHEDULE



According to the Project Paper (p. 62), the Alternative Energy Systems Project will not be a revenue producing activity. This assumption was not correct as far as some CDB activities are concerned (e.g., Monkey Control Project produced a revenue of \$50,000 from the sales of monkeys).

"Technically, sufficient fuels could be generated under several of the sub-projects to warrant marketing the energy produced during the field-testing program. In making the implementation arrangements for these sub-projects, CDB will often negotiate agreements with the governments and implementing agencies for marketing these outputs. As planned, revenue generated will be utilized to finance operating and maintenance costs of the non-conventional systems" (Project Paper, p. 62). This was done in the case of the Wind Energy Conversion Demonstration for Antigua as one of the points of the agreement between CDB and APUA.

6.3 The impact of project component sub-project activities and the expected impact of individual planned activities.

Institutional changes in the countries participating in the CDB/CARICOM/USAID energy program are basically centered around the creation of a Ministry of Energy or energy units in a designated Ministry. This is an important output, even though operationally these units lack qualified manpower and use staff borrowed from other departments.

The program focuses the attention of each country on its energy problems and exposes the critical importance of the energy situation on each country's balance of payments problem. It also points out ways of alleviating the existing economic burden of importing fossil fuels by conserving energy and by using abundant alternative energy sources in the Region. In addition to the long term technical impact potential, an immediate impact is made on industrial, economical and political decision makers who become aware of energy problems and potential solutions.

The evaluation team concurs with the request made by some of the governments to the evaluation team that a state-of-the art report on the alternative energy sources status be done by TEU for regional use.

The assessment of the applied R&D can be done by reviewing a selected number of individual projects under the Energy Program and under the Technology Research Funds.

(1) TEU Passive Solar Building in Barbados

According to the project records, the budget was US \$50,000. The project's financial records, however, show a disbursement of \$72,864.61. A document authorizes the disbursement by the Bank Secretary/Director of Administration. It is not clear whether the entire overdraft of \$22,864.61 was authorized. According to Project Procedures (p. 17), soon after the final disbursement is made on a project, the project supervisor submits a detailed

Project Completion Report. This report was not presented to the evaluation team, nor were the quarterly reports.

The passive solar annex to the existing TEU solar building was added prematurely without the technical assessment and the results of the environmental monitoring of the TEU building as outlined in the TEU Memorandum of June 3, 1981. The administrative priority of finding new office space took precedence over the technical reasons for waiting for the monitoring results of the existing TEU passive solar building.

From the technical point of view the new passive solar annex should not have been built before the monitoring of the existing TEU passive solar building was performed. Several features of the new solar annex should have been changed, starting with the design, before the building was built.

Since the CDB investment in this annex will be amortized within three years, the evaluation team recommends modifying this building according to the results of the monitoring with the total cost being absorbed by CDB. However, the financial soundness of the CDB decision must be commended since normally the payback on alternative energy equipment is five to thirty years.

It is not known how buildings like this will be accepted in the Region. Various changes in the construction of

the building seem to be warranted to make it more acceptable. The replicability of the building will depend upon what people will accept as a comfort level.

The evaluation team sympathizes with the TEU staff's comments as expressed in the "Comments on Design of New CDB Building" (August 21, 1981). Results of the technical monitoring of the building's environment are necessary, however, to substantiate some of the opinions. The following recommendations are made by the evaluation team about the building itself:

- Roof turbines and window screens could be installed;
- Roof thermal insulation could be increased to decreased the building's cooling load;
- Thermal mass should be increased by using stone or tile floor in the building.

No final report on this project was available.

(2) Environmental Monitoring of TEU Building in Barbados.

The budget of this project is US \$14,750 for 18 months. The project was approved by the CDB in June 1981. The main objective of the project is to monitor the performance of the passive solar TEU building.

With reference to the Memorandum entitled "Environmental Monitoring of the Technology and Energy Unit Passive Solar Building" (June 3, 1981), the evaluation team recommends monitoring the impact of hanging plants in the building on the interior humidity and temperature. The possibility of running an air conditioning system in the building's conference room by using a wind generator should be taken into consideration; surplus electricity could be fed into the utility grid.

The results of the environment monitoring should include recommendations concerning the best use of such a building (e.g., as a cafeteria, recreation building, workshop, office building, or commercial store). On the base of these results, the construction and architecture should be reevaluated accordingly and new conceptual designs included in the information brochure to be published by CDB. A technical staff member of TEU should analyze the incoming data on a day-to-day basis during the monitoring.

(3) Wind and Solar Energy Resource Assessment

From the approved funding of US \$512,420, the financial records show a disbursement of \$376,000 since January 1981, the date of the agreement between the Bank and CMI - the executing agency. Phase I of the project is 2.5 years. The main activities of Phase I of the wind and solar resources assessment are data collection in the field in Barbados, St. Kitts/Nevis, St. Lucia, Antigua, Monserrat, and other sites. The funds for Phase I were allocated as follows:

Technology Research Funds, \$250,000

Alternative Energy Systems, \$220,000

CDB funds, \$42,420

The overall project is planned for five years with a total budget of about \$1.6 million. In Phase II of the project, stations will be installed in Dominica, St. Vincent, Grenada and two Grenadine islands - six stations will be installed in all. The objectives of the Wind Resource Assessment Program are:

- (a) to carry out a detailed statistical analysis of existing long-term records for each island included in the program;
- (b) to map the wind flow over each island at the meteorological standard height of 10 m;
- (c) to identify the most probable sites for wind turbine location on each island.

The Agreement states that general progress reports shall be submitted on a quarterly basis. Two quarterly reports were presented to the evaluation team, one for the quarter ending on April 30, 1981, and the other for the quarter ending June 30, 1981. Both reports cover the progress of wind data collection. There is very little information about the status of the solar resources assessment which is part of the overall project activities. In both quarterly reviews, the graphs of the diurnal variation of wind speed do not have the time scale.

The evaluation team recommends that the quarterly reports for the above activities consist of two separate parts: one covering wind resource assessment activities and the other covering solar resources assessment activities. Budget records for both activities should also be presented separately. The quarterly reports should also include a schedule of completed work tracked against the original schedule approved by CDB. This information is not included in the reports.

According to the Agreement these reports shall include:

Phase I Activities:

- (a) Activities concerning the procurement of existing wind data;

- (b) Status of the development of computer software;
- (c) Status of statistical analysis.

The reports do cover each of these activities briefly.

Phase II Activities:

- (a) Progress on procurement of equipment;
- (b) Monthly status and location of mobile units;
- (c) Status of base stations;
- (d) Status of data collection activities.

The reports give a summary of these activities.

Since the computer PDP 11/34 and some other instrumentation were not delivered on time, there is a backlog of tapes to be analyzed and a backlog of data waiting for interpretation by CMI project staff.

The objectives of the Solar Energy Resource Assessment program are:

- (a) To collect data for direct, diffuse and global radiation at stations in Barbados, Montserrat, Antigua, St. Kitts/Nevis and St. Lucia;
- (b) To make a preliminary analysis of the data to provide information for such fields as tourism, agriculture and solar engineering.

The project budget is US \$42,420 for a 2.5 year duration or \$331,840 over a five year period. General progress reports shall be submitted quarterly. These reports shall include a schedule of completed work

tracked against the original schedule approved by CDB. These reports were not introduced; therefore, the status of the project could not be assessed.

The evaluation team recommends that separate final reports be written on both activities: wind resources assessment and solar resources assessment. These reports, in addition to the subjects listed as future chapters in quarterly reviews, should also contain information such as:

- (a) printouts of the computer program for wind and solar data analysis and statistical evaluation;
- (b) lists and description of sensors, instrumentation, and data acquisition systems;
- (c) statements on technical, manpower and logistics problems encountered and proposed solutions;
- (d) solar reports should give the diffuse and total radiation values on a horizontal surface as well as on an inclined surface for the inclination most appropriate for each country.

There are three full-time and five part-time people on the project at CMI. Five field observers collect data on each of the islands. In the evaluation team's opinion, at present CMI does have in house a very limited capability and manpower to perform the analysis of gathered data. The evaluation team recommends that additional, qualified personnel be hired specifically to perform the tasks of data

analysis, or a subcontractor should be employed to assist CMI in this work. This recommendation is important since CMI provides relevant expertise and assistance to the demonstration program of wind energy conversion in Antigua as well.

The regional benefit will be in the form of a better idea of the wind and solar resources of each country of the Region, which will enable ministries to compare various options and to have more data on hand to make a proper selection of solar and wind energy conversion devices. The wind and solar resources data will enable the ministries to determine the financial feasibility of developing these energy resources on a broader scale.

(4) Solar Water Heater Test Facility at BNSI in Barbados.

The project funding from CDB is US \$16,000 for one year. The overall budget of the project is \$42,000 of which \$36,000 comes from BNSI. The agreement for the project was signed between CDB and BNSI in March 1981

The main objectives of the project are to test solar collectors for thermal performance and to develop standards for their installation and manufacturing. The results of the project will be used to assist solar manufacturers, consumers, and regulatory agencies throughout the Region.

In the opinion of the team, the language of the Project Proposal for Testing Solar Panels and the language of Terms of Reference and Work Plan for the project are confusing, and the objectives are not properly stated. The main goals should be the formulation of minimum thermal performance standards for solar water heating systems and the formulation of installation guidelines recommended by BNSI for these systems.

The standard document of BNSI should be forwarded to solar manufacturers, solar standards institutions and solar researchers in the region for comments. The comments should be discussed during the meeting of the Standards Council and, if proven valid, incorporated into the document before it is passed to CDB for evaluation. The proposed standard should be announced for general public comments before its adoption.

BNSI has no experience with solar energy conversion or with solar testing and standards. In the team's opinion, solar testing and standards expertise is required to make the project fully operational. BNSI should engage assistance in this matter. The project leader of BNSI should spend an increasing amount of time on the project, with his time involvement being up to 100 percent when the commercial equipment is ready for testing. It is advisable

that TEU review the BNSI testing procedure before the testing.

Some equipment for a testing stand has been ordered. According to the project schedule, as outlined in the Terms of Reference and Work Plan, the project is behind schedule.

Finally, it should be pointed out that according to the GATT Code MDC's and LDC's may be "forced" to adopt ISO standards, even if they already have their own standards operational. Barbados is a corresponding member of ISO.

- (5) Integrated Energy Program at Orange Hill Estate in St. Vincent/Detailed Feasibility and Design

The project budget is US \$33,439 for the project duration of 2.5 months. The study was commissioned in June 1981, and the executing agency is TEU/Consultants. The main objectives of the project are to make a detailed technical and economic feasibility study on how to meet Orange Hill Estate's energy needs by using the Estate's alternative energy resources, and then to come up with a detailed engineering drawing of an energy system selected for this purpose. The results obtained during this activity could be used on similar estates throughout the Region.

According to Terms of Reference for Feasibility Study Detailed Design and Costing

(Attachment II) for Integrated Energy Program/ Orange Hill Estate - St. Vincent, the report on the project should have been available by October 1, 1981. It was not available by October 10, 1981, and the team was informed by TEU management that DSI, the project executing agency, was late with the report. Due to this fact, the team cannot evaluate the project.

(6) Wind Power Demonstration in Antigua

The budget of this project is US \$271,000 for 2.5 years. The project was approved by the Bank in May 1981. The Agreement has not yet been signed by Antiguan government. The main objective of the project is to build a utility grid interfacing wind machine of 50 kW_e to 100 kW_e power rating. The project executing agency is APUA. There is good replicability of the project in Barbados, Montserrat, St. Lucia, and the Grenadines.

The equipment for the project has not been ordered yet, and the overall project is behind schedule. No progress report is available on the project. According to TEU, equipment cannot be ordered and progress reports should not be expected from APUA until the Agreement is signed.

(7) Preliminary Site Assessment for Photovoltaic Pumping in Antigua and Grenada.

The project budget was US \$10,949.50 for the

project duration of one month. The project agreement was signed in July 1980 between CDB and Halcrow Caribbean Ltd. The main objective of the project was the selection of a project site. Diamonds Government farm in Antigua was selected. There is good replicability for this activity in the Region.

No final report on the project was presented to the evaluation team.

6.4 Specific Recommendations

A review of the program objectives for the next three years activities is recommended to establish priorities for each country based on the energy need assessment study and the energy resources assessment study already done. The following options are presented:

- (1) reduce the scope of the overall program by setting up clear priorities in a few selected areas of energy activities in each country on the base of the existing budget and the existing timetable; the shifting of the budget from some activities to others may be necessary.
- (2) follow up the existing scope under a new, larger budget with an extended timetable for the overall program implementation; a revision of the funds allocation between various activities may also be necessary.

The program is very much needed in the Region and in each country; both scenarios assume continuing work on the

projects while restructuring the overall program.

This is the major recommendation; a list of other recommendations follow:

1. The Head of TEU should have the authority to authorize activity budgets up to US \$10,000 without submittal of proposals for management approval.
2. Project officers at TEU should have the authority to authorize activity budgets up to US \$5,000 without submittal of proposals for management approval. The only approval required will be that of the Head of TEU.
3. A bookkeeper/accountant should be employed full-time at TEU.
4. An administrative assistant should be hired for the Head of TEU.
5. Greater privacy and locking document cabinets should be provided for the Head of TEU to assure the confidentiality of the loan and technical information.
6. A bar chart is needed in the Head of TEU office which shows the technical and financial status of each large USAID/CDB activity on a quarterly basis.
7. Technical meetings of Project Officers once per month are advisable to discuss specific aspects of the activities in progress.
8. TEU should invite experts to the Bank to give seminars on selected energy and technology topics of interest to Project Officers in relation to TEU activities.

9. Close contact development with agencies such as the World Bank, the Inter-American Development Bank, the Overseas Private Investment Corporation, the International Finance Corporation, and the Citizens Energy Corporation is advisable to coordinate energy funding efforts in the Caribbean.
10. Newly hired TEU officers should go through an orientation session which introduces them to how the Bank and TEU operate so that they can understand the overall system and particularly the mechanism of proposals preparation and activities supervision.
11. The evaluation team strongly recommends shortening the life cycle of an individual project's preparation, review, and implementation under the USAID/CDB program, taking into special consideration the five year timetable of the program.
12. An analysis should be performed by TEU management concerning the time Project Officers need for the management of each project.
13. Loans should be available for upgrading and repair of existing electricity stations in the Region.
14. Training of repairmen for small water pumping wind machines should be set up in the Region; car repair mechanics could be used as the available skilled manpower base.
15. Environmental impact assessments such as noise

- pollution and vibration propagation should be performed for medium and large size wind machines projected for the Region.
16. Small size grid interfacing electric wind generators for farms should be investigated as an alternative to a single big machine, especially since there is already a small windmill tradition in the Region.
 17. TEU should take into consideration the use of wind machines to generate electricity for the Grenadines to provide a displacement for diesel stations.
 18. Consultant services should be secured to assist in the implementation of the wind machine project for the CDB building.
 19. Experts should review TEU activities to provide technical assistance and operational advice on a quarterly basis.
 20. The Consultancy Agreement between CARICOM and CDB, and Development Science, Inc. and International Energy Development, Inc. should be extended or a new group of consultants hired as soon as possible.
 21. It is recommended that the financial work be done by a financial officer of TEU employed specifically for this purpose who, will have the responsibility of insuring that the guidelines of the CDB Loan Supervision Manual are followed and that pertinent documents and financial records are in order. He will take over this responsibility from the project

- supervisors, who, however, will retain the ultimate financial supervision of the projects and will review the documents related to their projects once a month with the finance officer at TEU.
22. Expanded TEU technical staff with institutional expertise should participate in the field implementation activities by direct technical involvement through TEU field offices, These field activities may be combined with field office activities of CARDI or of the DFC. At least once a year the Head of TEU or his technical deputy should visit the project countries to view the TEU activities.
23. A coordinator of field technical activities should be hired by TEU to oversee the field projects, act as a liaison between TEU and field activities implementing institutions, coordinate these activities technically and logistically, assist in the procurement and selection of equipment, and make decisions in the field on behalf of CDB. His function could be related to the setting up of TEU field energy and technology extension offices in coordination with the field activities of other CDB Divisions, CARDI field activities, and the local offices of the DFC.
24. There is some consensus among TEU staff that TEU should carry on only large projects which have a

perspective to make a national and regional impact. Since it now takes the same time to manage small projects as it does to manage large ones, it is recommended that this situation should be revised and the activities shifted toward larger projects. If not, a less time consuming process for small project management should be introduced. A management analysis network with a "critical path" method should be used by TEU Project Officers to follow up the technical and financial process of large project implementation.

VII COMMUNICATION AND INFORMATION

The Communication program is part of the Alternative Energy System Project; the Project as it will be referred to in the following; the Information program, also identified as the Technology Information Unit (TIU), is part of the Employment Investment Promotion Project. One constraint imposed by the Project Paper (p. 44) is that the TIU serve as the base for the implementation of the communication component. Since these two components are so intimately related, they will be considered together in the evaluation report.

7.1 The movement towards the Program objectives; the sufficiency of the technical and financial inputs; the validity of the original assumptions; regional and national constraints.

One important goal common to these two components which still has not been completely met is the establishment of a network of information and research resources for alternative energy development.

Due to the short time available to the evaluation team, it was difficult to ascertain how much has been accomplished regarding two other goals of the Communication component.

These goals are:

- (1) To identify the various interested groups such as researchers, policy makers, technicians and community outreach organizations, and respond to their needs for technical information. The TEU states

that this is being initiated by the Project Officer/Documentation who visited participating countries and interviewed interested individuals and groups in each country.

- (2) To identify information gaps in energy problem areas, technology R & D, field testing, policy issues and training.

A pilot project is being considered for implementation by TIU which addresses these two goals. The objective is to demonstrate for the Caribbean nations the value of technology and of energy information processes, including the cost effectiveness of various mechanisms that can be used to supply information.

Since information and communication pervade all project activities, no specific assumptions have been identified for these components. However, almost all of the "Important Assumptions" listed on pages 109-110 of the Project Paper apply directly to the communication and information components. Comment on the training component given earlier in this report applies here as well.

Two assumptions not explicitly mentioned in the Project Paper are obviously taken for granted:

- (1) Freedom of information exchange at regional and national levels.
- (2) Freedom of technology transfer, both extra-regional input and intra-regional exchange.

These assumptions are operative at present and underlie

the cooperative framework of the Caribbean Community and Common Market and other multinational Caribbean consortia. Their mention here should not yet be taken lightly. The conversion of indigenous resources may become cost competitive sooner in some economic sectors of the Caribbean than in industrially advanced countries. Therefore, interest from large and small private entrepreneurs may soon appear in the Caribbean scenario. These companies may offer the transfer and field testing of new technologies in return for exclusive rights or for certain government participation linked with protective measures to guarantee the economic value of potential developments.

The Project imposes the task of establishing a technical information exchange network in alternative energy development, that is the setting of useful linkages between organizations and individuals working in the alternative energy fields. To do this, the communication officer must identify such organizations and individuals and the information gaps that exist, and then respond to the information needs. This scheme is based on the assumption that such interested groups exist and that their information needs will be satisfied once the exchange network is in operation. In other words, that an infrastructure capable of taking practical advantages of the communication net exists. This is far from the truth in many places within the Region. The absence of this infrastructure is one of the most important impediments which have hampered the communication officer from reaching the objectives of this component.

The inherent complexity of the energy problem is compounded by the matrix of variables that originates from the diversity of economic, demographic and energy scenarios found in each country. In the absence of national needs assessments which have been unduly delayed, the identification of the technical information needs at the regional and national levels become dangerously uncertain.

With regard to the adequacy of inputs, the Communication and Information components are both behind schedule, particularly in the establishment of networks and information capabilities in many areas of the Region. The Information component has made adequate progress towards accomplishing procedural and organizational inputs. However, the net use by the community of the bibliographical service has not reached the level of significant impact, although it is increasing.

Seminars and workshops organized by the Communication component have been few and costly compared to the schedule set forth in the Project Paper. The schedule suggests four seminar workshops per year at a maximum average cost of about US \$14,000. Actually, only three seminar workshops have been held at a cost of \$85,000 after one year of actual operation of the Communication component. Another workshop costing \$16,000 has been approved for the next fiscal year. The average cost of these four activities is \$25,000. What has happened is that the amount allocated has been spent on four workshops instead of eight.

However, the Project Paper defines clearly the function

of the communication workshops vis a vis the objectives of training workshops sponsored by the training component of the Project. Although it is almost impossible to separate the training and the information functions of an activity, the Project Paper (p. 45) specifies that during workshops initiated by the Communication component the following two activities should happen:

- (a) Information will be exchanged among participants:
- (b) Information networks among participants should be established.

Due to the time limitations, the degree to which these two requirements were met during the workshops that have been held could not be determined. If any network was established among participants as a result of these workshops, it probably was quite informal without the support of a central base as is required of any network if it is to operate efficiently.

7.2 The effectiveness of CDB administrative and operational procedures.

The recent administrative reorganization of the information component has improved the effectiveness of this activity.

The most needed operational review should assure a close interaction among the three components: training, communication and information. This is imperative to avoid duplication of efforts. It is also required to assure that the special objectives of each component and the general objectives of the Project are met.

The documentation and procedural systems seem adequate.

Documentation of communication activities should include, in addition to the regular and obvious data, the rationale for the selection of each activity, its operational objectives, participant profiles, qualifications of activities directors and other human resources used, self-evaluation results and analyses, and information on networks, if any, that result from an information component activity.

Whenever the national energy assessments are available, a total review of the activities plan for the Training, Communication and Information components should be attempted, taking into consideration the results of the energy assessment and other recommendations included in this report. It would be advantageous to use the expertise of a communication/training consultant for this purpose.

7.3 The impact of project component sub-project activities and the expected impact of individual planned activities.

Thus far, the impact of the Information and Communication components has been less than expected. Except for the bibliographical service of the Information components and the helpful Caribbean Electric Utility Conference, the output of these components has been limited. Normal start up difficulties are partly responsible for this situation. Mostly, the complex nature of the communication activity addressed to a vast geographical Region containing isolated areas with little or no infrastructure on which to base information systems is the main factor responsible for the lack of adequate impact at this point.

The recommendations included in this report are intended to bring these components to the realization of their objectives. However, the establishment of an efficient bibliographical service and an operative technical information exchange network is a grandiose task out of proportion to the fiscal and time frame constraints set up by the Project. The validity of this apprehension should be tested soon, possibly at the time of the recommended planning review of the activities for the Training, Information and Communication components.

7.4 Specific Recommendations

- (1) The integration of these specialized networks arising from the communication workshops is an important step to establish a technical information exchange network for the Region by the end of the Project. The communication component should assign a staff with experience in network administration to work on the development of this network.
- (2) A strong effort should be made to coordinate the activities of the Training component which is the responsibility of CARICOM with the Communication component of CDB. The selection of subjects for training and communication workshops, the groups dynamics selected, and the materials and goals of the activities should be planned carefully. The Communication component should serve as a central base for these networks, and integrate and relate their information exchanges, with the final

goal of achieving a unified technical information exchange for the Region covering the various facets of the energy problem.

- (3) Every workshop, seminar and meeting should include a self-evaluation procedure to assess the quality of the activity. Uniform techniques for this self-evaluation should be followed to facilitate the statistical analysis on the responses of a particular activity.
- (4) Steps should be taken to expedite the computerized information system of CDB. This exercise should be the basis of a separate proposal for the establishment of a computerized, time sharing network covering the Region. This is a complex project which requires a separate fiscal and procurement time frame than that provided by the present Project.

VIII TECHNOLOGY RESEARCH FUND

According to the Project Paper (p. 144), "The Technology Research Fund (TRF) is used by the CDB for research and pilot projects to adapt, define, and/or demonstrate specific technologies appropriate to the needs of the Caribbean region. Emphasis is placed on projects in the less developed countries and on projects of specific benefit to lower income groups."

8.1 The movement towards the program objectives; the sufficiency of the technical and financial inputs; the validity of the original assumptions; regional and national constraints.

In the opinion of the evaluation team, a more detailed description should have been provided in the Project Paper of the types of activities which could be funded through TRF and of those which could be funded through TEU energy funds. Due to the inadequate definition of TRF objectives, the TEU Energy Program could be funded at present through TRF, and vice versa.

Projects for TRF funding should (Project Paper, p.146):

- (1) focus on "key information" needed to unlock specific development potential;
- (2) contribute, if successful, to development projects that increase employment and/or income, or reduce costs, or improve housing or other aspects of living conditions;
- (3) focus on benefits to lower income groups;

- (4) lead to projects for which there is a felt need and potential individual or institutional support;
- (5) result in near term useful results; and
- (6) utilize and support existing Caribbean research and development institutions.

Since other divisions of the Bank such as the Infrastructure Division, the Industrial Division, and the Agricultural Division are dealing with areas other than alternative energies, and the Energy Program of TEU is funding alternative energy sources development, the team recommends that Technology Research Funds be used to:

- (1) Promote through grants scientific and industrial development of alternative energies technology and research;
- (2) Promote through loans manufacturing of alternative energies equipment, devices and systems;
- (3) Promote through loans commercialization of appropriate technology.

The following examples of TRF funding could be given under the above categories:

- (1) Solar Ponds Technology Development
Solar Thermal Cooling & Refrigeration
- (2) Photovoltaic Cells
Solar Water Heating Systems
Solar Collectors

Solar Cookers

Solar Food Dryers

(3) Banana Defibering

Oil Production Through Wood/Wastes Pyrolysis

Feed and Fertilizer from Protein Wastes

Other technologies which proved feasible outside of the Caribbean may be funded through TRF to be adopted for use in the Region.

The TEU Five Year Work Plan and Budget, May 1980, states: "Based on its initial TRF budget, the Appropriate Technology Programme should spend about US \$1 million before December 1981" (p.3).^{*} At an average project cost of US \$50,000, this will necessitate the funding and management of some 20 projects over the next two years.

To follow such a schedule, TEU will require four or five project officers to handle the TRF activities. The evaluation team recommends a revision of the overall document and specifically a change in TRF implementation schedules. The latter are unrealistic since only the TRF activities mentioned in Table VI are being implemented now:

^{*}According to TEU the TRF program was recently extended to September 1982 by USAID.

TABLE VI
CURRENT TRF ACTIVITIES

<u>Activity</u>	<u>TRF Funds</u>
1. Peat Resource Assessment	\$ 6,280
2. The Testing and Demonstration of the Use of a Solar Powered Photovoltaic Pumping System in Irrigation	\$ 47,270
3. Control of Crop Damage by Monkeys	\$ 42,150
4. Solar Drying of Chili Pepper	\$ 49,500
5. Wind and Solar Energy Resource Assessment	\$250,000
6. Promotion of Simple Domestic Solar Food Dryers	\$ 9,592
7. Recovery of Fuel and Feeds from Arrowroot Processing Wastes	\$ 46,508
8. Chemical Lime Analysis	\$ 18,000
9. Feed and Fertilizer from Protein Wastes	\$ 48,169
10. Preliminary Assessment of Biogas from Arrowroot Factory Wastes	\$ 1,481
11. Banana Defibering Pilot Plant	\$198,000

The funds listed above amount to US \$716,950. Only activities one, three, eight and ten were finished by December 1981, and the funds disbursed amounted to US \$67,911. However, activities six, seven and nine were

well advanced according to TEU; these activities involve US \$104,269. In the opinion of the evaluation team activities one and eight should be financed by the Industrial Division of CDB rather than by TEU. Project three should be financed by the Agricultural Division of CDB instead of by TEU. In the opinion of the evaluation team activities two, four, five, and six should be financed by the Energy Program of TEU and not by TRF funds. The funding for activities seven and ten should be split evenly between the Energy Program and the TRF. Only projects nine and eleven qualify to be financed through TRF funds as perceived by the evaluation team; although according to the previously stated TRF objectives as listed in the Project Paper (p. 146), at present TEU can legitimately finance each of the eleven activities by using TE or TRF funds, at its discretion. However, again in the team's opinion, TRF funds are not being used according to the spirit and purpose of having two separate funds/programs, TE and TRF, which should be oriented toward separate goals.

The confusion concerning the classification of activities under TE or TRF can be avoided by restructuring the objectives and the scope of investment for TRF funds. At this time the implementation of the TRF activities is behind schedule. TEU should accelerate the implementation of TRF activities so that the TRF program may continue into a second phase beyond September 1982.

8.2 The effectiveness of CDB administrative and operational procedures.

The guidelines for Preparation of Preliminary Proposals under the Operational Procedure for the Technology Development Programme (Annex II of the same document) are not being followed in some cases. The Project Paper (p. 145) states that "The TEU will prepare proposals for funding by the TRF"..... The TRF proposals should be prepared by the technical staff of TEU and/or other Division at CDB as is actually being done now.

Many of the comments and recommendations made in section 5.2 of this report apply to this section as well.

8.3 The impact of the project component sub-project activities and the expected impact of individual planned activities.

Findings of the Appraisal Reports as outlined in the Project Procedures (Appendix II) were not given to the evaluation team for any of the USAID program's individual activities/projects. These appraisals of the USAID program's individual activities/projects could be of significant value to evaluate selected TRF projects one by one, as well as the overall TRF program. Because of the lack of Appraisal Reports the evaluation is limited to documents available to the evaluation team which are discussed below. Since most of the activities are still in progress, it will be premature to attempt a regional assessment of the impact of the overall TRF program.

Selected activities under the TRF program will be discussed and some relevant comments and recommendations made.

(1) Banana Defibering Pilot Plant in St. Lucia

From the approved funding of \$198,000, the financial records show a disbursement of \$99,000 since the date of the project agreement between the Bank and Beauchamp Estates, Ltd., in St. Lucia. The agreement was signed in December 1980. The project duration is 15 months.

Concerning the Pre-Investment Study of July 3 and 4, 1980, of the Banana Defibering Pilot Plant in St. Lucia, neither the agreement of December 19, 1980, nor the proposal of June 9, 1981, contain the information which was obtained during interviews with CDB personnel.

There has been some negative experience in defibering banana fiber in the Dominican Republic. The defibering of banana fiber will require new types of machines. These new machines are being developed by a manufacturer in the Dominican Republic. There is no separate agreement document in the project file received by the evaluation team between CDB and the manufacturer of the machines, Agrometal Industrial S.A. of Santo Domingo.

Clauses such as the following should be written into this agreement:

- (a) Patent, design and other similar rights to any discoveries or work resulting from the study shall belong to the Beneficiary provided, however, that the Bank and its licencees shall have the right to manufacture, market, use and permit the use of any such discoveries or work within Caribbean member countries of the Bank, other than St. Lucia, free of royalty, fees or any charges of a similar nature.
- (b) The Bank shall be entitled to make use of all documents and information (including technical and market data) obtained by the Bank from the Beneficiary or from its records with respect to the Study (including the Beneficiary's reports on the Study), for any purpose whatsoever whether or not connected with the Study and, in particular, to promote development within the CARICOM member countries and in information exchanges with other regional or extra-regional development agencies.

Such clauses are stated in the agreement of August 27, 1980, between the Bank and the NRC concerning chili pepper drying in Guyana.

No document specifies that the machines should be manufactured in Barbados or St. Lucia. The patent rights of the Bank are not covered by any document. If successful,

the manufacturer in the Dominican Republic will profit fully from the future mass production of the machines whose development was financed by the Bank.

Since this is a new technology, there is no guarantee that the \$198,000 of the project's funding will bring a return on the investment. No effort was made to set up a smaller scale defibering laboratory process for banana fiber in order to reduce the financial risk of the project. No documented effort was found in the project file to identify a smaller scale experimental production of banana fiber.

The management agreement of December 19, 1980, between the CDB and Beauchamp Estates, Ltd., for the Banana Defibering Plant, St. Lucia, does not cover a situation whereby a net profit is generated from banana fiber sales. This net profit, if realized, should go into a special fund for further development of the project. According to TEU since the Bank owns the plant, then it automatically follows that all income could be used for the development of the project.

According to the management agreement of December 19, 1980, between the CDB and Beauchamp Estates, Ltd., for Banana Defibering Plant, St. Lucia, several quarterly reports should be available on the project. These reports were not made available to the evaluation team, and so the team could not evaluate the current status of the project.

Concerning the project potential, the evaluation team can only state at this time that if the project is successful, then the technology has a potential of being used by the banana growing countries of the Region.

(2) Control of Crop Damage by Monkeys in Barbados

From the approved funding of \$42,150 the financial records show a disbursement of \$31,646.59 since February 1981, the date of the project agreement between the CDB and CARDI. The project duration was one year. The draft of the final report was submitted to CARDI by the project supervisor in March 1981. The date of the disbursement \$31,646.59 is not recorded in the project records of the Finance Department at CDB.

The evaluation team recommends that the overall project be evaluated by the Project Steering Committee in terms of its long term impact in Barbados. A decision should be taken by CARDI concerning the establishment of a research unit on primates on Barbados and on means other than mechanical to control the monkey population growth on Barbados. Another possibility as a project follow-up would be to provide a loan to assist in setting up a private business of green monkey control with the Ministry of Agriculture establishing a catch quota per year; this was one of the initial goals of the project.

Three mechanical trapping methods were investigated during the project, two types of cage trapping and shooting net trapping. The monkeys became cage "wise" after a limited

number of single cage trappings. Out of about 500 monkeys caught during the project, more than 90 percent were caught by a multiple cage trapping method. Although the multiple cage trapping method developed in the project was deemed highly successful by TEU, the shooting net seems to be a more effective solution at this time.

The team was told that the shooting net is dangerous, that its proper use should be introduced through a training program, and that the equipment may be too expensive for small farmers. Therefore, questions remain concerning what new technological development will result from the project and concerning the project's benefit to small farmers.

The project was a success in that about 500 monkeys were caught and a revenue of US \$50,000 to \$55,000 was realized from monkey sales.

The regional replicability of the project has potential in St. Kitts, according to interviews and TEU documents.

As stipulated by the agreement (Development of Appropriate Trapping Techniques to Control the Monkey Population and Reduce Damage to Crops in Barbados) between the CDB and Caribbean Agricultural Research and Development Institute, February 26, 1980, four interim reports should be available on this project. These reports were not in the project file and could not be reviewed by the team. One progress report dated June 30, 1980, was available on Control of Crop Damage by Monkeys Project. The final report was not passed by CARDI

to CDB after the completion of the project. The draft of the final report has not yet been approved, although it should have been done at the completion of the twelve month period to be in accordance with the Implementation Plan. The funds allocated to the project had not been disbursed by March 31, 1981. According to TEU, this had not been done because the final report had not been approved.

(3) Solar Drying of Chili Pepper in Guyana

From the funding of \$49,500 approved by CDB, the financial records show a disbursement of \$20,729.13 since August 27, 1980, the date of the agreement signing between the Bank and IAS&T, the executing agency. The project duration is two years. The main objectives of the project are to assess the physical and economical feasibility of drying chili pepper by using solar dryers and to establish commercial-scale drying methodology and systems.

The project will test three solar ventilator dryer designs for possible use at three different scales of operation - on a small farm scale, on a village scale, and on a large scale capable of satisfying an entire local market.

It seems that the project originated from the request of \$8,300 from IBRD/IDA of Guyana to assist these institutions in finishing the construction of a small solar drying unit; (see the letter of Mr. B. Orderson of September 8, 1979, to Dr. L. Campbell of CDB). The Pre-Investment Study was done in 1980 and the results published under the title of Solar

Drying of Chili Pepper - Guyana, in July 1980. According to the agreement of August 27, 1980, between the CDB and National Science Research Council of Guyana for Study of Solar Dryers for Peppers, several progress reports should be available.

Two reports were available on the project:

First Quarterly Report; no date

Second Quarterly Report; January - March 1981.

Neither report gives information about the design of the solar dryers or details about their construction. Therefore, it is difficult to assess the quality of work and the work progress from one quarter to the next one. The results of drying are not given nor are the drying conditions. In general, the information contained in the quarterly project reports is inadequate to assess the progress and current status of the project. The project is behind schedule; the solar dryers used during the first quarter of the project seems to have been built before the project started.

The market availability of some materials for solar devices is a problem in Guyana and the project experienced difficulties related to obtaining materials. The reports do not state, however, what steps, if any, were taken to eliminate the shortages of materials and chemicals for the execution of the project. The use of a spectrophotometer, vacuum ovens and other equipment for the project should be explained. According to TEU, the spectrophotometer and other equipment mentioned is used for bio-chemical tests and other quality

control aspects of the chili-pepper testing. However, the evaluation team did not see any results of bio-chemical tests or any other quality control tests.

Concerning the regional replicability of Solar Drying of Chili Peppers in Guyana, the team was informed that Montserrat also grows chili and solar drying could be used there.

Due to the inadequate reporting, both qualitative and quantitative, the evaluation team cannot provide a more in-depth evaluation of the project.

(4) Peat Resource Assessment in Belize

The project budget was \$6,280 for the project duration of one week. The project agreement was signed in June 1980, between CDB and Mattis Demain Beckford & Associates, Ltd., of Jamaica. The main objective of this activity was the assessment of peat as an energy resource for Belize.

The final report on the activity was submitted to CDB by Mattis Demain Beckford in August 1980, under the title "Investigation of Peat in Belize." The sampling of peat was performed on an area of 58,000 acres. At six sites out of fourteen, the drilling was done to a depth of six feet. At four sites the drilling was done to a depth of eleven feet. One sample was taken at eight feet, one at ten feet, and one at fourteen feet. All these samples were analyzed. The highest caloric value was 3,050 kcal/kg for the samples taken at eight feet. The tests carried out on samples taken from fourteen

sites at depths of zero to three feet showed that the deposits were thin and not suitable for fuel production (Project file - Ref. DFC 107/73).

The team could not identify a geological study of Belize peat resources, (e.g., various locations, stratification of peat, etc). Such a study had to be done before taking peat samples for chemical analysis. There is no indication in the project file about how the area for peat sampling was identified. Neither the letter of April 6, 1980, nor the "Proposal for Testing of Peat Samples from Belize in Order to Assess its Potential as an Energy Resource" states the depth at which the peat samples should be taken.

The team recommends further investigation of inland sites to identify the quantity and quality of peat deposits by taking samples at various depths. The geological mapping of peat deposits and the identification of the best sites by a geological team should be undertaken as the first phase of the study. Future drilling for peat samples should also include soil analyses for mineral deposits.

The scope of the Peat Resource Assessment Project for Belize and its budget (\$6,280) were not adequate to make a systematic assessment of Belize peat as an energy resource. The peat found was of too low caloric value to be used effectively as fuel in a power plant.

According to TEU the project was only to assess peat resources at the particular site in Belize and to make recommendations for further investigations.

The evaluation team concurs in general with most of the recommendations contained in the report Preliminary Investigation of Peat in Belize, August 1980, submitted to CDB by Mattis Demain Beckford.

Regionally, a peat deposit has been found in Jamaica; peat resources have already been identified there previously.

(5) Recovery of Fuel and Feeds from Arrowroot Processing Wastes in St. Vincent.

The project budget is \$46,508 for the project duration of six months. The project was approved in June 1981, and the executing agency is TEU/Consultants. The main objective is to investigate some arrowroot factory residues as biogas feedstocks in St. Vincent and to develop a conceptual design of a pilot plant. Two companies, Enerplan, Ltd., of Jamaica and Biogas of Colorado, Inc. of the United States, will perform the preliminary design of the biogas plant at a cost of \$19,835 per design. The project is in its initial stage. The arrowroot waste samples were taken on the sites and they are currently being analyzed in Colorado. The results of the analyses are not yet known.

The arrowroot plant study to be financed by CDB should also consider health hazards and possible starch contamination

problems during the production process of the starch and biogas if any, but especially to look at the existing health hazards and the contamination situation.

The idea of converting the galvanized roofs of the arrowroot plants into solar collectors to use solar heated air for drying starch and bitti should be taken into consideration. According to the proposal of Drying Chili Pepper in Guyana, the same idea is going to be investigated for commercial drying of chili peppers. The regional replicability potential of this drying method could be good.

According to the Agro-Business Project Profile, a paper prepared by the Arrowroot Industry Association, March 1980, for USAID and CDB, under optimal commercial conditions, the yield of starch should be in the range of 16 to 18 percent. Current estimates in St. Vincent show about a 13 percent yield. Each percentage point of starch yield increase would have a value of about EC \$173,000. TEU should initiate a study under a TRF grant to improve the yield of starch in the arrowroot plants in St. Vincent. Although the results of the study will be specifically oriented toward a single industry, the methodology could possibly be applied to other industries of the Region.

(6) The Testing and Demonstration of the Use of a Solar-Powered Photovoltaic Pumping System in Irrigation.

The project budget is \$47,270 for the project duration of two years. The project agreement was signed in April 1981, between CDB and CARDI. The main objective of the project is to demonstrate the performance and suitability of a PV water pumping system for irrigation in the Caribbean.

According to the Terms of Reference of the Project (Schedule II) all major equipment should be ordered within a month of the signing of the agreement and the system should be operational within a few months. The equipment for the project has not yet been ordered and the project is behind schedule.

The purchase of PV cells from a manufacturer should be covered by a warranty for the replacement of malfunctioning/defective PV panels. A detailed maintenance manual for the system should be provided. The cost of shipment of replacement panels should be covered by the manufacturer. Also, a TEU technician should be delegated to assist CARDI in the analyses of results of the PV system monitoring. This analysis should be performed on a day to day basis.

According to the project agreement, progress reports on the project should be available on a quarterly basis. Since no reports were available, the evaluation team cannot evaluate other aspects of the project in detail.

(7) Promotion of Simple Domestic Solar Food Dryers

A grant from TRF was awarded to the University of West Indies for use by the Women and Development Unit of the Extra Mural Department of UWI in an amount not to exceed the equivalent of \$9,592 to assist in meeting the cost of a one-year training program to develop and promote the use of simple domestic solar-heated food dryers among rural householders in Antigua, Dominica, St. Lucia and St. Vincent. The project started March 16, 1981, and is being carried out by the Communication Section of TEU.

The report available on the project is entitled: Summary Report - Solar Drying Project (no date). The report contains very brief information about the general activities which have been conducted on the project in Antigua, St. Vincent, St. Lucia and Dominica. The report does not contain such pertinent information as:

- (a) construction details for the solar dryers and cookers;
- (b) cost of dryers;
- (c) type of food/fruits being dried and a statement on drying or cooking conditions;
- (d) social acceptance of the solar dryers and cookers;
- (e) description of the social groups participating in the training workshops;

- (f) number of workshops conducted in each country and number of participants;
- (g) strategy of training and promotion, a discussion of results attained, the benefit to low income people, the manufacturing potential in each country.

The evaluation team recommends that these points be included in the final report in addition to the description of the technical and socio-economical limitations of the activities. Recommendations concerning the follow up should also be presented there. The summary report does not give enough information to evaluate the effectiveness of the project and its budget in order to justify the project expenditure of \$9,592.

The evaluation team believes that this activity should not be funded from the Technology Research Fund. Since this is basically a training/promotion program of solar food dryers, the funds should come from the communication funds of the Energy Program of TEU or, even more appropriately from CARICOM's Training program.

A systematic approach is lacking in some TEU activities. The team recommends follow-ups on all activities by the responsible project officers and the TEU Head to make sure that the activities financed under the USAID program bring the expected results.

7.4 Specific Recommendations.

- (1) It is strongly recommended that the TRF project continue into the second phase beyond September

1982 in a form reconstructed according to the comments of the evaluation team; the TRF activities are useful and very much needed for the Caribbean countries and the regional development, and their financing should be continued by USAID and other organizations.

- (2) The amount of documentation required at the Bank should be reduced to a minimum and more efforts should be concentrated on technical activities especially in the field countries.
- (3) Aquaculture and mariculture demonstration activities should be promoted in the region (for more details see "Case Paper for the Establishment of a Mariculture System in the Commonwealth Caribbean" by P.J.H. Slessor, CDB, February (1980)).

APPENDIX A
BIOGRAPHICAL INFORMATION
ON
EVALUATION TEAM

The PROJECT DIRECTOR is DR. KENNETH G. SODERSTROM who is presently the Associate Director of the Center for Energy and Environment Research (CEER) of the University of Puerto Rico. Dr. Soderstrom has a strong engineering background. He received his BS and MS degrees in 1958 and 1959 and his PhD in 1972, all at the University of Florida. He has an impressive record of accomplishments in research, education and management, both at the CEER and the UPR School of Engineering. His interest in renewable energy sources dates to the 1960's and he has worked actively in the energy conversion/conservation field since 1973. Having lived in Puerto Rico for over 20 years, he has more than a passing interest in the Caribbean region and throughout this period has traveled through most of this region.

Dr. Soderstrom is a registered professional engineer in both the Commonwealth of Puerto Rico and the State of Florida, and has served as a consultant in the areas of energy conservation and assessment, solar energy applications and design for industry, government, commerce and consulting firms. Since 1963, Dr. Soderstrom has been assuming increased responsibility in the direction and administration of scientific research activities starting as Head of the Mechanical Engineering Department of UPR (1963-68) and since January 1979 as Associate Director of CEER/UPR. As the Associate Director of CEER, Dr. Soderstrom is co-responsible for the multi-million dollar budget of CEER and the interactions with the Federal Government, the government of Puerto Rico and private industry.

The TECHNOLOGY AND ENERGY UNIT and the TECHNOLOGY RESEARCH FUNDS of the Caribbean Development Bank activities assessment are the responsibility of DR. GEORGE T. PYTLINSKI. Dr. Pytlinski is Head and Senior Scientist of the Solar Division at CEER. He is in charge of solar energy research, development and management and he participates directly in other activities on alternative resources development for the Caribbean, Latin America, Puerto Rico and the United States. Dr. Pytlinski has been involved at CEER in the assessment of solar energy as an alternative energy source for the Republic of Panama.

Dr. Pytlinski's educational background is in Mechanical and Aircraft Engineering and in Physics. He earned his Ph.D. degree in physics from the University of Paris in 1967 with high honors. Dr. Pytlinski has extensive teaching, research and project/program management experience in several energy conversion fields such as MHD energy conversion, plasma fusion, and solar energy conversion. Since 1964 he has worked in various government and university laboratories in France, England and the United States. His work in solar energy conversion dates from 1974. Dr. Pytlinski's international experience in energy is reflected in over fifty scientific publications. Dr. Pytlinski is a member of several professional organizations including the American Physical Society, the American Institute of Aeronautics and Astronautics, and the American Society for Testing and Materials. He is a referee of the American Journal of Physics, and Chairman of the Standardization Committee of International Solar Energy Society/American Section.

The CARICOM UNIT AND POLICY COMPONENT evaluation is the responsibility of MR. LEWIS SMITH who is a consulting economist to CEER. Mr. Smith brings into this project an excellent academic background, having earned both the AB and MBA from Harvard University, and a broad professional experience in policy and planning, especially in relation to energy planning. He served as chief economist for Puerto Rico's Economic Development Administration and was continuously involved with energy planning from 1971-1976. Prior to that he served with Commonwealth Oil Refining Co. (CORCO), 1966-71, a private company which is the largest refinery in Puerto Rico and had, at the time he was associated with them, the world's largest aromatics plant. Before that he served as a financial and economic analyst for the Puerto Rico Electric Energy Authority. Most recently he has been involved with planning and economic analysis in CEER as a consultant to the Solar and Biomass Divisions and to the Director of CEER. Mr. Smith, who is bilingual in English and Spanish, had an introduction to the international scene early in his career having served with USAID in Paraguay for three years.

He maintains his broad perspective by serving several clients concerned with energy and advanced technologies. In addition to these activities, he is involved with several family businesses.

He belongs to several professional organizations including the American Economic Association and the International Association of Energy Economists.

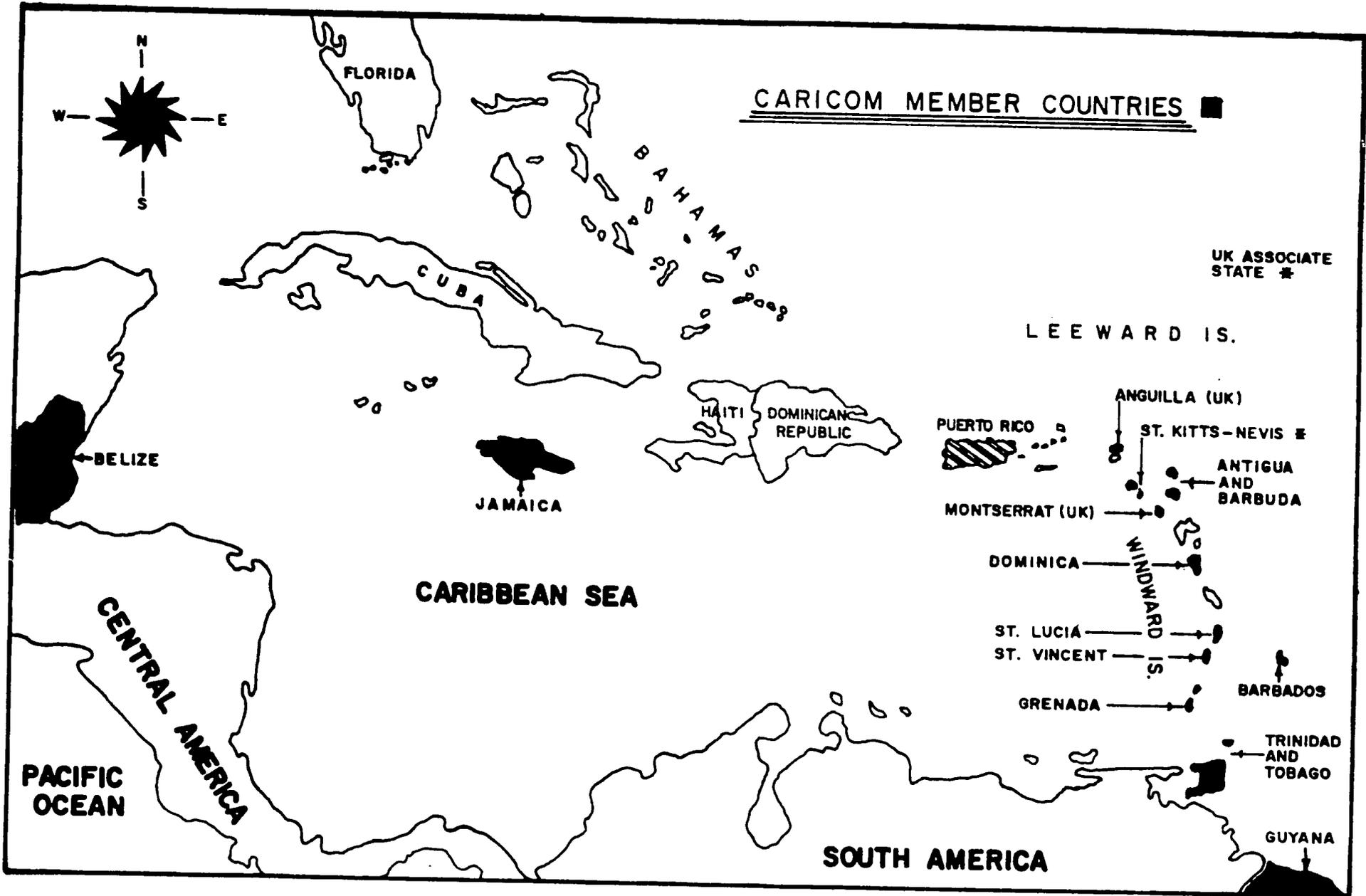
The assessment of the TRAINING COMPONENT of the CARICOM UNIT and the COMMUNICATION/INFORMATION COMPONENT of the CDB UNIT is the responsibility of DR. MANUEL GARCIA-MORIN. He received his BA and MA in chemistry in 1938 and 1939, and his Ph.D. in Chemistry from Duke University in 1948. Dr. Garcia-Morin has extensive experience from his over forty year career as an educator and scientist and has close to fifty scientific publications in professional journals.

From 1971-1973 he was a consultant on education to the Governor of Puerto Rico; in 1973-1974 he served as a special consultant to the Chicago Board of Education; in 1976 he was appointed a member of the Advisory Committee on Energy to the President of the University of Puerto Rico; in the period of 1975 to 1979 he served as the Science Education Specialist and Program Manager for the Science Faculty Professional Development Program at NSF.

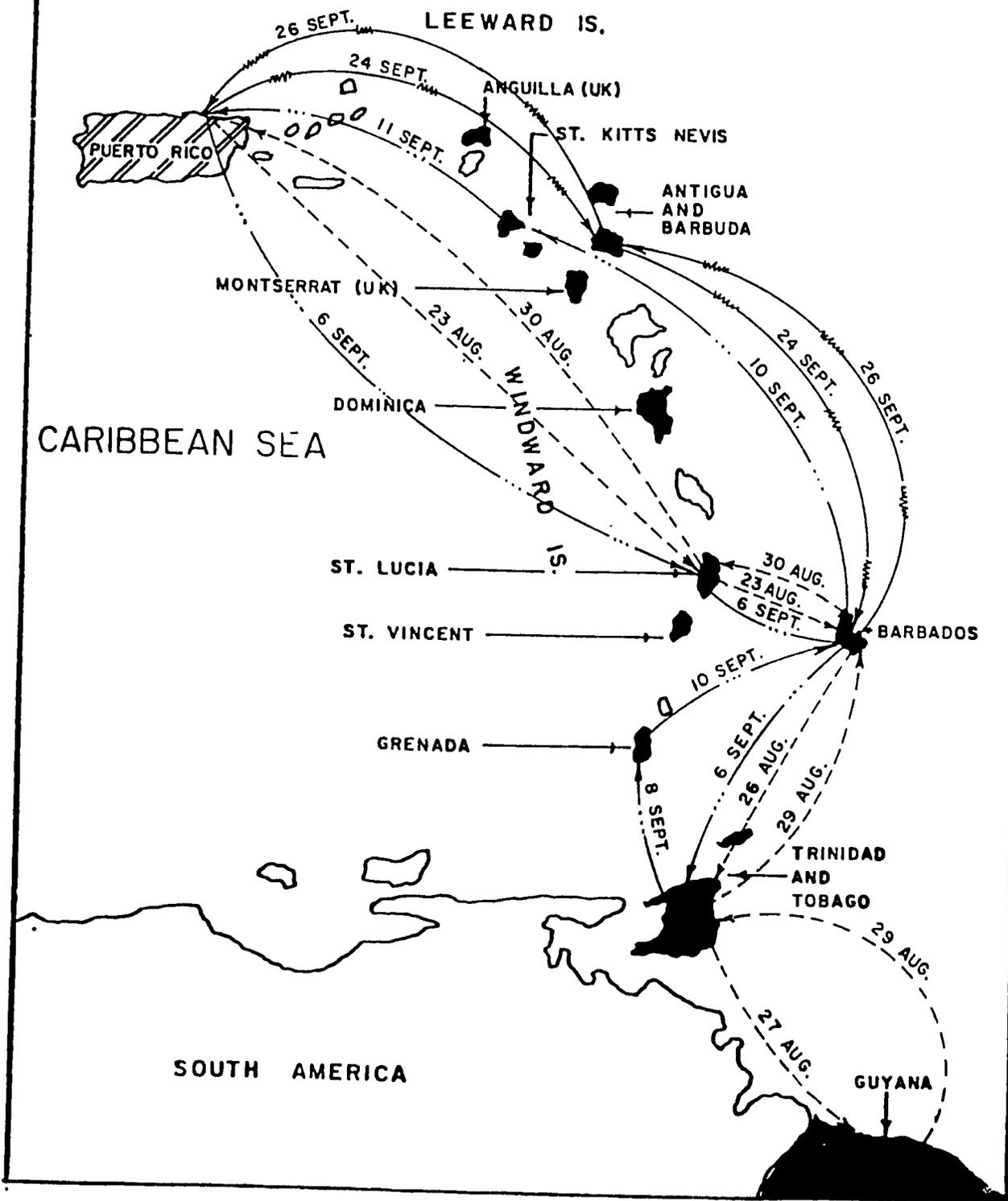
Dr. Garcia-Morin serves currently as assistant to the President of the Interamerican University and as a consultant to CEER. Since 1970 he has been the writer of the Science and Technology column, a weekly series for "El Mundo," the most popular newspaper in Puerto Rico.

Dr. Garcia-Morin is a member of several scientific and honorary societies such as the American Chemical Society, New York Academy of Sciences, Phi Beta Kappa, Sigma Xi, Phi Lambda Upsilon, and others.

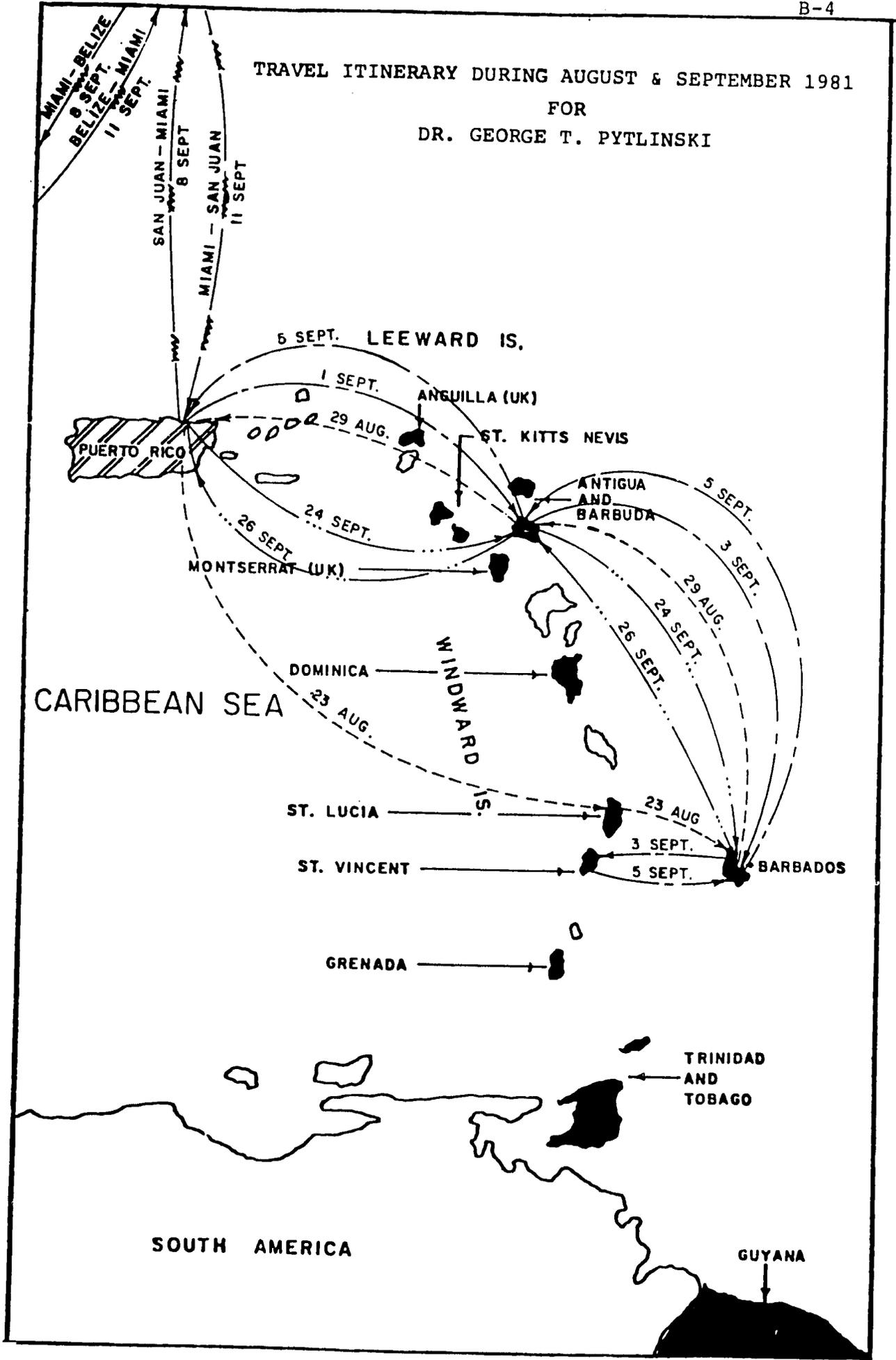
APPENDIX B
TRAVEL INFORMATION



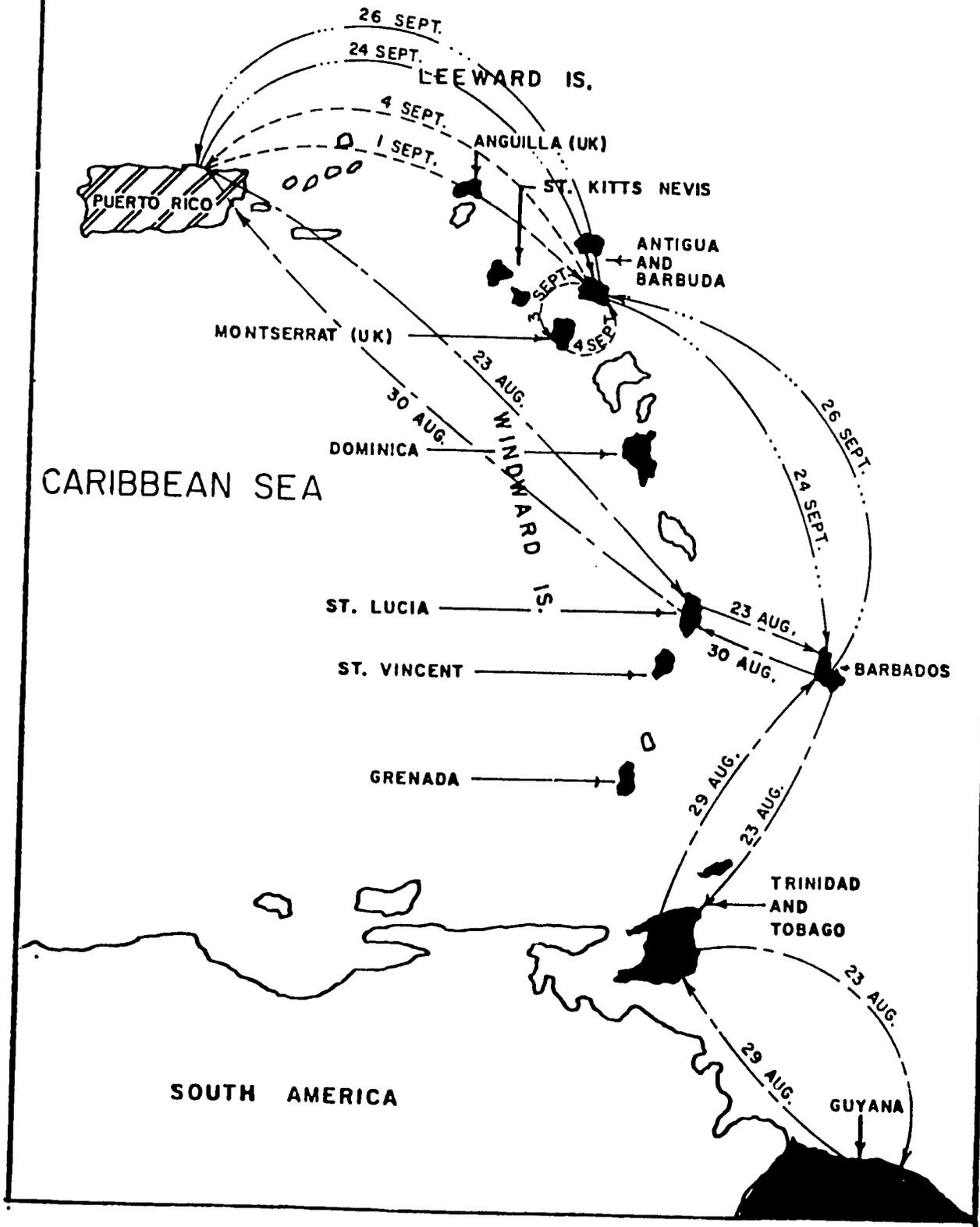
TRAVEL ITINERARY DURING AUGUST & SEPTEMBER 1981
FOR
DR. KENNETH G. SODERSTROM



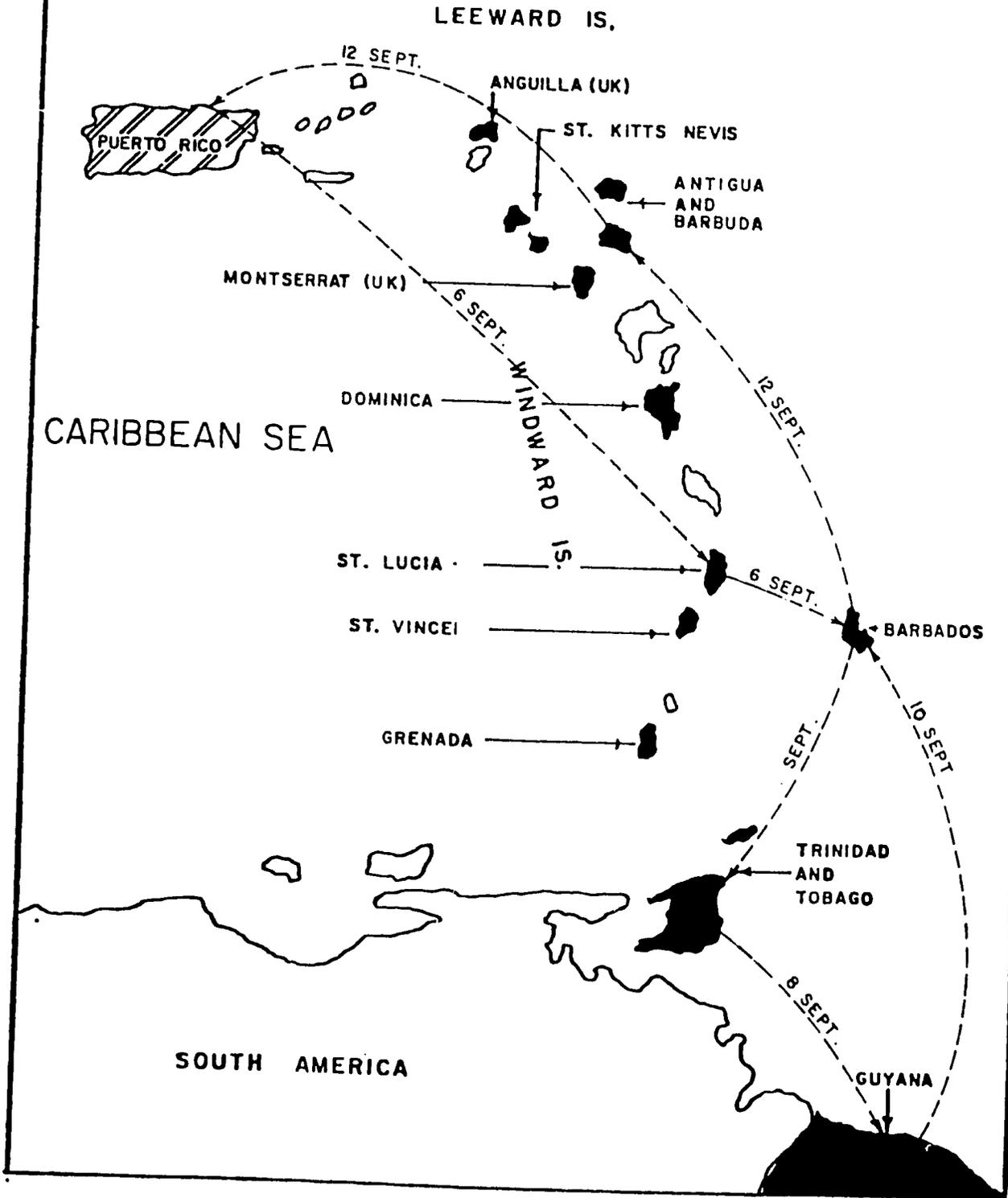
TRAVEL ITINERARY DURING AUGUST & SEPTEMBER 1981
FOR
DR. GEORGE T. PYTLINSKI



TRAVEL ITINERARY DURING AUGUST & SEPTEMBER 1981
FOR
MR. LEWIS SMITH



TRAVEL ITINERARY DURING AUGUST & SEPTEMBER 1981
FOR
DR. MANUEL GARCIA-MORIN



THE FOLLOWING LIST OF CONTACT PERSONS WAS PREPARED AT CDB DURING THE WEEK OF 23 AUGUST 1981 DURING THE INITIAL VISIT TO BARBADOS AND TELEXES SENT TO THE FIRST NAME (CONTACT PERSON) OF EACH COUNTRY LIST, INDICATING DATES OF VISIT FOR THE CORRESPONDING TEAM MEMBER. THE CONTACT PERSON WAS THEN INSTRUCTED TO SET UP APPOINTMENTS WITH THE REMAINING PERSONS ON THE LIST. SINCE NOT ALL OF THESE PEOPLE WERE AVAILABLE AT THE TIME OF VISIT AND ADDITIONAL PERSONS WERE INTERVIEWED THAT ARE NOT ON THE LIST, FOLLOWING THE LIST OF CONTACT PERSONS ARE LISTS OF THE ACTUAL PERSONS INTERVIEWED BY EACH TEAM MEMBER.

LIST OF CONTACT PERSONS IN VARIOUS COUNTRIES VISITED

COUNTRY	VISITED BY	CONTACT PERSONS
Antigua	Dr. G. Pytlinski Mr. Lewis Smith	<ol style="list-style-type: none"> 1. George Goodwin^a - 20804 2. Ernest Benjamin^{a,b} 3. Errol James^b 4. George Pigott^a 5. P.S. Ministry Econ. Development^{a,b} 6. Antigua Public Utilities Authority (Milton Rogers)^{a,b} 7. Mr. A. Francis, Principal, Technical College^b
Grenada	Dr. K.G. Soderstrom	<ol style="list-style-type: none"> 1. Ms. Gloria Payne-Banfield, P.S. Planning^{a,b} 2. Mr. Paul Koulen, Energy Advisor^{a,b} 3. Mr. Michael Julien, Tempe Oil Factory^b 4. Manager, Electricity Company^b 5. Ms. Jane Belfon, Director of Tourism
St. Vincent	Dr. G. Pytlinski	<ol style="list-style-type: none"> 1. Mr. Karl John, Director of Planning^{a,b} 2. Mr. Martin Barnard, Orange Hill Estates^b 3. Mr. Frederick Olivierre, Manager, St. Vincent Arrowroot Industry Association^b 4. Mr. S. O. Baveghems, Manager, St. Vincent Electric Services Ltd.^{a,b}
St. Kitts/Nevis	Dr. K.G. Soderstrom	<ol style="list-style-type: none"> 1. Mr. Blondell, Manager, Electricity Company^{a,b} 2. Heyliger, Director of Planning^{a,b} 3. Mr. Inniss, Principal, Technical College^b

LIST OF CONTACT PERSONS (Cont'd)

COUNTRY	VISITED BY	CONTACT PERSONS
Montserrat	Mr. L. Smith	<ol style="list-style-type: none"> 1. Mr. Franklin Margetson, Minister of Agriculture^a 2. Mr. C. T. John, P.S. Ministry of Agriculture^b 3. Mr. Nymphus Meade, Director of Agriculture^b 4. Government Statistician 5. Mr. Joel Huggins, Manager, Electricity Company^{a,b}
Trinidad (U.W.I.)	Dr. M. Garcia-Morin Dr. K.G. Soderstrom	<ol style="list-style-type: none"> 1. Professor Satcunanathan, Head Department of Mechanical Engineering^{a,b} 2. Professor Desmond Imbert, Dean, Faculty of Engineering^{a,b} 3. Dr. John Spence, ECLA Office, Port of Spain 4. Dr. Trevor Farrell, Senior Lecturer, Economics^{a,b} 5. Dr. Oliver Headley, Chemistry 6. Mr. Joe Bergasse, CARDI
Belize	Dr. G. Pytlinski	<ol style="list-style-type: none"> 1. Mr. Oscar Alonzo, Development Finance Corporation, Belmopan^b 2. Mr. Fernando Coye, Manager, National Electricity Authority^b 3. Mr. G. Fuller, Ministry of Energy^b
Guyana	Mr. L. Smith Dr. K.G. Soderstrom Dr. G. Pytlinski Dr. M. Garcia-Morin	<ol style="list-style-type: none"> 1. Dr. U. O'D. Trotz, Director, Institute of Applied Science and Technology^b 2. Mr. Ukarran Bhimsen^b

NOTE: All team members visited CDB at Barbados and CARICOM at Guyana. Dr. Dellimore handled the arrangements in Barbados and Mr. Granger in Guyana. Also, other interviews were conducted with persons not on this list and in some cases, persons on this list were not available at the time of the visit.

- a - Contact for Policy, Training, Needs Assessment.
b - Contact for Field, Tests and Resource Assessments.

Persons Interviewed by Dr. K. G. Soderstrom

BARBADOS

1. Mr. Lewis G. Campbell, Director - Projects Department
2. Dr. Jeffrey Dellimore, Head-TEU, CDB
3. Mr. Robert Zacharski, Project Officer, CDB
4. Mr. Harcourt Williams, Perm. Secretary for Planning, Ministry for Finance and Planning.
5. Mr. Andrew Cox, Economist, Energy and Natural Resources Div., Ministry for Finance and Planning
6. Mr. Stephen Lamming, CMI
7. Mr. Jean Balau, CARDI
8. Mr. Terrence Brown, USAID (Barbados)
9. Mr. Alejandro Sunderman, USAID (Barbados)

GUYANA

1. Mr. Frank Granger, Head-Energy Unit, CARICOM
2. Dr. Hopeton Gordon, Energy Unit, CARICOM
3. Mr. C. Watson, Energy Unit, CARICOM
4. Mr. W. Edinboro, Energy Unit, CARICOM
5. Mr. Joseph Farier, Chief-Tech. Assistance, CARICOM
6. Mr. B. A. Crawford, Exec. Chairman, Guyana National Energy Authority
7. Mr. Lance Carberry, Director General, Guyana National Energy Authority

TRINIDAD

1. Dr. G. M. Richards, Deputy Principal, UWI
2. Dr. Desmond Imbert, Dean of Eng'g., UWI
3. Prof. G. M. Sammy, Fac. of Eng'g., UWI
4. Prof. Sud, Fac. of Eng'g., UWI
5. Dr. Shinn, Fac. of Eng'g., UWI
6. Prof. Harry Phelps, Fac. of Eng'g., UWI
7. Dr. G. S. Kochar, Fac. of Eng'g., UWI
8. Dr. S. Thiruvarduchelvan, Fac. of Eng'g., UWI
9. Prof. K. Mahadera, Fac. of Eng'g., UWI
10. Dr. Oliver Headly, Chemist and Solar Energy Specialist, UWI
11. Dr. Ralph H. Phelps, Plant Pathologist, CARDI
12. Mr. Trevor Boopsingh, Ministry of Energy, Trinidad

GRENADA

1. Ms. Jane Belfon, Director-Tourism
2. Mr. Paul Koulen (UN)- Economist/Energy, Ministry of Trade, Industry, and Planning
3. Mr. Winston Bullen, Manager Elec. Company, Ministry of Planning
4. Mr. M. Jerome, Perm. Secretary, Ministry of Planning
5. Mr. McDonald, Tempe Industries
6. Mr. Curtis Hopkins, Owner-Ross Point Inn

Persons Interviewed by Dr. K. G. Soderstrom (Cont'd.)

ST. KITTS

1. Mr. Hugh Heylinger, Director of Planning
2. Mr. W. Blondell, Manager-Electric Company
3. Mr. Innis, Principal, Technical College

Persons Interviewed by Dr. George T. Pytlinski

BARBADOS

1. Mr. Ainsley Elliott, Deputy Director, CDB, Project Design and Analysis Division, August 28, 1981
2. Dr. Jeffrey Dellimore, Assistant Director CDB, Head Technology and Energy Unit, August 28, 1981
3. Mr. Fitzgerald Reid, Assistant Controller, CDB, Finance August 28, 1981
4. Mr. John Whittingham, Project Officer, CDB, Technology and Energy Unit, August 27, 1981
5. Mr. Robert Zacharski, DSI/EDI Consultant to CDB, Technology and Energy Unit, August 25, 1981
6. Mr. Jerome Singh, Senior Technical Assistant, CDB, Technology and Energy Unit, August 28, 1981
7. Mr. Steven Lamming, Project Manager, Caribbean Meteorological Institute, August 26, 1981
8. Dr. José L. Tudor, Technical Officer/Laboratory Head, Barbados National Standards Institution, August 26, 1981
9. Mr. Jean Balau, Project Leader, CARDI/CDB, August 16, 1981
10. Mr. Earl Barnhart, DIS Consultant to CDB, Technology and Energy Unit, August 26, 1981
11. Mr. Werner Voeth, Project Officer, Infrastructure Division, August 27, 1981

ST. VINCENT

1. Mr. M.M. Scott, Finance Secretary, Ministry of Finance, Planning and Development, September 4, 1981
2. Mr. K. John, Director of Planning, Ministry of Finance, Planning and Development, September 4, 1981
3. Mr. F. Ollivierre, General Manager, Arrowroot Industry Association, September 4, 1981
4. Mr. J. L. Huggins, Manager, St. Vincent Electric Services, Ltd., September 4, 1981
5. Mr. M. Barnard, Acting Manager, Orange Hill Estates, September 4, 1981

ANTIGUA

1. Mr. E.G.K. Challenger, Permanent Secretary, Ministry of External Affairs, September 1, 1981
2. Mr. C.A. Edwards, Acting Permanent Secretary, Ministry of Economic Development, Tourism and Energy, September 1, 1981
3. Mr. E. Benjamin, Industrial Development Advisor, Ministry of Economic Development, Tourism and Energy, September 1, 1981
4. Mr. J. Edwards, East Caribbean Common Market Secretariat, September 1, 1981
5. Mr. L. Emerson, Manager, Antigua Utility Authority and Power, September 1, 1981
4. Mr. L. P. Stevens, Director, Antigua Meteorological Service, September 1, 1981

Persons Interviewed by Dr. George T. Pytlinski (Cont'd.)

BELIZE

1. Mr. R.C. Swift, Under Secretary of Finance, Ministry of Finance and Economic Development, September 9, 1981
2. Mr. W. Craig, Project Officer, Office of Infrastructure Division/CDB, September 9, 1981
3. Mr. F.E. Coye, Deputy General Manager, Belize Electricity Board, September 9, 1981
4. Mr. G. Fuller, Secretary of Energy, Ministry of Energy, September 11, 1981
5. Mr. E. Bedran, Private Entrepreneur, San Ignacio Town, Cayo District, September 10, 1981
6. Mr. O. Aronzo, Economist, Development Finance Corporation, September 9, 1981

Persons Interviewed by Mr. Lewis Smith

Dr. Robert Nathan, Energy Development International

Mr. Mike Jones, Development Resources International

BARBADOS

1. Dr. Jeffrey Dellimore, CDB
2. Mr. Harcourt E. Williams, Permanent Secretary for Planning, Ministry for Finance and Planning
3. Mr. Andrew Cox, Economist, Energy & Natural Resources Div., Ministry for Finance and Planning

ANTIGUA

1. Mr. Eric Challenger, Permanent Secretary, Ministry of External Affairs
2. Mr. Ernest Benjamin, Coordinator of Energy, Ministry of Economic Development, Transportation and Energy
3. Mr. C. Edwards, Permanent Secretary, Ministry of Economic Development, Transportation and Energy
4. Mr. Brian Challenger, Research Officer, Ministry of Economic Development, Transportation and Energy

GUYANA

1. Mr. Frank Granger, Head Energy Unit, CARICOM Secretariat
2. Mr. Wallace Edinboro, Energy Unit, CARICOM
3. Mr. Conroy Watson, Energy Unit, CARICOM
4. Mr. Byron Blake, Director-Sectoral Policy and Planning, CARICOM
5. Mr. B. A. Crawford, Exec. Chairman, Guyana National Energy Authority
6. Mr. E. Lance Carberry, Director General, Guyana National Energy Authority

MONTserrat

1. Mr. Hilton Howson, Manager, Montserrat Electric Service
2. Mr. Joseph Daniel, Energy & Meteorology Office, Ministry of Agriculture, Transportation, Land and Housing
3. Mr. Ahwyn Howson, Chief Statistician, Government Headquarters
4. Mr. Reuben T. Meade, Development Economist, Chief Minister Office
5. Mr. Franklyn Morgetson, Ministry of Agriculture, Transportation, Land and Housing
6. Mr. Nymphus Meade, Director of Agriculture, Ministry of Agriculture, Transportation, Land and Housing

Persons Interviewed by Dr. M. García Morín

TRINIDAD

1. Dr. G. M. Richard, Deputy Principal, Univ. of West Indies
2. Dr. Desmond Imbert, Dean of Eng'g., UWI
3. Prof. G. Sammy, Faculty of Eng'g., UWI
4. Prof. Sud, Faculty of Eng'g., UWI
5. Dr. Shinn, Faculty of Eng'g., UWI
6. Prof. Harry Phelps, Faculty of Eng'g., UWI
7. Dr. G. S. Kochar, Faculty of Eng'g., UWI
8. Dr. S. Thiruvarudchelvan, Faculty of Eng'g., UWI
9. Prof. K. Mahadera, Faculty of Eng'g., UWI
10. Dr. Oliver Headly, Chemist and Solar Energy Specialist, UWI
11. Dr. Ralph Phelps, CARDI

GUYANA

1. Mr. Frank Granger, Head, Energy Unit, CARICOM
2. Dr. Hopeton Gordon, Energy Unit, CARICOM
3. Miss J. Budhooram, Energy Unit, CARICOM
4. Mr. C. Watson, Energy Unit, CARICOM
5. Mr. G. Goodwin, Energy Unit, CARICOM
6. Mr. U. Vhimsen, Solar Dryer for Pepper Seeds Project,
Univ. of Guyana
7. Dr. Ulric O'D. Trotz, Univ. of Guyana
8. Dr. G. Walcott, Dean of Natural Sciences, Univ. of Guyana

BARBADOS

1. Dr. Jeffrey Dellimore, Head TEU, CDB
2. Miss Ingrid Douglass, CDB
3. Miss Carolyn Ivette Cozier, CDB
4. Mr. Clifford Williams, CDB

APPENDIX C

TERMS OF REFERENCE

TERMS OF REFERENCEEVALUATION OF THE CARIBBEAN ALTERNATIVE ENERGY SYSTEMS
PROJECT AND TECHNOLOGY COMPONENT OF THE EMPLOYMENT/
INVESTMENT PROMOTION PROJECT

STATEMENT OF WORK

1. Background

Agreements for a Regional Alternative Energy Systems Project between USAID, the Caribbean Development Bank (CDB) and the Caribbean Community (CARICOM) were signed on August 25, 1979. The combined project estimated cost of US\$8.13 was to establish an institutional capability in the Caribbean region for carrying out energy planning, including conducting country energy needs assessments, and for designing, testing, adapting and disseminating alternative energy technologies. CARICOM and the CDB established Energy Units for Project Implementation. The countries included in the programmes are the member countries of CDB and CARICOM.

The CDB energy activities are combined under a Technology and Energy Unit which is also responsible for Technology information activities under an Agreement between USAID and the CDB (Employment/Investment Promotion Project signed on September 28, 1978) to develop and execute experimental research and demonstrate and disseminate adaptive technologies which support increased investment, employment and productivity in the industrial sector. A Technology Research Fund of US\$1.0 million and US\$466,000 for technical assistance and information dissemination under this Project, as well as US\$4.7 million

under the Regional Energy Project, are implemented by the TEU.

The above-mentioned Agreements call for the establishment of evaluation programmes, to include -

- (A) Evaluation of progress toward attainment of the objectives of the projects;
- (B) Identification and evaluation of problem areas of constraints which may inhibit such attainment; and
- (C) Evaluation, to the degree feasible, of the overall development impact of the Projects.

It is proposed to conduct in-depth evaluations of the CDB Technology Information and Energy Project activities and the related CARICOM Energy activities under the above-mentioned programmes. An evaluation of the CDB Technology and Energy Unit activities are being undertaken concurrently in view of the close interrelationship of the programmes within the CDB.

II. Scope of Work

The purpose of the evaluation is to assess overall progress and achievement of the purpose and objectives of the projects as well as provide recommendations for improvements or changes where needed. The evaluation team will conduct the assessment of the projects through visits and discussions with appropriate CDB, CARICOM, USAID, and participating country personnel, visits to project sites, and review of completed, on-going and planned project activities and documentation related thereto.

At the outset, the evaluation team should review and become fully conversant with the background information for the projects, including but not limited to:

- Caribbean Regional Alternative Energy Systems Project Paper;
- Caribbean Regional Employment/Investment Promotion I Project Paper;
- The related Project Agreements between USAID, the CDB and CARICOM;
- The approved CDB and CARICOM Implementation plans, budgets and operational procedures.

The evaluation team will prepare a comprehensive draft report of their findings, conclusions and recommendations for CDB, CARICOM and USAID review. Upon receipt of comments on the preliminary report from these three organizations, the team will complete a final report taking those comments into consideration. The areas of primary interest which should be addressed thoroughly, though not necessarily limited to those areas only, will be as follows:

A. Are the Programme objectives being met? Are technical and financial inputs sufficient and/or are original assumptions for the Programmes still valid?

1. Review original project assumptions and identify national and regional institutional and programmatic constraints, if any, to successful project implementation.
2. Review and examine each component in terms of adequacy of inputs (technical and financial) versus originally expected and actual magnitude of outputs. For the Energy Project the components are the Policy

Programme, the Training Programme, the Communications Programme, and the Technical Programme.

For the Employment/Investment Programme the components are the Technology Research Fund and the Technology Information Unit.

3. Considering present financial and time limitations for the programmes, provide specific recommendations to adjust or improve the programme to meet objectives.

B. What is the effectiveness of the CARICOM AND CDB administrative and operational procedures for the Projects?

1. Assess the adequacy of the operational systems for each project component.
2. Review policies, guidelines, and sub-project selection criteria as applicable.
3. Review and assess the effectiveness of operational coordinating efforts.
4. Examine the effectiveness of documentation and reporting requirements and procedures, as well as disbursement procedures.
5. Provide recommendations which could improve operational and administrative procedures.

C. What is the impact of completed and on-going project component sub-project activities and what is the expected impact of individual planned activities?

1. Review regional replicability of sub-projects.
2. Examine changes in national and regional institutional, technical or analytical capability as a

result of the projects for each component.

3. Review the actual and potential effect of each of the programme components in the participating countries.
4. Provide recommendations to improve the impact of project activities in the participating countries and to improve replicability throughout the region.

III. Work Plan and Level of Effort

The consultant will be expected to visit at least eight of the countries participating in the programmes to be evaluated. Commencement of the services under the contract is expected on or before August 19, 1981 and to end on or before September 30, 1981. Familiarity with Caribbean needs and problems in technology and energy resource development is desirable.

The level of effort required is a maximum of 90 man days. The Consultant is expected to provide expertise in systems management, resources policy and management, energy needs assessment, and in the field testing and development of technology suited to the needs of developing countries.