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MARTIN MARIETTA

**Mid-Term Evaluation of
USAID Sudan Energy Planning
and Management Project (650-0059)**

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MID-TERM EVALUATION OF USAID SUDAN
ENERGY PLANNING AND MANAGEMENT PROJECT (650-0059)

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EXECUTIVE SUMMARY

Situation and Project Outputs

USAID/Khartoum estimated conservatively that Sudan loses US\$150 million output annually in the agricultural and industrial sectors from energy supply interruptions. Against this background, the Energy Planning and Management (EPM) Project was designed to increase reliability of the Blue Nile Grid (BNG) and to bolster the management and operation of the National Electricity Corporation (NEC) and the General Petroleum Corporation (GPC), and to help develop the National Energy Administration (NEA) as a national energy planning institution.

Institution-building projects often have long gestation periods, but two major successes are already in evidence at NEC at mid-project. The Blue Nile Grid reliability has improved from a low of 74% in 1983 to 94% currently; although the EPM project has not been the only influence, its maintenance activities have been partly responsible for this improvement. We are unable to put even a rough rate of return figure on this improvement, but we conservatively calculate an 853% rate of return to the EPM's expenditures to improve NEC's billing and collection, in just one year. The outputs of NEA are less tangible, but all the evidence suggests that the EPM Project has strengthened NEA, even if not always in the ways intended, and that NEA will be able to stand on its own when USAID support ends. Discussions with the Minister of Energy and the Undersecretary of the Ministry of Finance and Economic Planning suggest that the Government of Sudan (GOS) is prepared to deal seriously with its energy problems and with its energy parastatals. Consequently, although NEA's formal influence on energy policy is quite limited, the environment is favorable for it to exercise the informal influence it has been acquiring at middle management and staff levels during the EPM Project. Despite these achievements, the project was hindered by a number of serious implementation difficulties which are described below. First, however, we turn to what the project accomplished.

Specific Accomplishments

The NEA component of the EPM Project has scored notable achievements in five major areas. (1) It has assisted in implementing a reorganization of NEA into a more task-oriented form. (2) It has strengthened NEA's computer capabilities with hardware and software acquisitions, a major study of computer system needs, and implementation of several of the study's major recommendations. (3) It has brought NEA to the point of publishing NEA Sudan Energy News on its own. (4) It has assisted in several survey data collection efforts. (5) It has assisted in the preparation of over ten analyses of energy issues and/or policy options.

The NEC component has made achievements in eight major areas. (1) It is completing computerization of a billing and collection system that already has increased NEC's collected proportion of accounts receivable

by 19% in its first year of operation. (2) It has prepared a long-run marginal cost tariff study, results of which NEC began implementing in January 1987. (3) It has trained six NEC engineers in the operation of a telecommunication system installed with previous USAID funding. (4) It has instituted systematic record keeping at NEC's Vehicle Maintenance Center. (5) It is training mechanics in the Vehicle Maintenance Center in engine, electrical system, and gear box repair. (6) It has increased the percent of NEC's vehicles that are in operation. (7) It has planned and initiated the installation of capacitors bought with USAID Commodity Import Program (CIP) funds. (8) Overall, the activities of the EPM Project have contributed to an increase in system reliability of the Blue Nile Grid from 74% in 1983 to 94% in 1986; although the EPM's contributions to this improvement cannot be separated from other BNG system changes, many of which are also USAID-funded, these maintenance and operation training activities have been necessary for the success of newly installed hardware funded by other projects.

Evaluation Team's Recommendations

Despite tight funding for USAID's Sudan portfolio, we strongly recommend that, at the very least, funding continue to complete the task of developing a computerized billing and collection system for NEC. NEC has a large capital expenditure plan for the next five to seven years (over \$250 million in loans and over \$31 million in grants), and it is crucial that it be able to collect its bills to pay for the system's expansion.

We further recommend that the computer equipment under bid for NEA be followed through to purchase, installation, and inspection. NEA will survive without the presence of the E/DI contractor, but retention of the contractor through the scheduled PACD of April 30, 1988, will solidify the organizational gains the EPM has already helped NEA achieve. Early termination of the project would undermine the informal influence with other GOS agencies that NEA has built in recent years with EPM support.

Implementation

The accomplishments of both components of the EPM Project (the GPC component was never funded) are all the more remarkable for having been achieved during a time of substantial external and internal turmoil. The tense political situation which eventually led to a 6-month evacuation of American personnel seriously interrupted and retarded work on both components of the EPM. Additionally, the implementation of the NEA component was seriously damaged by a problem involving high local currency spending rates and inappropriate expenditure of trust funds for project support rather than for contractor support. However, USAID bears as much responsibility for the problem reaching the proportions it did as the contractor does, and USAID appears to be largely responsible for letting that problem lead to a hostile, adversarial attitude toward the Project. In the resolution of the local currency problem, USAID largely ratified the contractor's spending rate and required that only one-ninth of the trust fund expenditures be shifted to the project account.

Putting the NEA/GPC and NEC components of the EPM Project under a single project, but with different contractors, was a serious mistake. The EPM project, despite its small size relative to USAID's entire Sudan portfolio (roughly \$13 million in U.S. funds and GOS contributions over nearly 5 years), is arguably the most complex project the Mission administers. Putting the two components together had a serious cost in terms of administrative control and led, in part, to the local currency problems at NEA.

Problem Areas

Despite the accomplishments noted above, the project has been hampered seriously by a number of problems. The chief of party (COP) of the NEA component had to be relieved after a little less than one year, and it was eight months before a new COP arrived. Meanwhile a major controversy arose between the Mission and the NEA contractor over the technical legality of certain categories of project spending and a higher-than-scheduled rate of overall spending by the NEA component of EPM. The contractor was largely vindicated in the former charge, while a major contributor to the high spending rate was the Mission's failure to process the paperwork on the NEA vehicles for over two years. These events occurred during the 1984-85 drought when Mission personnel were stretched very thinly across oversight of non-energy activities, but nonetheless, the controversy left relations between the Mission and the NEA component seriously strained for the remainder of the project.

The NEC component experienced difficulties as well. The first COP proved unsuccessful, and the Director-General of NEC refused to name an NEC counterpart for his successor. Power equipment went uncrated for over a year, and hundreds of thousands of dollars worth of utility construction vehicles were destroyed through misuse and/or cannibalization, many with fewer than 3,000 kilometers on the odometer. Controversy arose over the tariff study, which further soured relations between NEC staff and the EPM contractor.

In the face of these major practical adversities, the achievements of the EPM are remarkable. The successes notwithstanding are attributable in very large measure to the skill and dedication of the Mission energy officer, the remaining EPM contractor staff, and key members of the NEA and NEC technical staffs.

ABSTRACT

In 1984, the United States Agency for International Development's mission in Sudan implemented the Energy Planning and Management Project to strengthen several key institutions in the energy sector of Sudan. One component of the project focused on improving management, billing and collection, pricing, purchasing and stores, and vehicle operation and maintenance in the National Electricity Corporation. The other major component was devoted to strengthening the capability of the National Energy Administration to conduct national energy planning studies, including the analysis of energy issues and policies and the recommendation of policies. Originally the planned date for the mid-term evaluation of this project was early 1986, but because political turmoil and other events impeded implementation of the project, that evaluation was only conducted in January and February 1987. ORNL, at the request of the Sudan Mission and the office of Energy of AID, fielded a team in January 1987 to evaluate the progress of the project to that date and make recommendations for the remainder of the project's implementation. This study reports the findings and recommendations of the evaluation team regarding the Sudan Energy Management and Planning Project.

The evaluation team spent three weeks in Sudan studying files and documents at the AID Mission and documents at the National Electricity Corporation and the National Energy Administration, interviewing personnel associated, or otherwise familiar, with the project's implementation, and examining equipment in the field which was purchased and/or installed with project funding.

Evidence was found that the project had apparently been instrumental in increasing the reliability of the Blue Nile Grid from a low of 74% in 1983 to 94% at the time of the evaluation. The effort to improve the National Electricity Corporation's billing and collection system were already showing positive results at the time of the evaluation, and promised to be of major importance for the utility and the nation. The project contractors at the National Energy Administration had strengthened the computing system there, but had less tangible success in interjecting new routines into that agency than had the contractor for the other component.

The political events surrounding and following the overthrow of the Nimieri government in Sudan in 1985 caused major implementation problems for the Energy Planning and Management Project, including evacuation of all American personnel for over six months in 1986. A major drought coincided with these events and reoriented the attention of the AID Mission in Sudan, also contributing to implementation problems for the project. Considering these circumstances, the project, particularly at the National Electricity Corporation, had achieved some substantial accomplishments. Continuation of several subcomponents of the project, reorientation of some others, and the assignment of an energy planner/energy economist to assist the overall project officer, who also served as the Mission Energy Officer, were recommended.

1. INTRODUCTION

This report presents the findings of a detailed mid-term evaluation of the Sudan Energy Planning and Management Project (No. 650-0059) carried out by Sudan's National Energy Administration (NEA) and National Electricity Corporation (NEC) with funds supplied by USAID/Khartoum beginning in 1984 and scheduled to continue through April 30, 1988. Originally scheduled for January 1985, the project's mid-term evaluation was subsequently rescheduled for April 1986 after delays in project start-up, then postponed until January 1987 by the evacuation of all American personnel working in Sudan. For this reason the evaluation team has reviewed all the activities conducted by the project in its first three years, with a view towards informing the Mission on what can and should be accomplished under the project's remaining life.

The methodology used by the evaluation team conformed to standard USAID evaluation procedures incorporated in the Project Evaluation Summary (PES) Format. Following an orientation briefing on January 23, 1987 organized at USAID/W by Weston A. Fisher (AFR/TR/SDP), which included John Slattery and Warren Rush of the USAID Sudan desk, the team left for Khartoum. The evaluation team spent three weeks in Sudan, from January 25 to February 13, conducting an extensive review of the project. We critically reviewed the goals, objectives, strategy, inputs, and outputs of the Sudan Energy Planning and Management (EPM) Project, as well as each of its components. This included review of pertinent project files and documentation at USAID/Khartoum and through numerous meetings and informal discussions with the principal project-related staff at NEA and NEC, project contractor staff, key Mission personnel at USAID/Khartoum, representatives of other Sudanese government organizations, and donor organization representatives who have been involved with the project's activities (see Appendix 2 for a listing of persons interviewed).

With regard to the evaluation of the NEC project, field visits were conducted to several sites where equipment purchased through this project or related USAID energy projects has been installed, or where project activities have taken place (see Appendix 3 for a listing of the field site visits). Due to the short time the evaluation team was in the country, it was possible to visit only what the team thought to be critical sites. The team prepared a draft report of its preliminary findings and presented it informally to USAID/Khartoum before the team's departure from Sudan. The final version of the Mid-Term Evaluation Report incorporated comments from NEA, NEC and USAID and was prepared after the team returned to the United States. The organization of this Evaluation Report includes discussion of the major considerations called for in the evaluation team's statement of work (see Appendix 4) and further guidance from the Mission's Evaluation Officer, Blaine Jensen.

The evaluation team expresses its appreciation and gratitude to all those who participated in the preparation of the Evaluation Report and particularly acknowledge the administrative assistance, guidance and

logistical support provided by: Dr. David Jhirad, Office of Energy, Bureau for Service and Technology, (S&T/EY); Mr. Weston Fisher, AFR/TR/SDP; Mr. Blaine Jensen, USAID/Khartoum; Ms. Valerie Dickson-Horton, USAID/Khartoum; and particularly to Mr. Jay Carter, USAID/Khartoum.

2. USAID/KHARTOUM ENERGY PROJECT PORTFOLIO

In addition to the EPM project, USAID/Khartoum has had several other activities underway in the energy sector since 1980. With support from the Office of Energy in the Bureau for Science and Technology (S&T/EY) in USAID/W, the Sudan Energy Policy and Planning Project (SEPAP) was carried out from January 1981 through April 1984. SEPAP provided energy planning assistance to the National Energy Administration of the Ministry of Energy and Mining in preparing a National Energy Assessment and a National Energy Plan, along with training and institutional support (e.g., library and information systems). This project was the predecessor of the NEA/GPC component of the EPM project; EPM also funded an extension of SEPAP.

The SEPAP analysis of the electricity sector produced a series of recommendations for short-range reliability improvements in the Blue Nile Grid (BNG), Sudan's principal electricity supply and distribution system. Along with the National Electricity Corporation's (NEC) predecessor, the Public Electricity and Water Corporation, SEPAP consultants drew up a list of U.S. commodities, procurement of which would assist in improving the reliability of the BNG. A separate S&T/EY contractor provided specifications and procurement services for nearly \$16 million worth of CIP-funded electrical equipment, telecommunications equipment, computer equipment, and vehicles and heavy equipment for NEC under the BNG Rehabilitation Phase I contract. One component of the EPM with NEC provided training and technical assistance in installation, operation, and maintenance of this equipment. The other component of EPM with NEC was designed in large part to address managerial and financial administration deficiencies in NEC, to complement the commodity purchases, and enhance the effectiveness of their use. The EPM project was also modified several times to strengthen technical assistance support to NEC to ensure that USAID-procured equipment was being properly installed, operated, and maintained.

The initial BNG Rehabilitation Phase I Project was subsequently replaced by the BNG Rehabilitation Phase II Project in 1985. It has provided technical assistance to NEC in continuing the installation, proper servicing, and operation of USAID-funded, CIP-procured, electrical power transmission and distribution equipment.

Another project in the Mission's energy portfolio was the Roseires Dam Reservoir Sedimentation and Debris Control Project which, between 1981 and June 1986, provided dredges, barges, boats, trucks, cranes, and support equipment and facilities to carry out annual dredging of silt and debris in the area of the Roseires Reservoir adjacent to the power plant intakes. This project was undertaken in response to periodic blockages of power intakes by vegetative matter, sediment, and woody wastes during annual flood seasons. This culminated in the nearly complete blockage of the Dam's power generating capacity during 1981, 1982, and the 1983 flood seasons, which resulted in a severe, extended power loss to the BNG. This dredging project has prevented loss of power during the flood

seasons since 1984, resulting in very large savings to NEC and the industries of Sudan.

In 1983, the Mission designed a new Petroleum Initiative Commodity Import Program Grant designed to assure a sufficient and reliable supply of imported petroleum and establish an efficient system for the financing, procurement, importation, allocation, and distribution of petroleum products into Sudan. As implemented in 1984, the program authorized US\$120 million in economic support funds over a three-year period, to be obligated, in part, on the basis of major policy reforms such as energy pricing and allocation. The project was never fully implemented because of irregularities in GPC's petroleum purchases under the Nimieri government, and the final US\$10 million CIP payment was made for an oil shipment in July 1986.

The Mission also has funded the Sudan Renewable Energy Project (SREP) since 1982, to provide technical assistance, training, and commodities to support the Renewable Energy Research Institute (RERI), a unit of the National Council for Research and the Energy Research Council. The project's objectives are to promote widespread use of inexpensive renewable energy technologies that will reduce consumption of imported fuels and improve living standards for low- and medium-income households. The project has promoted improved charcoal cookstoves, afforestation, improved wood conversion (carbonization), and utilization techniques for small-scale industry, and has carried out experimental applications of solar photovoltaic cells for water pumping, refrigeration, and lighting in remote, off-grid areas.

Finally, through a separate contract, and now funded under the EPM Project, the Mission has maintained an Energy Advisor to provide project management and technical backstopping for the energy portfolio. This individual was also responsible for providing consultative support to the Mission on various energy related issues, including coordination of USAID/W energy assistance, donor assistance, and interaction with GOS institutions.

3. OVERVIEW OF THE EPM PROJECT

This chapter presents a brief overview of the history and evolution of the Sudan Energy Planning and Management Project (EPM). It recounts the purpose and description of EPM as expressed in the project paper as well as subsequent changes in the project which have occurred during its implementation to date. It also presents a perspective on major external events occurring over the life of the project that have affected its implementation, a current update on the importance of the energy sector in the Sudanese economy, and a description of other donor activities and their relationships to the project.

3.1. ORIGINAL DESIGN

The goal of the EPM project as expressed in the original project paper approved by Mission Director Arthur Mudge on August 31, 1982, was "to ease energy-related constraints to economic recovery while contributing towards the longer term goal of meeting Sudan's requirements for domestic, agricultural and industrial use in ways that are economical, efficient and environmentally sound" (USAID/Khartoum, 1982a, p. 2). This was to be achieved by strengthening the three institutions within the Ministry of Energy and Mining (MEM) that have primary responsibilities for public sector energy management and planning functions, the National Electricity Corporation (NEC), the National Energy Administration (NEA), and the General Petroleum Corporation (GPC).

As designed, the project was to achieve two major objectives:

- a. increase the short-term reliability of the Blue Nile electric power grid and improve the managerial and financial capability of the ... NEC to generate, transmit and distribute power, and
- b. improve the capability of the ... NEA and the ... GPC to plan and prepare for the most efficient use of Sudan's energy resources." (USAID/Khartoum, 1982a, p. 2)

The project paper envisioned that as a result of the project, NEC would "complete a nationally-mandated reorganization and decentralization of services... improve operations and maintenance with the goal of rapidly improving reliability. Power outage frequency and duration will be reduced and outage schedules established ... financial controls will be established ... and with a restructured tariff, NEC cash flow will improve. Load management plans will contribute to increased power factor values. Conservation and efficiency promotion programs ... will improve electric use efficiency.... At project end, NEC will be better organized and managed and thus provide more energy for development, in a more reliable and efficient manner" (USAID/Khartoum, 1982a, pp. 3-4).

By the end of the project, NEA was to be "capable of assessment and analysis of energy supply and demand data by sector for the purpose of preparing developmentally sound energy plans and programs for Sudan...

NEA will also play a key role in developing energy policy and pricing alternatives... NEA will revise national energy plans (annually) and oversee special analyses of prioritized energy problems. It will have all central staff planning responsibilities for the energy sector . . . NEA . . . will . . . take the lead in fuelwood management and planning" (USAID/Khartoum, 1982a, p. 3).

The GPC was to be assisted to "develop more flexible allocation procedures to accommodate the inherent instability of . . . oil supply financing . . . planning and developing its new role in petroleum exploration and production matters . . . improve its financial management and its knowledge of world petroleum pricing . . . (and) scheduling and planning procedures" (USAID/Khartoum, 1982a, p. 4).

As designed, the EPM project included long-term and short-term technical assistance and training along with selected commodities. The project grant was originally funded in the amount of \$5,952,700 in foreign exchange, with local currency support from the USAID trust funds generated by the Commodity Import Program (CIP) and from committed operating budgets from the Government of Sudan (GOS). The GOS inputs originally totaled \$5,068,000 in local currency (at the prevailing 1982 official exchange rate of LS 0.90 = \$1.00).

In terms of percentages, 48.4% of the project budget was earmarked for assistance to NEC, 45.2% to NEA, and 6.4% to GPC. The project was to finance 198 person-months (pm) of long-term technical assistance, 94 pm of short-term technical assistance, 24 pm of long-term U.S. training, 25 pm of short-term U.S. training, and 30 pm of short-term third-country training, totaling \$5,563,900, as well as \$388,000 worth of commodities.

3.2. IMPLEMENTATION HISTORY

The project grant agreement between USAID and the GOS was signed on August 31, 1982. It established September 30, 1987 as the Project Assistance Completion Date (PACD). The agreement set a ceiling on grant financing to the project of \$6,600,000 and provided incremental funding of \$1,955,000 to initiate project activities. No significant conditions precedent were included, although five special covenants were included, covering project evaluation, counterpart personnel, a requirement for an annual donor coordination meeting on NEC projects, private sector participation, and a requirement that full economic analyses of GOS energy pricing policies be conducted.

PIO/Ts for acquiring the long-term technical assistance contractors to NEC and NEA/GPC were issued separately in December 1982. However, because of delays totaling approximately eight months, contracting schedules slipped, and the Mission decided to bridge the gap between the termination of two predecessor projects in the energy portfolio and the planned EPM activities. A Project Paper Supplement (PPS) issued on September 22, 1983, (USAID/Khartoum, 1983) describes these modifications. The PPS provided funding for: (a) increased technical assistance to the

NEC through an extension of Bechtel's Blue Nile Grid Rehabilitation services contract; (b) increased technical assistance to NEA through an extension of the centrally funded Sudan Energy Policy and Planning Project (SEPAP) No. 936-5703 and its advisory services contract with ISTI (and subcontractor Energy/Development International); and (c) additional commodities for support of the EPM contractors and an addition to project contingency funds. It also extended the PACD from September 30, 1987 to March 31, 1988.

The PPS called for use of EPM to partially fund an already on-going procurement advisory services contract with Bechtel National, Inc., signed on July 5, 1982, in connection with procurement of \$15.6 million in power system equipment through the CIP program (Blue Nile Grid Rehabilitation I Project). A PIO/T issued on April 27, 1983 authorized spending up to \$368,000 of EPM funds. Under a separate, on-going, centrally funded S&T/EY contract with Bechtel, the Mission provided an additional buy-in of \$202,000 to provide the services of a purchasing and stores specialist for one year to provide assistance in the area of equipment warehouse management. This specialist arrived in February 1983. Another PIO/T was issued on March 9, 1983 to acquire infrared equipment for identifying power line failures. From data contained in quarterly project implementation reports prepared in 1985, it appears that an additional \$311,000 from EPM was added to Bechtel's contract, bringing their total of EPM-funded activities to \$881,000.

The PPS also authorized funds for a previously approved, EPM-supported, nine-month extension of SEPAP from August 25, 1982 to July 31, 1983. A PIO/T issued on March 29, 1983 provided \$86,207 in EPM funds for this extension. An additional \$390,000 for a six-month extension from August 1983 to January 1984 was also authorized. A 1985 quarterly project implementation report suggests that an additional \$289,900 was added to SEPAP from EPM funds, for a total funding level of \$766,107 out of the \$1,534,887 spent during this EPM predecessor project.

These modifications to the EPM project were intended to provide a transition of support to NEC and NEA until the EPM contractors were selected. The PPS provided an additional \$1.85 million in USAID project grant funds, which raised the total life-of-project (LOP) dollar costs to \$8.45 million.

In June 1983, an announcement of the project was made in the Commerce Business Daily (CBD) and requests for proposals (RFPs) for the two technical assistance contractors were issued. Proposals were scheduled to be received in August 1983, evaluated in September, with selection decisions made in October, and contracts signed by November 30, 1983. However, due to delays in the procurement process, the contractors were not formally selected until early 1984. The selected technical assistance contractors, Harza for NEC and Energy/Development International (E/DI) for NEA/GPC, fielded their long-term advisors/chiefs of party (COPs) in July and March 1984, respectively.

A portion of the NEA/GPC proposed project was also revised substantially before technical assistance contracts were issued. Mission Director Brown, when apprised of questionable petroleum procurement practices occurring at GPC during 1982 and 1983 that involved contract prices for crude oil purchases well in excess of spot market prices, ordered postponement of the proposed GPC component of the EPM project in late 1983.* As originally planned, the project was to include a wide range of activities with GPC. The contractor was to provide technical assistance to GPC to develop a systematic model of the Sudanese petroleum products distribution system; improve petroleum procurement, distribution, and product allocation practices; analyze operations at the Port Sudan refinery; and recommend improved corporate planning and management information systems. The project was also to supply training and computer hardware and software to GPC.

Although the GPC component was never carried out as originally planned, a small number of activities involving GPC have been carried out by the NEA technical assistance contractor during the EPM project.

Project Agreement (ProAg) Amendment No. 1 was signed by the GOS on April 20, 1983, and by USAID on May 31, 1983, authorizing an additional \$1,500,000 in incremental USAID grant funds to the project. Pro Ag Amendment No. 2, issued on December 5, 1983, included the changes authorized by USAID in the earlier PPS. In addition to providing incremental USAID funding of \$1,850,000 and an official extension of the PACD to March 31, 1988, it increased GOS-contributed funds to \$6,500,000 from \$5,595,000, increased the commodity budget to \$850,000, provided \$45,000 for English language training at the American Center in Khartoum, and increased the length of the project from five to six years. Project Implementation Letter (PIL) No. 3, March 7, 1984, extended the PACD to April 30, 1988.

Subsequent ProAg Amendments added incremental funding of \$1,300,000 (ProAg Amendment No. 3, in August 1984) and \$1,100,000 (ProAg Amendment No. 4, in December 1984). ProAg Amendment No. 5 (undated but apparently prepared around the time of the evacuation in April 1986) increased the number of long-term technical assistance advisor person-months from 198 to 300, increased the number of project vehicles from four to eleven, and added a new team of technical assistance contractors to provide equipment maintenance training and supervisory services to NEC. The latter contract with Arkel Talab was funded through a PIO/T in March 1985, with \$278,000 and LS 3,500,000 (Sudanese pounds) in funds authorized. A separate subcontract with Arkel-Talab for NEC computer services under the Harza contract was executed through PIO/Ts in November 1984 and June 1985, for a total of LS 212,000. The ProAg Amendment also added an additional 24 person-months of time to the ISTI subcontract with the

*During the evaluation team's visit, former Energy Minister Dr. Sherif El Tuhami was on trial and admitted diverting a number of cargoes of crude oil to third parties outside Sudan, as well as purchasing crude supplies at inflated prices from less than reputable suppliers.

USAID/Khartoum Energy Advisor, Mr. Jay Carter. A final ProAg Amendment No. 6 added incremental funding of \$300,000 in August 1986. The PILs are unremarkable except for PIL No. 4, of December 4, 1984, which authorized a trip to Washington for three NEC officials to interview finalists in the procurement of a BNG Rehabilitation II Project contractor. There was also a personal agreement between former Mission Director Brown and the Director General of GPC, which was never formally documented, to provide \$200,000 for training at GPC.

As this section has demonstrated, the EPM project has undergone a series of often abrupt shifts and changes during its implementation, all of them intended to strengthen the project's execution, but each individual action or amendment further complicating the process of overall project management and administration.

In addition, while the EPM project seems to have functioned as the centerpiece project in the Mission's energy portfolio, it was affected by delays and problems. Substantial sums of project funds were used to fund other, ongoing energy activities or new activities deemed necessary to support Sudan's energy sector, while other activities were deleted or postponed. This pattern of project activity appears to have diverted Mission attention from some of the original purposes of the project, and the Mission seems to have perhaps unwittingly complicated its own task of project management.

The EPM project, its predecessor SEPAP, and the BNG Rehabilitation project clearly helped to provide some of the impetus for other Mission energy activities such as the CIP petroleum funding facility initiative (USAID/Khartoum, April 4, 1984), and also interacted or intersected with activities under the BNG Rehabilitation II Project and the Sudan Renewable Energy Project (SREP). Therefore, it is not possible to ignore or easily separate for purposes of this evaluation, the overall impact of the EPM project, since so much of its implementation is characterized by close interworkings with other elements of the Mission's energy portfolio.

The procurement of both principal contractors was clouded with controversy. NEC representatives strongly objected to selection of Harza on technical grounds but were overruled because of cost considerations. Dr. Mahmoud Sherif of NEC's Corporate Planning Division expressed this formally to USAID in a meeting with Don Lake on February 5, 1984 (see Memo to files from Peter Kranstover, USAID/Khartoum, February 15, 1984). This antipathy toward Harza on the part of NEC seemed to exact a particularly negative impact on the project's early stages.

In the case of E/DI, the Mission decided well in advance of awarding the contract to exclude that portion of the contractor's scope of work calling for activities with GPC. As discussed earlier, this appears to have been motivated by information on questionable petroleum procurement practices by GPC, brought to light in part by SEPAP and in part by the Mission's development of a CIP petroleum financing initiative. The only other firm in the competitive range protested the planned award of the

contract to E/DI with a reduced scope related to GPC, on the grounds that they did not have the opportunity to bid on the revised scope of work. In an Action memorandum dated December 20, 1983, Mission Director William Brown approved signing of a contract with E/DI having the original scope of work and a caveat that any technical assistance to GPC be postponed, to preclude any possibility of legal action by E/DI's competitor.

The effectiveness of both contractors' efforts was seriously impaired by the security restrictions imposed on Americans in Sudan in the fall of 1985 and which still were in effect at the time of this evaluation. The restrictions on the use of short-term advisors effectively limited project technical assistance activities to those provided by the long-term resident advisors. The evacuation of Americans from Sudan, from April to October 1986, further interrupted project progress. What role this evacuation period played in terms of loss of confidence in the EPM project by counterpart personnel is difficult to ascertain.

According to the grant agreement, administration of the project was to be the day-to-day responsibility of the USAID/Khartoum Energy Officer. This individual was to have responsibility for overall contract and day-to-day project coordination and monitoring and contract coordination and monitoring. This individual has been Mr. Jay Carter, a personal services contractor (PSC) funded through an ISTI subcontract under the EPM project. Mr. Carter was variously supported by others in USAID/Khartoum, especially Richard Macken, Dean Moody, Valerie Dickson-Horton and Thomas Cornell. Project administration on the part of USAID/Khartoum appears to have been largely reactive and, at times, uncoordinated and dilatory. This was in large part attributable to the complexities of the EPM project and the fact that in his role as Energy Officer/Energy Advisor, Mr. Carter was also required to administer several other major energy project activities. His supervision of field engineering activities was strong, and his liaison role at political levels within MEM, NEA, NEC, and other GOS agencies invaluable, but office administration on the part of all those involved on the project management committee could have been improved and appears to have contributed to difficulties in project execution. Mr. Carter also initiated several important activities, such as the NEC vehicle maintenance and communications centers contract, which have strengthened the overall effectiveness of funds previously spent under CIP grants and other EPM activities.

Procurement of project vehicles funded under the commodity funds for the project was to be a USAID responsibility: "Because of the long delivery time, the vehicles will be ordered before the contractors are selected, in order to have their arrival coincide with that of the contract advisors" (USAID/Khartoum, 1982a, Annex 1, p. 9). Three months after his arrival in Sudan, in June 1983, Mr. Carter submitted a PIO/C for four project vehicles to the Mission's procurement officer. No action was taken on this PIO/C, for unexplained reasons not documented in project files, for nearly two years. A PIO/C for 11 vehicles was not reissued until May 1985; that PIO/C incorporated the previous PIO/C by

reference, and the vehicles were not received by project personnel until after the evacuation period ended in October 1986. This resulted in considerable expenditures in local currency for vehicle rentals by project contractors, to the detriment of other potential uses of these funds.

Most recently, the EPM project has suffered from uncertainty regarding its continued funding. From cable traffic and informal discussions with Mission personnel, it appears that as a result of a program consolidation plan adopted by USAID/Khartoum in November 1986, the EPM Project and the entire program of USAID assistance to Sudan's energy sector were to be phased out quickly. This planned close-out appears to have been developed partly in reaction to (1) the security concerns prevailing in late 1986, which had been limiting project staffing, but which have since been lifted; and partly to (2) the view of Mission Director John Koehring that the limited financial resources available to USAID/Khartoum might best be devoted to other program areas of the Mission's portfolio and his concern that power in Sudan was an infinite sink for donor funds.

A revised operating year budget (OYB) for fiscal year 1987, submitted to USAID/W by USAID/Khartoum on January 8, 1987, calls for additional incremental funding of \$500,000 for EPM from Special Development Account (SDA) funds because "orderly review and possible early close out of (EPM) activities ... requires Mission to sustain some TA presence and project implementation at least for immediate future" (USAID/Khartoum Cable 0281 to U.S. Department of State, January 8, 1987). No funds for EPM are included in the requested FY 88 budget. However the cable adds that "if SDA funding materializes later in Fiscal Year approximately \$1.5 million is required to cover short-term contract obligations" (ibid). Thus EPM will only have an additional \$500,000 in incremental funding available to it if the project is continued past this evaluation and no other priority changes are made. This is unlikely to cover all of the anticipated project requirements for the remainder of FY 87. Availability of fallout funds will not be known until around April 1987 and still will require a decision by the Africa Bureau of USAID/W to allow re-programming of funds to EPM. Thus at the present time there appears to be an impending, forced close out of EPM when available funds are expended, regardless of the conclusions of this evaluation, unless significant changes in Mission funding priorities and USAID/W concurrence occurs.

The project paper's evaluation plan called for a mid-term evaluation which would be "a joint effort of the MEM and USAID at a time early enough to allow adjustment in the project plan to correct any design errors or compensate for changing circumstances," after approximately fifteen to eighteen months of the project. Unfortunately, while the Mission attempted to schedule the evaluation for the end of 1985, events precluded the fielding of an evaluation team prior to January 25, 1987. The impact of this delay on the project has been adverse but unavoidable.

Table 3.1 presents a picture of the current funding status of the project.

TABLE 3.1.
Project Expenditures through December 31, 1986,
from U. S. Dollar Account in U.S.\$

Bechtel	\$1,123,064
ISTI (SEPA)	144,481
Harza	1,079,821
E/DI	1,232,331
ISTI (Carter)	471,054
Arkel-Talab	242,797
NEC Trip to Washington	6,243
Training	186,028
Commodities	323,893
*Total	\$4,809,711

Arkel-Talab Sub-contract to Sud Consult for
Computer Assistance LS 220,000

Source: USAID/Khartoum, January 1987.

*These figures, while USAID-generated, do not tally completely with invoices paid through December 31, 1986, and are not inclusive of all known EPM- contracted activities.

3.3. EXTERNAL EVENTS DURING THE PROJECT

In addition to its complex implementation history, the EPM project has been beset during its nearly four and a half year life by a series of external events affecting Sudan, USAID, and the global energy economy, which have had significant, but varying, impacts on the project. The project paper set out in its section on key assumptions to project success a series of what its designers believed to be pragmatic assumptions about the institutions to be assisted under the project and the economic and commercial conditions likely to prevail in Sudan. It was assumed that "extraordinary changes in the international price of crude oil and refined products are not expected to occur," that the "overall balance of payments situation in the Sudan will not worsen, and sufficient foreign exchange will be available for the purchase of sufficient if not optimal quantities of petroleum (USAID/Khartoum, 1982a, p. 27). Finally, "the continuity of AID funding throughout the life of the project is assumed, and lastly it is assumed that the professional staff at NEC, NEA and GPC who receive training and other EPM benefits will remain at their posts" (USAID/Khartoum, 1982a, p.28).

These were not prescient assumptions, and the EPM project must be judged in part within the context in which it has been executed. In

April 1985, the 16-year government of Jafaar Nimieri was toppled in a military coup d'etat, removing the Minister of Energy and Mining and ushering in a military transitional government which lasted for more than one year. This has a powerful effect on the GOS policy environment and created a period when certain types of policy analyses and actions were not possible. The renewal of hostilities in southern Sudan had, by the end of 1983, already produced a postponement of Chevron's planned oil export project, which once had brightened Sudan's economic prospects and energy outlook considerably. The recent dissolution of the White Nile Petroleum Company further emphasizes the minimal likelihood of SPDP moving ahead anytime soon.

The collapse of world oil prices by 70% over a short time interval between 1984 and 1985 offered Sudan the hope of reducing the impact of its petroleum imports on its balance of trade, but also reinforced the demise of SPDP and loosened economic expectations concerning its ability to pay for oil imports. Indirectly, the fall in oil prices hurt Arab oil exporters' economies, lowering remittance incomes from Sudanese working abroad and lessening the flow of Arab donor funds into Sudan's budget.

A crippling drought in 1984 and a series of regional conflicts produced a flood of refugees from within and without Sudan, exacerbating food and transportation bottlenecks in the country. USAID's administration of a major relief effort through 1985 and 1986 appears to have diverted high-level Mission attention from administration of the EPM Project. Election of a new government in March 1986 created yet another political complication, ushering in a new, and potentially more effective, democratic administration, but one forced to begin to define its energy and economic policies anew.

Finally, the deteriorating security situation for Americans and the abrupt evacuation period during 1986 presented the project with an insurmountable obstacle - - the inability to continue needed technical assistance during a forced, seven-month hiatus. The continuing restrictions on the use of short-term technical assistance personnel and a series of administrative delays in securing local currency allotments to be provided under GOS financing with USAID concurrence created a further handicap which the EPM Project has struggled to overcome.

In sum, the EPM Project plainly has suffered from radical shifts in the playing field during its life to date. Without doubt, this external environment has measurably affected the project's progress in achieving its expected goals and outputs.

3.4. THE ENERGY SECTOR IN SUDAN

With the recent drop in world oil prices, it may appear reasonable to reduce the amount of development assistance being directed into energy projects. However, as the current USAID Office of Energy Program Plan notes, "AID's target of at least 2 percent annual real growth in per capita income will require an energy growth rate of 7 percent or more.

The Agency's goals for reducing hunger and other development needs require similar energy growth rates" (USAID S&T/EY, 1985, p. 32). The current A.I.D. Energy Policy Plan states, "AID attaches high priority to policy and planning assistance to help countries understand the relationship among energy use, the available indigenous and imported resources, and broader development policies in natural resources and environmental planning ... Energy investments are enormous ... The cost of a bad decision, therefore, is a lasting drag on the economy" (USAID, July 1984, pp 5, 7).

Sudan can ill afford to ignore energy in its development plans. It is a poor country among poor countries. Its per capita gross national product (GNP) in 1983/84 was US\$400, compared with US\$1113 for middle income countries in sub-Saharan Africa (World Bank, 1985, p. 120, Table 1.1). A more recent report claims, however, that Sudan's GDP per capita has fallen from US\$440 in 1980 to US\$187 in 1986 (Anwar, 1987). Its per capita energy consumption is correspondingly low, at 70 kilograms of oil equivalent (koe) per capita in 1983/84, some 85% of which is supplied by traditional fuels. Petroleum products account for roughly 14% and electricity the remaining 1%.

Sudan's current macroeconomic situation is even bleaker than its long-standing poverty would necessarily imply. Its current debt (principal plus accrued interest) is now US\$10 billion. Its payments were last rescheduled in December 1983, but the country was unable to make the rescheduled payments. The average ratio of debt service to the value of exports for the period 1973-83 was 1.5; that ratio is currently 5.0.

Total imports were US\$1.2 billion in 1983/84, while exports amounted to US\$687 million (World Bank, 1985, p. 141, Table 3.6); P. 135, Table 3.3). Trade projections for 1987 are imports of US\$1.5 billion and exports in the range of US\$400 million to US\$450 million (Aulakh, 1987).

Foreign loans and grants have been keeping Sudan's international accounts balanced, and it might be argued, inappropriately, that the ratio of debt service or commodity imports, or petroleum imports to exports is a meaningless or misleading statistic. The fact remains, however, that these ratios indicate Sudan's real economic performance and its near-term economic problems. Measuring these accounts against grants and soft loans masks the problem that, poor as Sudan is, it is living beyond its means.

Energy appears deceptively small in Sudan's national accounts. In 1981, electricity, gas and water accounted for 1.96% of gross domestic product (GDP) in 1982 Sudanese pounds (World Bank, 1983, p. 167); in 1983/84, public utilities, the closest corresponding account for that year, contributed 2.02% to GDP (World Bank, 1985, p. 126, Table 21). These small figures are highly misleading about the primary importance of energy to the Sudanese economy.

Petroleum imports, at US\$327 million, were the second largest import account item in 1983/84, behind consumer goods, which cost US\$350 million. In addition to the direct importation of petroleum, attention should be paid to the importation of energy-using items: transportation equipment, US\$104 million; electrical machinery, US\$58 million; tractors, US\$4 million. It is improper, of course, to simply add all these accounts together and call them energy costs. The point is, rather, that a sizeable share of non-energy imports requires importation of energy for operation. The important fact about the relationship between energy and Sudan's economic health is that nearly one third of the value of imports directly or indirectly involves energy.

Agriculture is the dominant sector in the Sudanese economy and may even be the driving force for economic growth in Sudan. Agriculture contributes around 40% of GDP; 60%, by value, of Sudan's agricultural output is irrigated; 90%, by value, of exported agricultural production is irrigated (gum arabic, accounts for roughly 10%); and over 90% of Sudan's exports are agricultural. Eighty-one percent of Sudan's exports, by value, are the products of irrigated agriculture (World Bank, 1983b, p. 25). Thirty to forty percent, by value, of irrigated agriculture uses pumping, either diesel or electric (calculations from figures in PAEA, 1986). The timing and water quantity requirements of irrigated agriculture often have low tolerances for deviation, so the timely supply of adequate quantities of energy is very important. For example, a ten-percent reduction of water coverage or a slippage in irrigation timing by two weeks, or roughly 10% of the growing period, could reduce crop output by much more than ten percent. This statement must, of course, be qualified with the observation that crops' vulnerabilities to alterations in water vary, and the vulnerability of output to water supply shortages for any given crop may depend on water salinity and mineral content, water content of the soil, and a host of other factors. But the caveat remains: a small drop in water supply can imply a much larger output reduction. Thus, in the neighborhood of 25% to 30% of Sudan's exports could be affected by energy interruptions in pumping alone. Even in rainfed agriculture, energy requirements for machinery can be substantial where irrigation energy use is low or nil. Cotton can use from 16 to 54 imperial gallons per metric ton of output, rainfed sesame 19, wheat from 5 to 14, and refined sugar 35 gallons per ton (Bateson & Sidhu, 1984, p. 35). A previous Mission report suggests that agricultural losses from petroleum shortages reach US\$100 million annually (USAID/Khartoum, April 1984, p.61).

Assurance of fuel supplies to agriculture, however, is no assurance of effective fuel use for either irrigation pumping or mechanized equipment operation. Current fuel allocation schemes send large fuel allotments to agricultural cooperatives, but the fuel is sold on the black market before it can be used as intended (NEA, 1982, p. 25). Such interruptions have the same force as undelivered supplies.

Reliable supplies of commercial energy are important to industry as well as to agriculture, but under the resource constraints of this evaluation, little can be said about the sensitivity of industrial

activity to developments in the energy sector. The 1981 energy balance for Sudan shows that industry is a less intensive user of commercial energy than is agriculture, however. The ratio of 1980/81 industrial and agricultural GDP shares was 1.07 (World Bank, 1985, p. 127, Table 2.2), while the 1981 energy balance shows the ratio of these sectors commercial energy consumption to have been 0.71 (World Bank, 1983c, p. 72). Currently, much of Sudan's industrial sector is operating far below capacity because of both fuel and spare parts shortages. Industry uses relatively and absolutely more electricity than does agriculture, and the reliability of electricity supply has been and continues to be a major concern to industrial users, although there appears to be evidence reliability is increasing. In the meantime, however, industry has developed substantial gasoil autogeneration capacity - - 110 MW in 1980 (NEA, 1982, pp 13, 18, 48-49) - - which is, of course, vulnerable to petroleum supply interruptions. This substantial installed autogeneration capacity is directly attributable to the lack of reliability of the electricity grid. Not only is this a misallocation of capital investment resources, but also of petroleum product supplies which could be utilized more productively elsewhere in the Sudanese economy if a more reliable electricity supply were available. The Mission study noted above claims that an estimate of annual industrial production losses from energy supply interruptions of US\$80 million is conservative (USAID/Khartoum, April 1984, p. 61).

Sudan's energy sector also has a large component of traditional fuels consisting of fuelwood, charcoal, animal dung, and crop residues. While some of these energy supplies are commercially exchanged, others are viewed and utilized as "free goods." Sudan's traditional fuel economy and its shortages of commercial petroleum products for household fuel purposes have contributed to the growing problems of environmental degradation and deforestation.

To the degree that Sudan's future economic growth is dependent upon achieving an export-oriented agricultural and industrial production system, adequate supplies of energy will remain a critical requirement for sustained economic recovery. The marginal value of energy supplies in these productive sectors is very high, estimated by some economists as a multiple of 5:1. This implies that for each additional dollar Sudan spends on fuel, it will gain five dollars in increased GDP. However, given the fact that at present there are severe limits on the extent to which Sudan can increase the supply of energy (due to foreign exchange shortages, the high cost of new electricity production facilities, and the inability of Sudan to develop its domestic oil reserves), it is imperative that existing supplies be efficiently allocated. This implies a greater reliance than heretofore on using energy pricing as a tool in demand management and emphasizes the importance of stressing energy conservation in national energy programs.

In sum, the energy sector's share in GDP is a misleading indicator of its importance in the economy. The large agricultural sector is relatively vulnerable to fuel supply interruptions, and agriculture is the major foreign exchange earner in the country, such as foreign

exchange earnings are. Industrial development in the long term depends more upon electricity than petroleum fuels, and reliability problems have hampered capacity utilization in recent years.

3.5. RELATIONSHIP TO OTHER DONOR ACTIVITIES

In addition to USAID funded projects, numerous other donors have been active in Sudan's energy sector in recent years. The World Bank's 1983 report on Sudan's energy sector observed that there is, "a multiplicity of foreign donor assistance in the energy sector. This assistance is uncoordinated and part of it might be better directed towards essential spares and equipment rather than demonstration/pilot projects and studies." (World Bank, 1983, p. 71). This situation continues, although within the wide spectrum of donor-assisted energy activities in Sudan, USAID efforts are distinguished by their focus on institution-building and long-term technical assistance rather than the turn-key approach pursued by foreign equipment suppliers to the power sector and the demonstration project/short-term technical assistance approach provided in discrete activities by other donors.

Presently the EPM project is the only institutional support donor active at NEC, with the exception of some training provided by the ILO.

Under a previous World Bank-funded activity, the Irish Electricity Supply Board prepared a new organizational structure for NEC. The World Bank also helped to shape the NEC tariff study funded under EPM. All other donor activity at NEC appears to be presently channeled into the thermal power plant expansion program and improvements to the transmission system under the umbrella, World Bank-sponsored Power III project presently underway and its successor, Power IV, which is currently still in the planning stage. Major current or likely equipment suppliers or donors at NEC include: the United Kingdom, Italy, the European Investment Bank, the World Bank's soft loan window-IDA, the Netherlands, Finland, Denmark, West Germany, the African Development Bank, the Kuwaiti Fund, the Saudi Fund, and the Arab Investment Fund.

The EPM project is the largest of the present donor-supported activities at NEA. Other donor-assisted activities include energy conservation activities funded by West Germany, agricultural residue briquetting project funded by UNDP/DANIDA, an agricultural residue gasification project funded by France, funding of a national cookstove network by DANIDA, biogas digester activities funded by a Norwegian church PVO and GTZ of West Germany, a World-Bank financed solar water heater thermal efficiency study, and a series of training activities funded by the Netherlands, France, Belgium, Italy, West Germany, Australia, the People's Republic of China, the Philippines, Czechoslovakia, and the Soviet Union. There have been some additional activities funded at NEA which we have not been able to thoroughly document, such as projects funded by Sweden and the U.N. Sudano-Sahelian Office. There also have been some USAID SREP activities conducted jointly with NEA, particularly concerning local production of improved cook stoves. At the moment, NEA has two proposed areas of World Bank technical and institution-building assistance under review with the Bank,

one as part of the new Fuelwood/Forestry project and the other in transportation energy conservation.

4. SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

4.1 OVERALL PROJECT DESIGN AND IMPLEMENTATION

The original project design, which put two largely independent, substantially different projects under one umbrella project with different contractors was seriously flawed and the project's goals and objectives unrealistically ambitious. In addition, a series of external factors and institutional constraints on the GOS side further limited project achievements of both major components of the EPM project. The resulting project was too complicated for a single manager to oversee adequately.

The NEC component required an experienced power systems engineer with sensitivity to project execution in developing countries and dedication to the project's development efforts. The project has had this in Mr. Carter. However, the NEA component required an experienced energy planner or economist rather than an engineer. Carter lent his moral support and considerable personal skills to keeping the NEA component on track as a viable, institution-building project during very difficult times, but the bulk of his time was spent with the NEC component and the other energy projects working with the Blue Nile Grid, and he was out of his professional expertise in providing technical backstopping for an institution-building project in integrated national energy planning. However, we contend that no single person could have filled both NEA and NEC components perfectly. It would have been impossible for a non-engineer energy planner to direct the NEC component, given the technical characteristics of many of the component's links to equipment acquired under the Commodity Import Program.

The main weakness of lack of an energy planning expertise in the Mission's Energy Office was that the NEA component never developed a unified concept of the energy problem that NEA was charged with addressing. The first half of the EPM project's NEA component was also saddled with deficiencies in field project management and a period of drift after the COP was removed and a replacement was not immediately available. The local currency problems which so preoccupied the Mission's project committee resulted from a combination of poor initial judgments on the part of the E/DI contractor, in albeit straitened circumstances, and administrative overextension and lack of oversight by the Mission, but the bitterness these problems caused between USAID and the EPM was needless. When the problem finally was cleared up, only one-ninth of the trust fund expenditures were disallowed and shifted to the project account, but the attitudinal legacy appears to have crippled the NEA component of the EPM project in USAID/Khartoum's eyes.

The original objectives of the EPM, to ease energy-related constraints to Sudan's economic development by increasing the reliability of the Blue Nile Grid and bolstering the institutional capacities of NEC, GPC, and NEA so they could expand and make better use of Sudan's available domestic and imported energy resources, are still valid, remain

vital, and are important to present and future economic health. Under the project, despite its implementation difficulties, NEC improved its financial viability even if it would not yet merit a AAA bond rating, and NEA has increased its visibility and informal influence among Sudanese government agencies in the energy policy arena.

The impact of short-term assistance is difficult to assess. A number of consultants worked at NEA and satisfied clearly defined statements of work, but follow-on activities were not well organized. The most lasting advisory services and training under the NEC component have been the work with computerization of billing and collection. The maintenance services provided have helped ensure that USAID-procured CIP equipment is properly installed, operated and maintained while USAID support remains, but these benefits are less likely to survive the PACD or an earlier project termination. At NEA, the most long-lasting contributions of the advisory services will probably be in the organizational restructuring encouraged by the contractors, and possibly in the Computer Unit. Much of the planned short-term training at NEA was precluded by the long, de facto freeze on local currency spending and the travel restrictions placed on the contractor by the security situation. Another significant project contribution has been the computerization of NEA which has greatly expanded its potential for performing sound energy analyses and maintaining reliable energy data for national planning purposes.

There was little coordination among contractors across the NEA and NEC components, but there were no pressing reasons why there should have been much. On the NEC component, there seemed little reason for coordination - - the activities were very disparate - - but the different contractors were aware of and in touch with one another's activities.

The project's contributions to NEA and NEC were appropriate. E/DI actually helped strengthen an institution at NEA and contributed to conducting some substantive energy analysis. A major shortcoming in the NEA component was the failure of the contractor, the Mission, and the project design process to give coherency to an EPM view of Sudan's energy problems which would have aided NEA to focus its planning mission.

Much of the effectiveness of NEA under the previous Energy Policy and Planning Project rested with the informal influence NEA derived from participating in interministerial committees, influence that NEA lacked formally. The interministerial committee linkages did not continue into the period of EPM or diminished as active entities as NEA shifted its efforts from energy assessment to tackling tough energy policy questions with sensitive political implications. The successes of the predecessor project were partly attributable to the influence gained from the interministerial committees, and subsequently the NEA component of EPM suffered from expectations placed on it that were unreasonable given the policy changes it was expected to affect.

Despite the problems during EPM Project implementation, NEA is a more viable institution today than it was before SEPAP and EPM efforts started. It is still young and in need of experience and in danger of diluting its efforts. The project objectives for the NEA are still appropriate, but the strategy should be shifted toward bolstering NEA's institutional and informational capacities for energy planning and analysis and solidifying capabilities to conduct its analytical energy studies in anticipation of the end of USAID support. The present contractors are already moving in this direction.

The relationship between the E/DI contractor and NEA has improved from its ebb in 1984 and early 1985. The relationship could have been enhanced by better information flow from the contractor to all NEA staff about the goals and activities of the project. This may have retarded the development of some EPM/non-EPM schisms among the NEA staff. Given the short time remaining to the PACD, no further effort is needed to redress this problem.

We were especially concerned with NEA's strong orientation toward hardware projects, which we feel runs counter to its planning and policy mission. Donor support appears easier to obtain for hardware projects, but the heavy emphasis of NEA in this direction has two major, negative effects on the institution as we see it. First, NEA has a conflict of interest in recommending energy policy options that involve the technologies it is financially involved with; and second, the project emphasis tends to divert the incentives for its engineers to study policy as opposed to pure engineering. Additionally, USAID bought NEA its computers to support policy studies, but their largest single task category of use, other than the computer unit itself, has been the hardware projects (at 29% of user time) that USAID does not want NEA to emphasize; planning activities used around 10%. If the E/DI contractor were not present, the imbalance toward project work probably would be even more lopsided.

NEC has made very limited use of its EPM contractors, partly because of bad feelings developed in the initial contracting and early implementation and partly because of weak management at NEC. Some contractors simply do not have counterparts, and those who do find access to their counterparts difficult. The Harza contractor is working directly on the implementation of a computerized billing system with some junior staff from NEC.

The coordination between the NEC portion of the EPM and the Blue Nile Grid Rehabilitation Project has been very good, but has been very time-consuming and has taken a toll on overall EPM Project administration. This has been a consequence of the initial project design flow of putting two major, diverse projects under one project management. The project manager was put in the position of having to choose which activities in EPM were most crucial, and we found Mr. Carter's decisions to have been wise ones. In no small part due to Mr. Carter's personal efforts, a portion of EPM activities was redirected to

ensure that equipment purchased through BNG Rehabilitation Project CIP funds was properly installed and maintained by NEC.

We offer a series of short conclusions and recommendations about the project that we particularly wish to emphasize.

4.2. CONCLUSIONS

General Energy Planning and Management Project

1. The EPM Project was sufficiently large and diverse, even as originally designed - - i.e., without the substantial amendments it underwent - - that either (a) it should have been split into two projects or (b) the Mission's energy advisor (ISTI contractor) a power systems engineer, should have had oversight help from a qualified energy economist/planner.
2. The project would have benefitted from an earlier mid-term evaluation which could have re-directed certain project components.
3. Despite its moderate size relative to the USAID/Khartoum portfolio, the EPM Project appears to be among the most complicated projects in the entire Sudan portfolio. However, improvement of the project's management could be accomplished relatively inexpensively by simply hiring another counterpart to assist with the technical aspects of the planning (NEA) component. There is, additionally, a need for a longer-term USAID view on institution-building projects.
4. A substantial amount of goodwill and trust has been developed between current GOS energy sector decisionmakers and Americans as a result of USAID projects undertaken in the energy sector to date. This has been supportive of American interests and has the potential to be strengthened and deepened if desired.

National Energy Administration

1. The successes of the predecessor project and flaws in the project paper led to excessively high expectations from the NEA component of the EPM. These expectations were rendered nearly meaningless by the series of political shifts and institutional lethargy exhibited by GOS planning organizations during the project to date.
2. For an institution-building project, the project paper put too much emphasis on physical outputs and policy implementation in the NEA component. If the project was to have effectively influenced GOS energy policy, certain additional institutional changes in formalized linkages should have been required by USAID as conditions precedent (i.e. inclusion of NEC and GPC planning units in the NEA project component in a formalized way; appointment of the Director General of NEA to the Boards of Directors of NEC and GPC).

3. USAID management and external political events materially impeded implementation of the NEA component of the project at several critical junctures. There is a need for a longer-term USAID view on institution-building projects.
4. Neither the project paper nor the Mission offered intellectual guidance to the NEA component of the project, and the project was able to give only limited help to NEA in developing truly integrated, national energy policies. Neither does NEA appear to have had any particular vision regarding its mission, but instead took advantage of ad hoc opportunities for funding, to the detriment of its principal mission.
5. NEA clearly will be able to carry on without the EPM Project, but the fate of its planning activities could be jeopardized by early withdrawal of the contractor. The only critical, specific activity remaining is the acquisition of additional computer and peripheral equipment. Nevertheless, the E/DI contractors' continued presence would further enhance and strengthen NEA's work as a planning and policy institution.
6. Since Fall 1985 when new resident advisors arrived, the E/DI contractors for the NEA component have accomplished a considerable amount of progress under seriously adverse conditions that included domestic political turmoil, a funding freeze, security restrictions and evacuation, and only limited support from the Mission.
7. NEA is still a young and developing organization whose institutional maturity is in the future. Therefore it is unable to exert major influences on GOS energy policy at this time despite the presence of a supportive Minister. The project has helped give NEA leverage within MEM and the Ministry of Finance. To what extent this leverage will outlive USAID assistance is unclear.
8. The reformulation of GOS policy on fuelwood/charcoal and forestry issues is at a critical juncture. USAID should examine its role carefully on SREP and other forestry activities to ensure that NEA's role as the key fuelwood policy agency with respect to energy utilization is supported. However, energy is not the important issue in forestry, and NEA, in NEA should integrate the activities of agencies dealing with both energy and non-energy topics in forestry. NEA's hardware project activity jeopardizes its potential role as such an integrator of forestry policies.
9. NEA's capability to conduct economic analysis is very weak.

General Petroleum Corporation

1. While the inactivation of the GPC component of the EPM project was a necessity at the time from USAID's point of view, GPC staff benefitted from the project-provided training. Due to administrative problems, two candidates for U.S long-term training

have been prevented for over a year from utilizing EPM training funds. The Mission should explore alternative means to fund this training and other GPC-proposed training if EPM funds are unavailable.

2. Despite the near absence of project-funded activities, GPC is making considerable strides to reform its activities in such critical areas as product pricing, product distribution and allocation, optimization of refinery operations, and organization and management. However, it still has a critical need for technical assistance in such areas as financial accounting systems, management information systems, and corporate planning. The availability of an excellent series of petroleum sector short-courses through CETP should be utilized more fully by GPC through central S&T/EY funds or Mission participant training funds.
3. Due to a combination of internal and external factors the EPM project never achieved the anticipated synergy with the CIP-funded petroleum facility. In light of the continuing improvements being made by GPC and the longer-term interests of American companies and Sudan in petroleum exploration and production in Sudan, USAID should consider continued technical and financial assistance to this important organization.

National Electricity Corporation

1. The NEC is a relatively weak organization with vacancies in key senior management posts. This weakened management structure presides over a collection of hardware of varying degrees of incompatibility that has come from an array of donors. Consequently the national electricity grid, composed of two major systems planned for interconnection and a series of remote power systems, has been plagued with fuel shortages, inadequate equipment, inadequate maintenance and repair capabilities, low employee morale, and disorderly management which have continued to yield major reliability problems. Low flows in the Blue Nile currently threaten to reduce output from the Roseires Dam to 10% of capacity, which would put crisis-level strains on thermal generation capacity, increase power outages, increase autogeneration demands on concurrently reduced petroleum supplies, and pose a major threat to Sudan's industrial production.
2. Under the NEC component of the project, the Harza contract to improve the billing and collection system showed substantial cost-effectiveness - - roughly an 850% rate of return in one year on the money spent on this effort. The number of bills and amount of revenues collected is improving on a monthly basis. The progress was interrupted during the evacuation because a new computer billing system had been installed for only six weeks when key technical assistance was withdrawn.

3. Considering the considerable capacity expansion plans of NEC over the next 5 to 7 years, it is imperative that NEC establish a viable financial footing, the foundation of which must be adequate metering, billing, and collection, as well as proper, economic pricing of services.
4. The short-term reliability of the Blue Nile Grid has improved dramatically between 1983 and 1986. Specifically, the reliability index based upon monthly energy delivered increased from 74% in 1983 to 94% in 1986. The increase can be attributed to the USAID commodity purchases which improved the transmission system, additional generating capacity (Khartoum North, funded by the U.K.'s Overseas Development Administration, ODA), and solution of the siltation problem at Roseires, also financed by USAID.
5. The provision of direct technical assistance to the NEC by USAID has been a unique arrangement. Other donor countries provide turnkey facilities such as the Khartoum North Generating Station.
6. NEC is having difficulty determining how to effectively use technical assistance. The lack of a person assigned to monitor the EPM Project on a daily basis and no consistency in assigning a counterpart are evidence of the problems.
7. The corporate organizational structure recommended by the Irish Electricity Supply Board is being implemented by the NEC, but several key positions at the Senior Director level have remained vacant for years and these vacancies are severely impeding the proper management of corporate activities.
8. This is NEC's first use of U.S.-manufactured equipment, and they have little familiarity with the specific maintenance procedures. Inadequacy of spare parts for U.S.-supplied equipment is severely limiting the repairs of essential equipment, and the amount of equipment out of service will continue to increase without the required spare parts.
9. The vehicles and construction equipment provided by the CIP are being effectively utilized, with a few exceptions. The operations and maintenance technical assistance provided by Arkel-Talab has trained ten mechanics and numerous equipment operators. The training has been hindered by the slow construction of the Vehicle Maintenance Center and is not complete. The telecommunications equipment provided under CIP is being effectively utilized by NEC. The technical assistance provided has trained six NEC engineers who can work.
10. Since the project began, NEC has been forecasting revenues and cash flows and preparing an annual budget which appears to be an improvement over former practice, but the tracking of actual expenditures is difficult because improper accounts are being used. In addition, it appears that NEC is still not paying for its fuel,

although Finance Ministry subsidies to cover fuel costs now appear on NEC's balance sheet as accumulated debt. The collection system (cash remittance control) installed through the project is functioning properly.

11. Significant improvements have been made in billing and collection of customer accounts. The new computerized billing system, which includes the reading of meters, preparing of bills, and collection of payments, is not completely developed yet. Procedures for meter reading are still inadequate, but new procedures which are being implemented now will alleviate some of the problems.
12. Data created during the billing process are being used in several of the company's other departments as data for planning of financial and electric plant needs. These totals are not checked with any subsidiary records, nor are adjustments made to reflect corrections in kWh usage. Consequently, data used in planning departments may still provide a distorted picture.
13. The financial control system is still not a consistent process. The accounting procedures have not been completely adapted to the new computerized billing system. Part of the situation here is a normal result of any computer system enhancement, but coordination between data processing and user sections has been sadly deficient.
14. The installation of capacitors procured by the CIP to reduce distribution system losses has not been completed. Thirty-one percent of the capacitors installed are operating, 16% have failed, and 53% are in stores. The installations have not been completed because the cause of the failures has not been established. The need for distribution system loss reduction still exists.
15. With the exception of one formal meeting between NEC, ODA, USAID, and the World Bank in 1985, and several informal meetings among donors, there is no evidence that the project covenant calling for annual donor meetings with NEC has been fulfilled by the GOS.
16. Instrumentation to monitor distribution system loads has been procured by Harza but not utilized by NEC. The instrumentation is needed to further determine the extent of distribution system losses.
17. The EPM Project is the only institutional support to NEC in the donor community; this support is especially important in light of upcoming Power IV and subsequent power sector investments.

4.3. RECOMMENDATIONS

- o The Harza contract to upgrade the computerized billing and collection capacity of NEC should be continued to its completion on the April 30, 1988 PACD.
- o The recent call for bids to provide computers and peripheral equipment for NEA should be followed through to purchase, installation, and inspection, and the contractor should be directed to focus his efforts on ensuring that identified deficiencies in NEA's computer unit are corrected.
- o If funds are available, the E/DI contractor for the NEA component should be retained to the April 30, 1988 PACD.
- o Training activities for GPC should be continued using EPM, S&T/EY, or Mission participant training funds.
- o The ISTI contract should be continued regardless of decisions made about the NEA and NEC component of the EPM Project so that the other energy activities of the Mission can be coordinated successfully, in order to deal adequately with Sudan's crisis-proportion energy problems.
- o Proposed training for Accounting and Financial Management Staff should be funded and expedited. The cost is estimated at US \$190,500. This training is a key ingredient of Harza's ability to achieve a greater measure of success in the EPM project.
- o The Mission should adopt improved administrative and financial control procedures for managing the local currency components of projects.
- o The Mission should develop improved and generalized procedures for procurement and installation of computer equipment installed in Sudan under USAID-financed projects. Host country agencies should be required to make certain minimum physical improvements to installation sites prior to the initiation of procurement (i.e. power supply improvements, air conditioning and dust control, physical layout, etc.), or installation.
- o Shamshad Azri has recommended reallocation of the funds remaining in the Harza contract to include an accounting specialist who would be hired under the Harza contract. In conjunction with the proposed NEC training, this advisor should be able to establish a solid accounting foundation. We endorse this recommendation.
- o The Arkel-Talb contract for operations and maintenance technical assistance at the Vehicle Maintenance Center should be continued for a two-year period to complete the training in progress.

- o A distribution engineer should be provided to NEC by EBASCO on short-term assignment to assist them in determining the causes of the capacitor failures and solutions.
- o The NEC/Harza request for a short-term instrumentation engineer should be approved.
- o USAID should make strong efforts to encourage NEC to fill empty posts in NEC management, which are currently drastically reducing the agency's ability to improve performance and effectively utilize international donor agency support.
- o Annual meetings of international donors and NEC should be begun and maintained to coordinate the wide range of assistance activities to the agency. Similar meetings between NEA and its donor agencies should also be implemented.

5. THE NATIONAL ENERGY ADMINISTRATION PROJECT COMPONENT

This chapter evaluates the performance of the NEA component of the project in terms of the extent to which it met its objectives, with consideration of the reasonableness of the objectives. We report considerable technical detail in project execution because many of the difficulties the project encountered turned on small details of administration that had greatly magnified consequences, particularly when cumulated. Some of the most important lessons about administering development projects emerge from these details. Similar detail is reported on the NEC component in Chapter 6.

5.1. RELATIONSHIPS TO THE PREVIOUS ENERGY PLANNING PROJECT

In many respects, the successes of the first project, the Sudan Energy Policy and Planning Project (SEPAP) led both the Mission and the contractor to underestimate the difficulties in implementing the follow-on project. In addition, while the general structure of EPM was understood, the substantive differences between the first and the second projects were not sufficiently identified by the parties concerned. Certain dysfunctional trends, evident during the first project, were continued. The first project helped to launch the NEA, and sensibly did this through a specific task, an energy assessment. In addition, substantial training (including overseas long-term training) was provided. By the completion of the first project, the NEA's staff had some experience in primary and secondary data collection and analysis. A sizable cadre of trained personnel were in the process of returning from overseas.

While the first project was essentially a data collection exercise, the contractor had assisted NEA in setting up a series of interministerial and intersectoral committees. These committees not only permitted the collection and refinement of data outside of the purview of the Ministry of Energy and Mines, but they provided a degree of legitimacy and informal leverage which the NEA lacked formally. The committees successfully helped to forge informal links between the NEA and the various sectors of the economy, at least in terms of collecting baseline data needed for the energy assessment.

The EPM Project was designed to consolidate gains made under SEPAP, to strengthen the NEA so that data collection and policy analysis could be continued, and NEA's legitimacy increased, and to address certain key issues of relevance to the Sudan economy. To do this the project was to assist in the completion of the National Energy Plan, drawing upon data in the Assessment.

However, the interministerial linkages developed during the first project were not continued, in part because ministers changed, but also in part because interministerial committees organized to discuss and elaborate policy are far more problematic than those mandated to collect

and evaluate data. In addition, discussions with EPM staff over the first phases of the project indicate, in general, a belief that the second project was primarily a consolidation of the gains made during the first. Only the first COP, Dennis Monaghan, appeared to believe that turning the NEA into an effective policy review body would be far more complex than simply continuing in the footsteps of the first project.

5.2. OBJECTIVES

The objective of the NEA component of the EPM Project was to solidify NEA as an institution to analyze energy policies and conduct energy planning. The project intended to bring NEA to a stage of institutional development such that it could prepare sound energy plans and policy alternatives for Sudan (USAID/Khartoum, 1982a, p.3). The statement of work specified that NEA should become a respected, central source of energy data and that it should develop the capability to provide analytical support for policy and investment decisions in the energy sector (USAID/Khartoum, 1983, p.1).

The General Petroleum Corporation (GPC) was already a well-established institution in 1982, and the EPM Project objectives for it were less wide-ranging. The Project intended to help the GPC (1) develop more flexible petroleum product allocation procedures to mitigate the problems associated with the uncertainties in the financing of Sudan's oil imports; (2) plan and develop its new role in petroleum exploration; (3) improve its financial and corporate management (USAID/Khartoum, 1982a, p.4). At the beginning of the project, the GPC was reported to be paying excessively high prices for its crude, and Mission Director Brown ordered that the GPC component of the EPM Project not be implemented until this situation was resolved. The GPC component has not been funded to date with the exception of a few small activities conducted by the NEA contractor and a \$200,000 training activity which has not been completed (a fuller examination of GPC is found in Appendix 9).

The project paper and the scope of work for the NEA component stated the final objectives for that component in considerable detail (USAID/Khartoum, 1982a, pp 17-19; 1982b, pp 1-10), but far less guidance was offered regarding mid-term milestones. The project paper offers a chronology of due dates for activities in the NEA/GPC component, but this is restricted to arrival and departure dates of contractor personnel and due dates for several reports and the national energy plan (USAID/Khartoum, 1982a, pp 58-59). There is no prescription for NEA's institutional strength and independence from the contractor by the time of the mid-term evaluation, which was originally scheduled for January 1985.

5.3. INPUTS

Manpower inputs into the NEA component were planned at 128 person-months, 96 in long-term technical assistance and 32 in short term. Forty-eight person-months of long-term technical assistance were scheduled for the chief of party, 30 for energy/economic planning, and 18 for supply logistics, pricing and allocation. The GPC component was to be administered by the long-term technical advising staff at NEA; no long-term technical assistance was planned for the GPC component. GPC was to use 22 person-months of short term technical assistance.

Training for the NEA/GPC component was scheduled to use US\$684.4 thousand, US\$418.1 thousand in foreign exchange and US\$266.3 thousand in commodity import program (CIP) funds.

Commodity purchases were planned at US\$257.6 thousand for NEA and US\$53.4 thousand for GPC. The entire GPC commodity budget was in foreign exchange, while the NEA component had US\$159 thousand in foreign exchange and US\$98.6 thousand in CIP funds. Table 5.1 summarizes these inputs.

TABLE 5.1

ORIGINALLY PLANNED INPUTS FOR THE NEA AND GPC

Inputs	EPM Component					
	NEA	GPC				
<u>Technical Assistance (person months)</u>						
Long-term	96	0				
Short-term	<u>32</u>	<u>22</u>				
Total	128	22				
<u>Training (thousand US\$)</u>						
Foreign exchange	418.1					
CIP funds	<u>266.3</u>					
Total	684.4					
<u>Commodities (thousand US\$)</u>						
	<u>NEA</u>		<u>GPC</u>			
	Foreign Exchange	CIP Funds	Total	Foreign Exchange	CIP Funds	Total
	159.0	98.6	257.6	53.4	0.0	53.4

Source: (USAID/Khartoum, 1982a, pp 24-27)

Foreign exchange funding for the NEA/GPC component was originally budgeted at US\$3,041.9 thousand, matched by GOS local funding equivalent to US\$2,910.8 thousand at an exchange rate of US\$1.00 = LS 0.90, for a total budget of US\$ 5,952.7 (USAID/Khartoum, 1982a, p.30). Project Agreement Amendment No. 2, of December 5, 1983, increased the USAID foreign exchange contribution to US\$3,714.4 thousand and the GOS local currency funding to the equivalent of US\$7,566.8 thousand. These figures do not include project evaluation and contingency funds. Project evaluation budgeting remained the same, but the original contingency budget of 10% for each funding source changed to a 12% contingency for the foreign exchange component and a 5.5% contingency for the GOS component. Project Agreement Amendment No. 3 added US\$1.3 million to finance foreign exchange and local currency costs, but without an assignment between the NEA/GPC and NEC components. Project Agreement Amendment No. 4 added another US\$1.1 million, again without specifying NEA/GPC or NEC destinations. Project Agreement Amendment No. 6, August 12, 1986, added another US\$300 thousand to EPM.

5.4. CURRENT STATUS OF OUTPUTS

This section relies on the enumeration of project outputs specified in the project paper (USAID/Khartoum, 1982, pp 17-19) and the description of contract responsibilities specified in the NEA statement of work (USAID/Khartoum, 1983, pp 2-10).

Each output from the project paper or the scope of work (they are the same in all but task 12) is described, and NEA and EPM activities under that task are discussed and evaluated to the extent the evaluation team was able to make judgements. We also reviewed and evaluated the contractor's performance of responsibilities in each task, as specified by the scope of work. These are relatively detailed evaluations of EPM and NEA performances; we draw more general evaluations of contractor performance in Section 5.5.

5.4.1. Adoption of an Orderly Transition to New Organization Structure.

E/DI, the contractor for long-term assistance to NEA, was charged with assisting NEA to prepare and issue written job description for NEA employees. This explicit structuring of jobs within NEA was to have been accomplished during the first year of the project. Examination of early work plans and progress reports (Monaghan, 1984; EPM, July 1984, p. 6) indicates that efforts on this task early in the project focused on (1) evaluating the experience, performance and training of individual employees, with an apparent eye to career development of NEA staff members; (2) structural reorganization of NEA, for which it proved difficult to secure Ministerial agreement (e.g., EPM, December 1985, p. 3); and (3) development and implementation of a salary incentive plan for NEA staff. E/DI appears to have considered the written job description task completed with Daudon's report on training needs, (Daudon, December 1985; EPM, April 1986, p. 6), which identified the

training and experience required for managers and staff members in specific sections of NEA but did not identify the tasks to be executed by individuals holding specific positions. A better example of written job descriptions is provided in the report of the Nile Waters Study which proposed establishment of a water resource planning unit within the Ministry of Irrigation (U.S. Department of Interior, 1985, Appendix III).

The EPM Project has devoted effort, with some success, to restructuring NEA into a more task-oriented organization, which would tend to focus NEA's mission. The Director General, however, has felt more comfortable with a formal organization and a de facto working style that allow NEA greater latitude in the problems it can address i.e., hardware projects. It is possible that an early EPM effort to specify job descriptions, rather than concentrating on identifying staff training needs and establishing career development opportunities, could have better focused the dialogue between EPM and NEA regarding the mission and goal of NEA.

5.4.2. National Energy Supply and Demand Planning and Evaluation Functions Consolidated at NEA.

These activities need not have been generally consolidated at NEA; NEA simply should have been conducting integrated, multi-fuel, multi-sector, and multi-regional energy planning. NEA clearly has included such activities in its portfolio of activities.

The contractor has fulfilled his obligations of providing short term training, collaborating in the preparation of analytical reports, evaluating the effectiveness of NEA programs, and making recommendations to NEA for program modifications. It is apparent from the project files that making recommendations for NEA program modifications has been a sensitive issue and that progress in this area generally has involved compromises of EPM ideas (EPM, May 1985, p. 3).

5.4.3. Prepare Energy Analyses and Policy Option Papers.

Ten such reports were to have been prepared during the course of the project. With reasonable interpretation, there is overlap between the reports to be prepared under Tasks 2 and 3. According to the grant agreement, these reports were simply to be on "key topics of national concern" (USAID/Khartoum, 1983, p. 3), which is quite broad. At least ten such reports have been prepared by NEA, some in collaboration with EPM staff.

The analytical quality of these reports varies considerably, but the evaluation team simply has not been able to assess whether there is a trend of improvement in quality; insufficient time was available to make such a study. However, other agencies and analysts in the energy sector in Sudan have found various NEA reports to be useful.

5.4.4. Detailed Energy Plans Completed and Reviewed Annually.

NEA published its National Energy Plan in January 1985 (NEA, 1985) and had a revision nearly completed in February 1986. At that time, the Minister of Energy and Mining of the Interim Government described the National Energy Plan at a press conference as a document prepared by capitalist expatriates to exploit Sudan. The Minister responded to vigorous protests to his remarks by NEA by claiming misinterpretation by the press of his actual statement, although the newspaper report appeared quite clear. See EPM (February 25, 1986) for a translation of the reporter's question and the Minister's reply. In fact, the original plan and the nearly completed revision were prepared largely by the NEA staff, but the political furor created by the remarks delayed appearance of the revised plan, and it is only now nearing publication.

The National Energy Plan is a credible first effort at the complex task of devising a national plan. Its recommendations are uneven in specificity. Some specific taxes are recommended, but many recommendations remain at the stage of exhortation to increase efficiency of fuel use and increase energy supplies. The project paper's expectation that the National Energy Plan would be revised annually was unreasonably high for a young organization given the relatively disorderly political environment which prevailed during the project.

5.4.5. Recommended Policies and Plans of NEA Shall Be Implemented.

This was a sanguine goal. Admittedly, there is little point in having a planning and policy analysis agency if none of its plans or recommended policies are used, but it is naive to expect such rapid results. It is also naive to expect direct implementation of multi-sectoral plans and policies prepared by an administrative agency with a limited, direct constituency. It seems more reasonable to expect such an agency to inform its country's political debates, with occasional implementation of especially persuasively argued policies than to expect it to dictate policies, particularly if those policies concern sensitive areas within the policy domain of other, more better-established agencies.

We have found no evidence of direct or formal influence of NEA on national energy policies, but this does not imply that NEA is without influence. Staff members and managers at NEC and GPC have expressed to the evaluation team that they find the work of NEA directly useful to them in their task of planning for petroleum and electricity supply. This mid-level informal influence may be more effective in the long term and politically safe in the short term than more prominent policy advocacy.

5.4.6. Capacity for Computer-Assisted Data Processing and Analysis Expanded.

Five NEA staff members were to be trained during the first two years of the project in the use of microcomputers to assist analytical tasks and manage data. The computing equipment at NEA was to be augmented.

EPM has purchased 3 IBM XTs (640 kb) and one Compaq Portable 286; one IBM PC (512 kb) was acquired with EPM funds under an extension of the previous Sudan Energy Policy and Planning Project in early 1984. Four printers were acquired: an NEC 3550 letter quality, and Epson MX100 dot matrix, a Genicom 3014 dot matrix, and an IBM letter quality. A Hewlett-Packard 7470A 2-pen plotter and several backup peripheral items were also acquired. The Genicom printer arrived in September 1985, and broke down in December 1985. For want of spare parts and high cost of sending it out for repair, it has not been used since and now collects dust in the computer room. Ibrahim Hussein, the head of NEA's Computer Unit, estimates the life expectancy of an IBM microcomputer in Sudan at roughly two years. The equipment has usually come in with American voltage specifications although European specifications were required, requested, and available. Part of the problem appears to have been inadequate support of their employees in the field by E/DI staff in Washington, and part is attributable to the difficulty associated with processing waivers to purchase outside the United States and with U.S. export licensing procedures for computer equipment. However, USAID understands the problem of getting locally serviceable equipment and makes waivers readily available.

EPM commissioned a consultant study on NEA's information system in January 1986. The report was very thorough and itemized a number of problems, including software-hardware incompatibility, hardware-hardware incompatibility, inadequate or no documentation of existing software, spare parts problems, absence of a humidification system, and poor documentation of data bases, among others (Arnold, 1986). Some of Arnold's recommendations have been, or are being, implemented. Ibrahim Hussein currently is developing a file index system to allow users to find data files on the hard disks (Ibrahim Hussein, interview, January 29, 1987; EPM, December 1986, p. 9).

EPM has offered several software courses for NEA staff, and Ibrahim Hussein has offered six computing and software courses for NEA staff as well as to other GOS agencies. Currently, some 80% of NEA staff could be called users of the computer facility, and there are definite congestion problems. The current E/DI contractor has shifted its technical assistance away from a planning emphasis and toward developing NEA's capacity as an informational institution (David Pluth, interview February 1, 1987). This can be expected to further increase the demand for access to the computer facilities. The contractors have ordered 4 more IBM XTs, 4 printers, and peripheral equipment to strengthen NEA's information processing capabilities (EPM, December 10, 1986, pp 4-5).

NEA's management of its Computing Unit needs attention. The Unit is a crucial support element for all the analytical units of NEA, but its staff is poorly paid, and their skills and experience may be lost to NEA. That staff appears to work the longest hours of any unit at NEA, members often working till after 5 P.M. (the usual work day is over at 2 P.M.).

It appears to be an uphill struggle, but EPM has not developed a smoothly operating maintenance and spare parts supply systems for the EPM-purchased computer equipment. Government import restrictions have complicated the accomplishment of that component of this task. Additionally, we found no evidence that EPM has established an on-line information search and retrieval system from American data bases as was called for in the work statement.

5.4.7. Develop a Plan for Regional Energy Allocation.

This activity was interrupted by the evacuation of 1986, but the EPM contractor is now requesting Mission approval for short-term technical assistance on this task. See E/DI, October 1986, p. 10, and E/DI, March 31, 1986, p. 10.

5.4.8. "Energy Pricing and Regulations in Accordance with National Development Priorities Implemented" (USAID/Khartoum, 1982a, p. 18).

The actual descriptions of this task, as they appear in both the project paper (USAID/Khartoum, 1982a, p. 18) and the statement of work (USAID/Khartoum, 1983, pp 6-7), call for analysis of current energy prices in Sudan and for recommendations to rationalize them rather than for implementation of the recommended policies. Implementation is out of NEA's hands. This study was to have been completed during the first two years of the project.

Such a study appears not to have been completed, although a number of pricing-related activities have been undertaken. NEA has devoted considerable effort to assembling price data and trying to insure their reliability. This is a big task in itself, and the analysis of prices cannot be undertaken without a large enough body of reliable price data, either cross-section or time series. For a short time in the first half of 1985, GPC was supplying petroleum price data to NEA, from which NEA constructed economic (as apposed to financial) cost data. GPC stopped furnishing the data in June 1985. NEA has directed another effort at collecting time series charcoal price data for Khartoum. They have so far assembled an annual time series of charcoal prices in Khartoum (in current Sudanese pounds) from establishment (charcoal distributor) records. A report has not yet been published.

In the remaining two years of the project, NEA was to conduct "biannual reviews, presumably one such review of national energy pricing and regulatory policies, in order to advise MEM" (USAID/Khartoum, 1982a, p. 18). This task has not been accomplished yet.

5.4.9. Fuelwood and traditional energy subsector policy established and initial action taken.

NEA was to prepare a national plan for monitoring fuelwood harvesting, charcoal production, and fuelwood use. Implementation of this monitoring plan was to "provide NEA with the necessary data to propose a national policy on the use and replenishment of fuelwood and other renewable energy resources" (USAID/Khartoum, 1982a, p. 18). NEA and the EPM contractor were to work with other GOS agencies in these two activities.

NEA has published several reports on fuelwood and charcoal, and the EPM contractor has recently completed adaptation of its Forest Resource Assessment Planning (FRAP) model for use in Sudan with the assistance of NEA, but there appears to have been no attempt to develop a unified, national-level, woodfuels monitoring and policy program. However, NEA has been active in the area of woodfuels nevertheless. NEA, in conjunction with the EPM project, has organized the delivery of some 100 thousand sacks of charcoal to Central Region refugee camps from Blue Nile Province in June 1985 (EPM, April 1985, pp 3-4; EPM, August 1985, pp 6-7) and has worked with the World Bank's recent fuelwood and forestry assessment of Sudan. NEA has collaborated with the World Bank and the Central Forestry Administration of the Ministry of Agriculture and Natural Resources in the planning and design of a new World Bank 5-year fuelwood and forestry project anticipated to begin in mid-to-late 1987, pending World Bank internal review.

5.4.10. Expanded use of energy-efficient equipment promoted.

NEA was to conduct equipment surveys at facilities of large energy users to determine equipment needs to improve energy efficiency, to develop strategies to increase market penetration, simplify financing and improve maintenance, and to take steps to implement these strategies (USAID/Khartoum, 1982a, p. 19). The statement of work specifically called for technical assistance from the contractor in performing energy audits of large energy users (USAID/Khartoum, 1983, p. 8).

This has not been done. A revised NEA work plan submitted by E/DI Chief of Party Dennis Monaghan in September 1984, recommended investigating the possibility of gaining access to the Energy Policy Development and Conservation Project, centrally funded by S&T/EY. The contractor for the conservation portion of that project is the Washington-based firm Hagler-Bailly, which has wide experience and an excellent technical reputation in energy conservation in developing countries. E/DI's rationale for not undertaking industrial energy conservation work in the EPM project was that a West German project funded by the Government of Lower Saxony had already audited a cement plant with NEA in 1984, and had brought in energy audit equipment, had offered training locally, and had sent one NEA staff member to Germany for training. The NEC portion of the EPM project called for energy efficiency studies including, but not restricted to, load management. This represented a major opportunity to coordinate energy conservation

activities in both the petroleum and electricity markets. The evaluation team judges that a significant opportunity was lost by failing to pursue industrial energy conservation. Subcontracting with Hagler-Bailly for a study of conservation opportunities for NEA to pursue could have proven very useful. Given Sudan's low energy prices now, conservation may be difficult, but it is too important an activity to be ignored.

E/DI's alternative to industrial energy conservation has been a long-standing attempt to initiate an energy awareness conservation program focused on four mechanisms: posters, brochures to accompany electricity bills and benzine (gasoline) allocation coupons, a movie or television clip, and an energy mascot contest (Abbas and Brown, 1985). This project did not make the 1985/86 NEA/EPM work plan, but does appear in the 1986/88 work plan (EPM, December 1986, pp 15-16). The contractor is currently requesting funding for an informational conservation task which relies heavily on brochures. Considering Sudan's present literacy rate and per capita income, the efficacy of this task is questionable using the methods proposed.

5.4.11. Energy Information Needs Prioritized and Strategies Implemented.

This is an information management and library development task. An energy information network was to be established. EPM was to provide technical assistance in data base management and use, develop an energy library appropriate to NEA's needs, and assist in the development of software for Arabic-language data base management, and evaluate the performance of NEA's information program.

The materials in the library have been catalogued, some books and journals have been ordered, and NEA is on a list to receive Blackwell's books in-stock notices. Sudanese energy and related data bases have been developed with LOTUS software and as noted in Section 6, a file index system is under development by Ibrahim Hussain. We have seen no evidence of the establishment of a formal energy information network, but NEA has numerous informal contacts for data exchange, e.g., with CFA for woodfuel and forestry information, with NEC for electricity data, with RERI for renewable energy information, and occasionally with GPC for petroleum information although the GPC contacts have been erratic.

EPM's advice on library development was weak. EPM ordered seven journals for the library in June 1984 (Dandon, June 1984), but the selection of titles since that time shows little insight into the literature, especially in the areas of energy economics and economic development or awareness of the wealth of current literature on rural energy problems and national energy policy and planning in other developing countries.

With the assistance of EPM, NEA has published seven issues of NEA Energy News (now NEA Sudan Energy News), a bi- or triennial journal which publishes some short energy articles aimed at a general audience interested in timely energy information and offers some current energy

data. The next to latest issue, Volume 3, Number 1 (June 1986), was prepared by NEA during the evacuation period, completed on its own, with no help from the EPM contractor. The NEA staff involved reported that it was difficult for them, but that they derived a good deal of pride and new self-confidence from the achievement. The subsequent issue, Volume 3, No. 2, also has been published by NEA alone. In this particular case, the evacuation was a handy, controlled experiment which tested whether EPM was in fact teaching NEA how to stand on its own institutional feet, and NEA passed.

- 5.4.12. "Case studies of successful energy-related efficiency operating experiences prepared and finding documented" (USAID/Khartoum, 1982a, p. 19); or (In order to identify those GOS statutes, regulations, and/or laws which should continue to exist in their present form, be revised or be abolished, the NEA will review all existing energy statutes, laws and regulations and study recommendations for a unified energy law" (USAID/Khartoum, 1983, p. 10).

There is an obvious conflict between the project paper's concept of the twelfth task of the NEA component of the EPM Project and the statement of work's concept of it. No grant agreement resolves the conflict. This may be a moot issue, however, because neither task has been undertaken to date.

Of these outputs, it is likely that the Project will achieve good results in outputs 1 (institutional transition), 2 (consolidation of planning and analysis functions at NEA), 3 (studies and assessments preparation on a regular basis), 6 (data base and computer capacity expansion), and 9 (establishment and initiation of policies related to fuelwood and renewable energy). Output 4 (annual revision of the data base) should be feasible, but the revision of plans and assessments on a regular basis will depend upon the political interest in having NEA prepare such documents. Output 5 and 8 implementation of energy plans and rationalization of energy prices, are key outputs, but realistically they cannot be achieved directly through a technical assistance project. NEA can develop useful, accurate and timely analyses of key issues but cannot by itself resolve policy conflicts or ensure the implementation of their own recommendations. The extent of NEA's power will be influential, not regulatory. Output 11 (information needs prioritization and strategy implementation) also can be accomplished prior to the PACD, but the extent to which NEA will continue to gather and review data still needs to be identified. The regularization of a series of publications (such as the monthly energy prices bulletin) is a useful first step, but such documents per se are useless without an outreach plan which, at the least, ensures their availability by those in Government potentially interested in the information.

5.5. CURRENT STATUS OF NEA AS AN INSTITUTION

The National Energy Administration (NEA) was created by statute in May 1980, as the planning body of the Ministry of Energy and Mining. "NEA has overall responsibilities for:

- o assessment and development of energy resources;
- o conducting demand and supply studies;
- o formulation of energy conservation and demand management policies (studies of programs);
- o formulation of national policy issued to develop renewable energies;
- o build up a national energy information system to serve the policy and decision makers, energy sector and related institutions;
- o carrying out national and regional energy planning;
- o identifying feasible energy projects and present them for financing; and
- o work with the institutions in the energy and energy-using sectors" (NEA/CFA, Forestry Sector Review Report, p. 7).

At its founding, NEA inherited the official organizational structure and job descriptions of the moribund Petroleum General Administration. It was apparently easier to transfer this framework despite its inappropriateness, than to undertake the lengthy process of getting approval of a new organizational structure. Many of the original staff of NEA were seconded to NEA for limited periods of time, with their salaries paid by their own agencies. By Sudanese law they could stay at NEA no longer than five years. So there was an ongoing process of recruitment, training and departures which gradually built up NEA's present staff over its seven years of existence.

Today NEA has a staff of about 161 workers, grouped as follows:

	Number	Percentage
Professional	77	48
Administrative	46	28
Laborers	38	24
Total	161	100

(Source: NEA)

Of the 77 professional staff, only 45 were actually physically working at NEA at the time of the evaluation. The rest are absent on long-term or short-term training programs or are on leave. There has been an increase in staff of 14 in the last two years, and four senior NEA professionals are scheduled to return from overseas training and assume positions as section chiefs in the next year or so. Although NEA is authorized to increase its professional staff to 100, it is not seeking to hire any new staff at present. Of its present staff complement, most are either engineers or have science degrees (chemistry, physics, agriculture, forestry, etc.) and many now have received at least some training in energy planning, energy resource assessments or energy

technology evaluations. The number of economists at NEA is small, numbering fewer than five, and of these only two appear to be adequately trained. A December 1985 report on training needs by Marc Daudon estimates that 46% of NEA's staff are engineers, 43% have degrees in the sciences and only 11% are economists (Daudon, 1985, p. 15).

The majority of NEA's professional staff are located in its three divisions conducting energy-related activities. As shown in the attached organization chart Figure 5.1, NEA's newly adopted organization is divided into four major sections. The majority of the energy-related professional staff is in the Planning Division and the Information Systems and Studies Division totaling some 32. In the Techno-Economic Studies Division, NEA has about 23 employees, mainly working on actual engineering or field projects involving renewable energy technologies and energy conservation. An additional 19 personnel, under the Financial and Administrative Affairs Division, are handling budgeting, logistical and personnel services.

In evaluation of NEA's status as an institution, we concentrated our attention on interviewing the staff of the Planning Division and the Information Systems and Studies Division which are jointly responsible for the policy and planning activities being carried out by NEA. A list of those interviewed at NEA is attached as Appendix 2.

Although NEA's staff is, on balance, relatively young and inexperienced, they appear to have reached a stage in their professional development where they can begin to produce results effectively if given sufficient incentives, support and managerial direction. Several concisely prepared policy review documents have been prepared by NEA staff, and there is evidence that NEA may be more capable of analyzing and preparing such reports without contractor assistance than they were before the EPM project started. However, for a variety of reasons, NEA seems to be underperforming as an institution, given its available staff resources and mandate.

In common with many other Sudanese government agencies, NEA is constrained by the low salaries it is able to pay its staff. Moreover, salary levels at NEA are even lower than those at government corporations such as GPC and NEC or research institutes such as RERI. Thus, the salaries NEA pays are less than those required to attract and retain the best qualified individuals. Despite this, the training opportunities, access to computers, and an incentive pay system appear to have addressed at least partially this issue during the EPM project. The real question is how NEA will maintain its institutional growth and momentum after the project ends. There is evidence that NEA is already losing well-trained staff to other Sudanese institutions while less well-trained or capable individuals remain. Correction will require creative and disciplined leadership by NEA's top managers, along with assurances of GOS support for incentive pay systems. Other support staff such as computer technicians, librarians and English language secretaries are also in high demand in Khartoum and will leave NEA over time unless compensation issues are addressed.

There is also evidence that the work of NEA may be hampered by lack of adequate secretarial services and the limited financial resources available by the GOS. The low pay scales of secretaries and the high demand for English language secretaries limits the productive work by NEA clerical staff. While the EPM project is training secretaries in computerized word processing which is having an immediate impact on NEA's outputs, this training renders these individuals more marketable and they are likely to move on to higher paying jobs unless NEA is able to increase their compensation in tandem with their skill levels. Work on NEA's goals is also hindered by shortages of funds for computer paper, xerox machine supplies, benzine (gasoline), publications and other necessary expenses required to maintain the institution.

NEA has exhibited a pattern of managerial leadership which while innovative and talented, appears to have been unable to respond adequately to NEA's inherent structural deficiencies. Despite what appears to be consistent attention paid by NEA's managers and the EPM project to issues of management, personnel evaluation, work organization and planning, and organizational structure, NEA still has not been able to effectively implement a smoothly functioning system. Whether this is attributable primarily to the growing pains to be expected of any new and evolving institution, managerial limitations, or to some intermingling of cultural and bureaucratic factors endemic in Sudanese organization is not clear.

One of the clear weaknesses at NEA is the absence of experienced mid-level managers. With the exception of several individuals in the Techno-Economic Studies Division, most current section chiefs have only limited managerial experience or are vacant and the acting chiefs are more junior still. This undoubtedly affects both the quality of work performed at NEA as well as NEA's effectiveness in dealing with policy issues affecting the agendas of other agencies. The need for a few seasoned managers or section chiefs of stature is an organizational deficiency which NEA will not be able to overcome quickly.

Another issue affecting NEA's effectiveness has been its organizational structure. In 1982, under the SEPAP project, a functional style of organization was adopted. Later, during the process of preparing the National Energy Plan a series of committees and subcommittees was organized to which NEA served as staff. In January 1986, NEA adopted a temporary structure of action groups at EPM's suggestion. More recently NEA informally has adopted the new organization illustrated earlier and first proposed in September 1985, with the help of the technical assistance contractor, a process which is still being formally approved by the GOS Civil Service and Organizations Department. In a sense, its changing organizational structure over time reflects NEA's search for a concrete identity and an operational style which can overcome some of the bureaucratic inefficiencies inherent in GOS organizations.

One of the advantages of NEA's present institutional character has been its ability to respond flexibly to the changing demands placed upon

it during its short history. In this respect NEA seems to have functioned most effectively when it had a clear objective in sight and where the technical assistance contractor was able to join forces with it in the accomplishment of the objective (i.e. the National Energy Assessment in 1982-1983; and National Energy Plan in 1984-1985). During the EPM or post-SEPAP phase of USAID assistance to NEA, much of this institutional momentum and purpose appears to have dissipated or been redirected, some of it attributable in part to external events but also in some measure due to NEA's inability to articulate a clear agenda for itself in the national energy policy arena. This issue is discussed at greater length in a subsequent section of this chapter which evaluates the policy impact of NEA. To what degree the new NEA work plan completed in December 1986 will help rectify this situation could not be determined by the evaluation team since it was not typed completely in English and has not received the approval of the Minister yet.

The present Director General of NEA, Dr. Abdel Rahman Shulli, despite his admirable efforts to engage NEA fully in national energy policy-making, seems to be redirecting much of NEA's institutional attention away from energy policy and planning issues into applied research and demonstration projects involving renewable energy technologies funded principally by other donors. This split in NEA's attention between planning and projects, while justifiable under NEA's mandate, appears to have had several drawbacks. It duplicates the applied research being carried out by the Renewable Energy Research Institute (RERI) a unit of the National Council for Research. It also diverts attention from NEA's primary mission of energy policy and planning. While an examination of a selected number of these projects indicates that in general they are well-designed and potentially informative, from a research perspective, the evaluation team questions their location within NEA given the existence of RERI. This seems to be an unnecessary duplication of effort. In addition, several of the engineers interviewed in the Techno-Economic Studies Division who are working on renewable energy technology (RET) projects expressed the desire to be working on policy and planning activities, which they consider the primary responsibility of NEA.

Dr. Shulli has also expressed his plans to develop a Renewable Energy Promotion Center within the NEA organization designed to help commercialize renewable energy technologies (RETs). While this appears to be an admirable goal, economic analysis of available RETs in Sudan done under the Sudan Renewable Energy Project (SREP), as well as the experiences with RETs in other developing countries, and resource availabilities does not support the notion that RETs will easily gain wide acceptance despite their apparent applicability. Experience with similar dissemination centers in other LDCs including Morocco and Jordan has illustrated the difficulties of promoting rapid RET adoption, even where applications with good economic potential exist (i.e. solar domestic water heaters and mechanical windmills). The evaluation team feels strongly that NEA should confine its role in RETs to policy issues rather than applied R&D and that commercialization efforts should be a joint responsibility of RERI and private entrepreneurs. NEA appears to

be gravitating in the direction of donor-funded RET activities rather than applying careful analysis to such issues as the likely contribution of RETs to national energy balances. Such analyses would likely reveal that with the exception of fuelwood/charcoal and expanded utilization of agricultural residues, RETs are unlikely to make a major contribution to national energy supplies in the short or medium term. We are concerned that these activities constitute a drain on the organization's resources and we question whether NEA can effectively carry out both spheres of activity simultaneously, even with generous donor support.

To explain this possible shift to RET activities it is necessary to examine NEA's experience with energy policy. Clearly, the electricity and petroleum distribution systems dominate the energy sector of Sudan. Despite the high proportion of Sudan's energy balance met by fuelwood/charcoal, the commercial energy commodities critically affect the direction and pace of Sudan's economic growth. For a variety of reasons, NEA has not been able to realize its intended role as a major actor in formulation and resolution of critical energy sector policy issues.

From its inception, NEA was planned to review policy options across sectors. Since it was not possible to provide NEA with the degree of formal oversight and control which would permit it to enforce changes in policy, its power was largely informal and depended critically upon reliance on the influence of the Minister of Energy and Mining to support NEA; professional respect for NEA staff from peers in other ministries; and the perceived quality, timeliness and objectivity of outputs.

During the preparation of the National Energy Assessment and the National Energy Plan, NEA galvanized the formation of a series of interministerial and intersectoral committees. These committees not only permitted the collection and refinement of data outside the preview of MEM, but they provided a degree of legitimacy and informal leverage which NEA lacked formally.

However, the results of these major building blocks of NEA legitimacy were not well received. Then-Minister Dr. Sharif El Tuhami failed to act on the National Energy Plan, despite the fact that it represented a good beginning for national energy planning. The transitional government showed little interest in the Plan (published in January 1985) after the fall of the Nimieri government. The Plan was in fact attacked soon after committees were formed by NEA in December 1985 to update the plan. The Minister attacked the plan in February 1986 as dominated by foreigners and foreign companies interested in profit-making and exploitation, effectively ending NEA's attempts to update the plan.

Ironically, the Islamic opposition party recently criticized the present government for not implementing the National Energy Plan, and as a result it is now again being updated. NEA is also playing a key role on the MEM Management Committee and Director General Shulli of NEA has been appointed by the Minister of Finance and Economic Planning to head

the technical committee planning all budget expenditures for the Four Year Economic Salvation Plan presently under preparation.

There is also evidence that NEA's research and analysis activities as well as its advocacy on particular energy policy issues has produced some results to date. NEA's work on the petroleum allocation system under the SEPAP project exposed questionable practices in petroleum procurement which were utilized by the new government in reforming GPC and indirectly supported USAID to establish the CIP-funded petroleum facility. NEA's analysis also played a role in cancelling a GPC proposed bitumen plant addition to the Port Sudan refinery through a study that identified problems the plan would impose on NEC's fuel supply for its power plants. GPC also asked NEA to undertake a study of agricultural energy use which has just been completed. NEA conducted a joint study with NEC on the transportation needs associated with thermal generation expansion and the role of SNR. NEA participated in the recent World Bank-led Forestry Sector Review and will likely have a funded role concerning fuelwood/charcoal utilization policy issues in the actual project. NEA has provided some energy conservation auditing services to industry and plans seminars in March 1987 for the cement industry which is a major industrial energy consumer.

NEA was approached by a group of farmers from the Gezira scheme who complained about the high electricity rates they were being forced to pay. Subsequent study by NEA helped to establish a time-of-day pricing system whereby farmers were able to irrigate crops at night at lower rates. NEA's staff also provided information to the EPM contractor preparing the NEC tariff study. NEA sponsored an energy conference in March 1986 which provided input into the subsequent National Economic Conference. These examples are indicative of the range of policy issues with which NEA has grappled. At the time of writing they were organizing a task force, which Dr. Shulli will chair, on the effect of impending low water in the Spring of 1987 on power output of the Roseires Dam and on the rest of the nation's energy economy. Participants on the task force include NEC, GPC, the Ministry of Agriculture, the Ministry of Irrigation, SNR, the Transport Ministry, and the Ministry of Finance.

Another problem faced by NEA in attempting to carry out its energy policy planning mission is the short-term crisis orientation of much GOS planning. One can argue that long-term planning is a luxury which Sudan has not been able to afford and that despite its attempts to encourage long-term and intersectoral energy planning in Sudan, NEA's efforts were displaced by this orientation toward reactive crisis management. In part to respond to this problem, NEA has set up a studies unit which is on call to the Minister for special studies and crisis situations and to do continuous studies on pricing and allocation issues.

However, in the final analysis, the efforts of NEA in the energy policy arena has had very limited impacts for three principal reasons. First, the level of economic and financial analysis by NEA staff is weak. There is a strong need for hiring more competent senior economists and receiving training in fundamentals of project analysis techniques and

investment planning/feasibility studies. Until NEA achieves competence in these areas it is arguable whether they will have the stature or technical qualifications to engage well-armed in high-level energy policy debates. Second, the influence of NEA is critically dependent on the receptivity of other energy sector agencies (principally NEC and GPC but also others such as the Ministry of Agriculture, CFA, and the Ministry of Irrigation's Division of Dams) to sharing critical planning data with NEA and welcoming and supporting a coordinative and independent analytic role for NEA. The reality is that, not surprisingly, the present corporate planning groups at NEC, GPC, and other key ministries appear unwilling to yield more than a small portion of their strategic planning and project planning functions to NEA, even in the interests of coordinated national economic and energy policies. In addition to resistance caused by bureaucratic inertia there is legitimate concern that NEA still lacks the competence and experience to play a major contributing role in anything but data compilation, analysis and summaries. Finally, much of policy-making is ultimately political, and many of the key decisions in energy policy involve sensitive issues such as price subsidies, donor assistance, political constituencies and political/economic stability.

Therefore NEA's activities are constrained by larger political forces and realities which are generally unyielding to even the best economic analysis. In their respective spheres of influence, GPC and NEC appear paramount and it would only be through the actions of an activist Minister of Energy and Mining that NEA could begin to achieve real policy influence, even if the other facets of its technical competence, maturity, and institutional development are assured.

In conclusion, the intended role of EPM to promote the development of NEA into a central policy player in the energy sector has not been fully realized. Much of this is largely due to the gradual nature of institutional development. It was unrealistic to expect a new organization to achieve full institutional maturity and political influence over a four-to-six year time period. NEA faced the dual challenge of simultaneously building itself as an institution (through staff recruitment and training) and actually carrying out its organizational objectives during a complex historical period characterized by a series of radical political shifts which the energy sector, given its importance to the national economy, could hardly be expected to transcend.

In many respects, the opportunity for NEA to assert its influence in the policy arena is better now than at any time since SEPAP ended. The new Minister of Energy and Mining is receptive to a larger NEA role, provided it proves its competence through preparation of informed rather than anecdotal analyses. There is also evidence that the GOS considers energy to be among its top priorities and that a continuing interest in coordination on intersectoral aspects of energy exists, which NEA could exploit. However, to do so effectively, NEA will have to meet the power centers as a peer.

The timing is propitious: NEC is poised on the brink of a major thermal expansion program and hopes also to study long-term hydroelectric generation investments; GPC is reforming its troubled distribution and allocation system and studying changes in refinery operations and optimization of product imports; the Ministry of Irrigation is studying electrification of pumping schemes and new dams; the Ministry of Agriculture is concerned with the energy implications of agricultural expansion; and the Central Forestry Administration is being redirected to tackle intricate fuelwood/charcoal problems. For NEA to have an impact at this time requires strong ministerial reinforcement of its role along with some strengthened GOS consensus on a viable NEA role. Finally, NEA itself must rise to the challenge.

5.6. CONTRACTOR PERFORMANCE

On balance, the contractor had not been performing satisfactorily until the replacement team started work in October 1985, and E/DI must share some of the responsibility with USAID and NEA management for the relatively weak position of NEA (bearing in mind the serious impact from the severe external factors discussed above in Section 3.3).

While the E/DI contractor had been given high marks for its work during the first project, there had been concern expressed on the part of USAID and NEA over the widespread use of short-term technical assistance during the completion of the Assessment. During the first year of the second project, tensions developed between the new Chief of Party, Dennis Monaghan, and NEA and USAID over the implementation of the project. Noting, correctly, in our view, the difference between an institution-building project on the one hand and one which directly affects policy, Monaghan urged that the project be redirected away from NEA as a focal point and towards the Minister of MEM, on the grounds that NEA was too young to have a significant role during the project's lifetime.

The removal of the COP in February 1985 was a correct resolution of the personnel problems facing the project at that time. Unfortunately, the replacement of the COP required some eight months, for a variety of reasons: the qualifications identified under the Project Paper had changed (away from an emphasis on petroleum), and the resultant position was extremely difficult to fill; the political situation in the Sudan at the beginning of 1985 was unstable; and USAID/W interposed at least once in the decision-making process, overruling the Mission on the selection of the COP.

During the interim phase, the contractor used the NEA long-term advisor Marc Daudon as temporary COP. While his enthusiasm and drive were essential for ensuring continued momentum during this trying phase, several unfortunate misjudgments were made (the use of trust funds for project-related activities and support for an active role by the contractor in the distribution of charcoal for use by refugees). These errors in judgment have been rectified with time, but their damage was

extensive, including damage to the goodwill and trust between USAID senior management and the contractor. In addition, these errors provided another signal that project, as opposed to policy and planning, activities were not necessarily inappropriate for the NEA. Most of the errors which occurred between February, 1985 and October, 1985 were understandable errors of judgment. We believe that USAID and the contractor's home office are primarily responsible for the resultant damage to the project, through ineffective or minimal oversight during this sensitive period.

In terms of the contractor's visibility, prior to October 1985, over 20 people directly involved in implementing the project were on E/DI's direct payroll. Building signs directed visitors to the E/DI office, rather than to the EPM Project Office, and there was a clear and palpable gulf between EPM staff and those NEA staff financed under the E/DI contract on the one hand, and other NEA staff. In fact, during the preparation of the initial SOW for this evaluation at the end of 1985, the relationship between the contractor and the NEA had been one of the most troubling items of concern to the Mission. The project team now in place deserves considerable praise. They have lowered the visibility of E/DI vis-a-vis both EPM and NEA and have emphasized the improvement of organizational skills and procedures rather than concrete outputs. In addition, at least six E/DI staff have been let go, in part due to NEA's taking on production of the NEA Sudan Energy News.

The contractor of the NEA portion of the EPM Project has fulfilled a reasonable proportion of the tasks enumerated for them in the statement of work (USAID/Khartoum, 1982b). Short-term technical assistance has not been provided to the extent called for, but this is attributable largely to the local currency and security problems.

The local currency problem is partly E/DI's own creation, but only partly. The first chief of party, Dennis Monaghan, decided very early that the specified budget was inadequate to accomplish the task specified by the contract and requested an increase. Most early project files are missing from USAID records, but it appears that while Monaghan's proposed revisions were not given official approval by USAID, neither were they clearly disapproved, and to get the project off the ground, he began spending at exactly the rate his revised plans called for. Eventually USAID ratified the larger budget, but not before the local currency problem grew to serious proportions and caused major irritation at USAID. The local currency problem left a lasting, unfavorable impression of the NEA component of the EPM, but its real seriousness appears to have been blown out of proportion. Of the two related local currency problems - - overspending and spending trust fund money on items to support NEA rather than restricting trust fund expenditures to direct contractor support - - the contractor appears to have been largely justified in the end. USAID eventually increased the budget to the level Monaghan requested, and only about one-ninth of the trust fund expenditures were eventually disallowed as NEA support rather than contractor support. USAID claimed that the contractor did not provide proper notification of the approaching money problem, but Pluth directed USAID's attention to eight such notifications

between May 14, 1985 and September 25, 1985 (Pluth, October 1985). The contractor, however, bears responsibility for not either forestalling this problem or resolving it much earlier, while USAID bears responsibility for not keeping closer account of contractor expenditures earlier and for what appears to have been a rather legalistic attitude toward the problem rather than offering supportive assistance to help a contractor solve a problem and successfully execute a project.

A major contributor to the overspending was the failure of the EPM vehicles to arrive within two years of the beginning of the project. As noted above, vehicle purchase was, quite explicitly, USAID's responsibility; USAID failed to process the PIO/C for some two years. Nonetheless, we have been unable to document whether the contractor regularly pestered USAID about these early in the project. E/DI's large local staff also contributed to the early exhaustion of trust funds. USAID has criticized E/DI for their staff size; E/DI has defended its local staff size but has recently begun reducing it. We think that the initial staffing was excessive although we understand E/DI's frustration at being unable to encourage or cajole NEA to produce in line with their expectations.

A final contributor to the local currency problem appears to have been NEA's failure to present satisfactory documentation of local currency requests to either USAID or the Ministry of Finance and Economic Planning, whose approval was also necessary. See Daudon's memo to Moeen of NEA, with copies to "all managers and the Director General," urging NEA to more promptly submit required paperwork to USAID and the Ministry, warning that, otherwise, the project could be seriously compromised (Daudon, February 1985). Once again, both E/DI and USAID share responsibility for letting this problem at NEA cause such major problems. An alternative perspective is that in an institution-building project, tolerating delays caused by counterpart learning may better accomplish the project tasks than having the U.S. contractor do the work itself. However, if this approach to an institution-building project is to succeed, the Mission must remain supportive and be prepared for some roughness of execution.

The local currency problem led to a de facto USAID freeze on EPM spending, as EPM budgets were not approved and the local currency funds were exhausted. To retain staff and keep the project going, the contractors delayed EPM staff salary payments, borrowed paper and benzine (gasoline), took LS 25 thousand out of the E/DI fee, and used around LS 10 thousand in personal funds. Short-term technical assistance was, of course, brought to a halt.

In addition to the local currency problem, there have been problems associated with the choice of E/DI long-term expatriate staff. The first chief of party had taken early retirement from an executive position at Exxon. He was experienced, vigorous, knowledgeable about energy and the petroleum sector in particular, and had definite ideas. However, he apparently saw the Minister of Energy and Mining as more naturally his counterpart than was the Director General of NEA and tried to shift the

focus of the project to the Ministry and hasten the elimination of NEA as an institution rather than attempt to build it as an institution as the project called for (Monaghan, June 1984). Serious disagreement arose between the chief of party and NEA and his effectiveness was seriously compromised (see, e.g., El Gizouli, 1984 for a critical discussion of Monaghan's attitude). The disagreements precipitated several visits by E/DI Washington staff to assess the problem, and eventually the first chief of party was removed, in February 1985. E/DI Washington management had been searching for a replacement chief of party since September 1984 (E/DI, n.d.), and the resident advisor, Marc Daudon, filled in as acting chief of party from April through September 1985, with some short-term assistance from Paul Cough from E/DI Washington who had formerly served as SEPAP's assistant field manager and later its field manager (chief of party). Daudon worked reasonably well with both NEA management and USAID Mission administration, but did not have the 15 years' experience called for the chief of party in the statement of work.

The current chief of party, David Pluth, arrived in October 1985, shortly after Daudon left the project. Pluth was preceded by several weeks by Dr. Mir Heydari, a mining engineer and mineral economist. Pluth had some fifteen years' experience in the management of scientific and mineral exploration activities, including an array of short-term developing country mineral exploration experience. He had recently completed a master's thesis on energy use and economic development in northern Ghana, which included a short assignment in the field in Ghana supported by CIDA.

E/DI's Washington management may be criticized in retrospect for the choice of a person with Monaghan's senior executive credentials on the grounds that a person with that background probably would be dissatisfied with the working conditions to be found at NEA. On the other hand, the statement of work called for "experience at a senior administrative level" (USAID/Khartoum, 1983, p. 18). In addition, the project as originally planned included a major component involving the GPC, for which Monaghan's background was well-suited. Why E/DI sent Monaghan to Sudan, given the Mission's indefinite postponement of the GPC activities, which was well-known to them at the time, is not clear.

At any rate, the attempted redirection of the institution-building project by the first chief of party left the acting chief of party, Daudon, both behind schedule in project implementation and with political fences to mend with his NEA counterparts. When Pluth arrived, he was immediately faced with the local currency problem and what he found to be a hostile attitude toward the project in USAID/Khartoum. Two months later, the American security situation prompted the Mission to halt the entry of all short-term consultants, which, following the local currency problems, effectively eliminated local training by short-term expatriate technical assistance and NEA support from other E/DI employees and consultants. Between December 1985, and the actual evacuation in early April 1986, the political uncertainty led Pluth to give more weight in the project to short-term tasks than long-term ones. Considering the circumstances -- problems with the first chief of party, the local

currency problems, personnel discontinuity, political uncertainty, and evacuation -- possibly the most remarkable aspect of the contractor's substantive performance is that anything was done at all. Amidst the confusion, both external and internal, the contractor has undertaken or initiated a number of planning-and policy-related studies; has upgraded the information management and computer capabilities of NEA; has jawboned with NEA regarding its organization, mission and management; and has helped NEA increase its visibility with assistance in establishing NEA Sudan Energy News.

Two more abstract issues of contractor performance which, again, point to contributing causes external to the contractor warrant examination. The first involves a matter of vision, and the second is an issue of cultural interface in implementation. The project, as designed, involved an array of diverse tasks, some of which dealt specifically with energy and some with internal organization and operation and the consequent execution of the energy-specific topics has produced a relatively disjointed attack on Sudan's energy problems. There have been some assessments of regional energy resources and demands, some work with more efficient charcoal stoves, some efforts at energy data assembly, some prospective conservation information work, etc., all called for by the statement of work, but there is little coordination among these to solve one or two major, overarching problems. The National Energy Plan illustrates these symptoms well. The section on energy problems quite properly leads off the Plan, but the problem is simply conceived as "... consumers in the Sudan have suffered as the supply of energy has not met their needs and wants. This shortage has disrupted the lives of most people, forced up the cost of living, and caused major losses to the economy As a result of shortages, diverse cars and lorries waste hours queuing for benzine and gasoil ..." (NEA, 1985a, p.1). The conception of Sudan's energy problem, which NEA has been established to try to help resolve, never comes into focus as a two-or three-sentence statement of the problem that could guide priorities. What appears in place of a clear conception of an admittedly multifaceted problem is a series of problems and symptoms, minor and major, all on a rough par with one another.

The contractor has not offered such conceptualization, and it is illuminating to consider possible explanations. The project paper itself presented a very scattered array of tasks and offered little in the way of integration, and contract awards are based on a proposer addressing specific tasks in a statement of work. Recomposing the statement of work in an RFP is not the kind of activity that is readily rewarded, and the first chief of party's attempt to redefine the task on the scene was nearly disastrous. A contractor reasonably can be expected to attempt to execute the statement of work as it is, presuming that the work is part of a larger plan of the funding agency, in this case, USAID/Khartoum. However, there was no such coordinating guidance from the Mission. The Energy Officer was heavily occupied with the administration and execution of the NEC component of the EPM, which itself was a complex task, and his training and experience as an engineer, while giving him a keen sensitivity to executing engineering tasks successfully in a developing

country, did not prepare him to offer high level guidance in developing national, multifuel energy policy. He offered valuable moral and political support and had useful ideas on particular topics, but he simply was not trained as an economist or energy planner. No other Mission personnel offered such guidance, and the project was permitted to proceed, largely adrift intellectually, while all parties were doing roughly what was contractually required of them, and some far more.

The second conceptual problem involves methods of dealing with cultural problems encountered in introducing an essentially Western institution into a non-Western social milieu. The current E/DI contractors have been very conscious of their primary mission of institution-building, as opposed to output-producing, and have been very sensitive to Sudanese cultural interpretation of their actions. Until recently they employed full-time on the EPM staff a very senior, German-trained Sudanese with a degree in engineering and a sociology Ph.D., who acted as a cultural liaison between EPM and NEA in addition to performing technical assignments. This EPM staff member occasionally offered advice on how the expatriates' actions and procedures were being perceived, although the E/DI contractors made their own decisions on how to proceed. The idea of closer cultural integration with the counterpart agency is good, yet we have some reservations about the status and costs of his employment. His qualifications were not directly relevant to the most important parts of NEA's work. The skills he brought could have been hired on a short-term basis, and his salary was higher than that of any other Sudanese national employed by the project. We see little evidence that his specialized expertise was ever made available to NEA staff, e.g., in providing improved survey methodologies or social science analysis techniques. Other projects in Sudan and in other developing countries we have observed have not found the necessity for such a full-time cultural liaison. Additionally, the creation of such a position on the E/DI staff created another layer between the contractor staff and NEA.

Overall, the contractor's technical performance, in spite of the project's many extenuating circumstances, did not meet normal expectations for technical assistance contracts of this type. At the most general level, E/DI's previous corporate experience in energy planning was never effectively transferred or instilled within NEA. Presumably one of the reasons why E/DI was selected as the EPM project technical assistance contractor for NEA was its similar role in the predecessor SEPAP project and its worldwide experience with national energy planning projects. However, we see little or no evidence that any of the lessons learned by E/DI in previous projects were transferred to EPM. This deficiency was magnified by the fact that E/DI's long-term in-country personnel and many of its proposed short-term consultants are not permanent full-time E/DI employees. This accentuates the necessity for providing adequate home office direction and support as well as underlining the need for mechanisms to ensure that previous company experience was transferred to NEA during the course of the project. The evaluation found evidence of inadequate support from E/DI's Washington office in such basic areas as delivering equipment and only limited

attempts by E/DI to transfer the experience gained by its senior staff through other comparable national energy planning projects to either its in-country project staff or NEA.

Within the range of activities called for by E/DI's technical assistance contract, technical performance varied considerably. For example, the work with the computing facility was good, while support of energy pricing analysis, library development, and energy conservation was weak. Key policy areas such as energy pricing and fuelwood supply and use were not consistently emphasized by the contractor in its annual work plans or in actual project performance. Without actually performing analyses for NEA, we believe E/DI's staff could have done considerably more to shape or redirect NEA's activities. E/DI's analytical support of such an admittedly sensitive but vital topic as energy pricing was restricted to supplying a computerized accounting device which simply added up components of specific fuel prices. NEA was weak in economic analysis in general, and E/DI did little to help to alleviate this deficiency.

The contractor did not exhibit strong qualifications in the areas of LDC management consulting and energy conservation but chose not to subcontract for assistance from other firms with excellence in these fields. Consequently, the field staff's efforts to assist NEA's reorganization and work reorientation were not notably successful, and energy conservation was neglected nearly altogether. At a minimum, E/DI should have made NEA aware of case studies of successful energy-efficiency and energy conservation applications in other developing countries, but we found no evidence that this was done.

The near non-performance of the project prior to Fall 1985 (progress reports were not made from March 1984 to April 1985) was attributable to selection of personnel unsuited to producing an acceptable work plan and executing it, as well as to inadequate technical oversight and direction on the part of the home office to ensure that E/DI's contract obligations were being fulfilled.

On the brighter side, since Fall 1985, the contractor's employees in the field have done a good job, especially considering the limitation of the use of short-term consultants, the disruptive political circumstance in Sudan, the limited support offered by USAID/Khartoum, and the limits of the home office support provided by E/DI.

5.7. TRAINING

The training component of the EPM project called for 65% of the training budget or US\$684,400 to be allocated to NEA and GPC (USAID/Khartoum, 1982a, pp 23 and 26). Of this total, US\$418,100 was in Foreign exchange and US\$266,300 in CIP local currency funds was provided. The training component of EPM was principally focussed on U.S. and Sudan short-term training and to a lesser extent third-country short-term training. Only US\$51,400 was available for 24 pm of U.S. long-term

training under EPM directly. The project paper anticipated that NEA and GPC training, "will address longer-term strategic aspects of energy planning, and management" (USAID/Khartoum, 1982a, p. 25). There was also to be close coordination between NEA and GPC in selection of training courses and trainees.

The project paper assumed that the short-term training " . . . will use Sudanese training facilities and instructors, wherever appropriate" (USAID/Khartoum, 1982a). In addition, the technical assistance contractor was required to provide various types of training in connection with their activities. There was also US\$45,000 provided for English language training at the American Language Center in Khartoum.

This analysis will distinguish between NEA and GPC training and its institutional context, EPM and non-EPM USAID-funded training, short-term and long-term training, and contractor- and non-contractor-provided training. The section concludes with some general observations on the EPM training activities for NEA/GPC.

NEA's institutional development of its training activities appears to have been halting at best during the early stages of the EPM project. A letter from COP Dennis Monaghan to Jay Carter dated December 26, 1984 states, "we are developing a comprehensive training and manpower development program that we will present to you in the first quarter of 1985." Thus, nearly a year elapsed before any NEA training program related to the EPM training, or other types of non-EPM training was prepared, other than a sketchy outline of NEA's career development levels with attendant training requirements submitted by E/DI to USAID on April 5, 1984. This pattern continued into 1985, apparently due to inaction on the part of NEA, since Paul Cough, in a letter to Jay Carter on February 3, 1985 requesting approval for an NEA short course trainee, states, "Given limited funds USAID has available for . . . training . . . the NEA has yet to establish its priorities in light of available resources and discuss these with USAID."

In a letter to Dr. Shulli approving the short course training in question, Jay Carter stated on February 21, 1985, "It would appear that a great deal of training is being provided to this participant, and the Mission looks forward to receipt of your overall training program which we trust will demonstrate how this additional training . . . will further the overall objectives of NEA."

In a September 14, 1985 letter to Richard Macken (then Acting EPM Project Officer) from Marc Daudon, E/DI's Acting COP, states, "This fall E/DI plans to prepare with NEA a complete budget to use the funds available for training in the EPM project. This should clarify any questions about the use of these funds resulting in a consensus with USAID, NEA and EPM." Subsequently, the new E/DI COP in a memo to Jay Carter dated November 7, 1985 titled "NEA Training Requirement," states, "E/DI has recently completed a training report for NEA. This report outlines the objectives of a training program, NEA training needs,

personnel selection criteria, training plan priorities and paths for post-career advancement."

This report, Assessment of Training Needs (Daudon, December 1985), does begin to address NEA's critical training needs and to recommend steps to correct deficiencies in NEA's administration of its training activities. Daudon's assessment of NEA training activities to date observes, "The NEA lacks effective control over training opportunities and programs . . . because: needs have not been clearly defined, financing, and . . . acceptances are controlled . . . by donors, opportunities appear irregularly [and] . . . with very little notice." He concludes that NEA has had many more opportunities for training than other institutions but that training has not satisfied NEA needs due to staff enrollment in inappropriate training and the absence of too many NEA staff on training simultaneously causing problems in achieving NEA's work program. He adds, "on-the-job and local training programs have been underutilized. In many cases foreign experts have not provided any training. Many staff do not take local training seriously."

Daudon's analysis provides a section of training program guidelines including selection and eligibility standards. The NEA committee working with Daudon concludes that the nomination and selection process be controlled by senior management with the assistance of the newly-created position of NEA training officer. These decisions will be based on an annual training plan with input from division managers with candidates for overseas training ranked on the basis of a series of criteria including such factors as minimum tenure with NEA, job classification, and civil service ranking.

Daudon provides other useful insights into the utilization of training by NEA. He states, "long-term training opportunities are assigned mostly on the basis of tenure, with performance only a secondary factor. Those who return from training are expected to contribute more, but in an unclear way. Usually there is no specific job or assignment on their return." He concludes that the sum total of NEA's human resource utilization policies, including training, have produced an organization "characterized by uncertainty and a lack of standards. The result is frustration and poor performance by many staff."

Whether this plan is being implemented effectively, was not apparent. During our interviews with NEA staff it became clear that overseas training is a coveted commodity and several individuals felt that EPM and non-EPM USAID training had been improperly administered by NEA management on the basis of favoritism or other non-germane criteria. We were unable to directly confirm this although Daudon's report states, "In the past eligibility for training has been based principally on seniority and not whose work activities fit . . . the type of training offered. Sometimes chances have gone to individuals with very little work experience or minimal contribution to the NEA work program."

This assessment of training needs was not in the Project Paper, but it should have been. REDSO said, in 1983, that it should have been in

the Project Paper. Carter was the prime motivating force behind the training assessment when it finally was conducted.

It is also important to distinguish between EPM and non-EPM funded training. With the possible exception of on-the-job training by the E/DI contractor and their short-term consultants, the bulk of USAID long-term training conducted during the EPM project was not EPM-funded, but rather funded under the centrally-funded S&T/EY Conventional Energy Training Project (CETP) administered by the International Institute of Education. In a November 7, 1985 memo to Jay Carter on training, COP David Pluth indicates that only \$88,521 of EPM training funds had been expended, out of the total \$642,000 budgeted for both EPM contractors. In an assessment of EPM training provided at the request of Jay Carter, Mir Heydari of E/DI in a February 15, 1986 letter with attachments is only able to cite three instances of overseas short-term training funded by EPM, two masters' degree candidates, and one short-term conference attendee.

Heydari's letter was in response to a Jay Carter memo to Mission Director Brown on November 27, 1985, concerning training activities and progress to date. Carter concluded "no training programs have been developed which would support an amendment to the EPM project. Until that is realistically accomplished I propose no training allocations." This restriction seems to have held up with the exception of a short-term training course in R&D management taken by Dr. Shulli and some incremental funding provided to long-term degree candidates in special situations.

In a September 14, 1985 letter to Dick Macken at USAID, Marc Daudon explains that the \$50,000 in the EPM budget for long-term U.S. training has been reallocated from the 24 person-month total which could have supported only one masters' degree candidate, to partial funding for several degree candidates having only partial funding. He explains, "It is the decision of the NEA as expressed by Ismail Gizouli that these funds be used not for one person . . . but to make the long-term training programs of several different candidates possible."

While EPM itself may not have had the direct training impact on NEA that was originally intended, certainly the cumulative effect of USAID and non-USAID-funded training activities has been felt. A recent summary of NEA staff training shows that 49 separate USAID and non-USAID training activities, whether short courses, seminars, conferences, or academic degree programs, have been provided to NEA staff members who are still with the organization. In addition to CETP, which has graduated 19 NEA staff since 1981, 15 NEA staff were trained under the USAID Training in Alternative Energy Technologies program from 1981 to 1983, and at least another 7 NEA staff received other USAID-funded energy short-courses. Of the NEA staff who have received USAID-financed training, a significant number are no longer working at NEA. This seems to be particularly true of the CETP masters' degree graduates. The emphasis on energy management training may have been excessive. Energy management training does not necessarily develop energy planning skills. More training in accounting,

economics, business administration (MBA degrees), or public policy would have prepared energy planners better.

Contractor-provided training is a more problematic issue. Because of the restriction on short-term technical assistance for nearly all of 1986, and the controversy surrounding the original E/DI COP, the originally planned in-country training to be provided by E/DI has not all materialized. To their credit, however, a significant number of training activities were carried out by the short-term consultants who were available to NEA through the EPM project. In the absence of formal training course materials we are unable to fully evaluate the efficacy or usefulness of these efforts. Some documentation of the computer training course offered by Gregoire Genot and the management course offered by Mir Heydari were available, but in general we relied on interviews with NEA staff to evaluate the usefulness of the training provided.

In general, NEA staff expressed frustration that more training was not provided by E/DI. Several individuals wished that more training in economic analysis had been offered. The most successful training activity has been the training on the use of NEA's computers, provided initially by Gregoire Genot but maintained on a continuing basis by Mir Heydari and now institutionalized by Ibrahim Hussein of NEA's computer unit and his assistants. This training has reached nearly all of NEA's professional staff by the time of this evaluation and had even been offered to non-NEA staff including the Director General of GPC.

In conclusion, it appears that not all of the initially planned training activities for NEA were realized as planned. To some extent the non-EPM, long-term, USAID-funded training appears not to have been as useful to NEA as originally intended. Several returned graduates expressed their reservations about the academic programs of which they had been a part and implied that the training received was not particularly useful to their work at NEA. Other graduates have returned to NEA and performed well. Whether a better performance record for NEA training could have been achieved through earlier attention to this important objective by both NEA and E/DI is not clear. Moreover, the inability of the contractor to galvanize NEA into providing a viable training plan until nearly two years into the project undoubtedly limited the amount of potential training which could have been initiated with EPM funds. A final unanswerable question is how EPM could have trained more of NEA's relatively small staff than it did, given the prior and on-going, long-term, overseas CETP activities, and still maintain a viable organization capable of undertaking its proposed work plan.

Although the project paper envisioned some training activities for GPC personnel funded by EPM, the postponement of the GPC portion of the project rendered this moribund. In a meeting on December 30, 1984, Jay Carter discussed with GPC's Director for Administration the activation of GPC training under EPM. An inability by GPC to contribute any funds toward training expenses of their employees, in compliance with a 1982 GOS Act suspending government sponsored training, delayed matters

further. However, on June 23, 1985, GPC employees began English language training funded by EPM.

In a series of meetings in late 1985, Mission Director Brown agreed to use EPM funds to provide \$200,000 worth of training to GPC employees. Letters to USAID from GPC on December 3 and December 25, 1985 provided lists of candidates for long- and short-term training. Two candidates for master's degrees in petroleum geology were identified in a PIO/P dated February 24, 1986. However they were not permitted to leave since their training would not be completed before the PACD. At the time of this evaluation, a cut-back of CETP long-term training funds and the uncertain future of the EPM project has prevented these two individuals from leaving Sudan, despite the fact that they have firm acceptances and have had all of their prerequisites satisfied since March 1986. USAID should see if it is possible to devise a creative solution to this problem regardless of whether EPM is extended.

To date, GPC has had 4 short-term overseas training activities under EPM, out of a plan for 7 to 8 activities. In the period between 1980 and 1984, 4 GPC staff received long-term training in the United States, and 16 GPC staff received short-term training. It should be noted, in support of additional GPC training, that under the CETP project a series of exceptionally well-organized training courses have been offered, covering such topics as applied petroleum exploration and production technology and managing a national oil enterprise.

5.8. EQUIPMENT/COMMODITY PURCHASES

Commodities were not a major portion of the EPM project. Only US\$618,000 were allocated in foreign exchange and CIP funds. Of this total, 42% (US\$257,600) was intended for NEA and 9% (US\$53,400) for GPC. The principal purchases were to be three vehicles for NEA, with adequate provision for maintenance and fuels, audio-visual equipment and related training materials, and microcomputers with associated peripheral equipment and software packages for both NEA and GPC. Due to the pre-contract award postponement none of the planned commodities have been supplied to GPC. Thus, this section will review the NEA portion of the project.

As discussed earlier, procurement of the three project vehicles was the responsibility of USAID. Because of nearly two years' delay in the procurement process by USAID/Khartoum, project vehicles were not received until the evacuation period on Spring 1986 and thus, were not physically received by E/DI and NEA until October 22, 1986. As a direct consequence, E/DI was forced to spend approximately LS300 per day for vehicle rentals for the first two and one-half years of the project. This extraordinary large cumulative expenditure, while not planned for in the original budget, pushed E/DI's local currency usage up significantly and reflected a poor use of project funds over the life of the project, for which the contractor cannot be held responsible. It is also worth noting that a vehicle loaned to NEA by the USAID motorpool (an earlier

model Jeep Wagoneer), remained at NEA at the time of the evaluation. NEA no longer uses it because of its high benzine consumption and the unavailability of spare parts. They have tried repeatedly to have USAID reclaim this vehicle, but without success.

While none of the audio-visual equipment originally called for appears to have been purchased, the microcomputers, peripherals and software purchased and installed at NEA have been perhaps the most striking commodity success associated with the EPM project. A total of four IBM personal computers have been acquired along with two IBM-compatible Compaq personal computers (one of the Compaq computers is currently being repaired in the United States). The computer hardware, related peripherals, and support items such as backup batteries and computer software purchased for the project are shown in the attached Tables 5.2 and 5.3. There also have been purchases of photocopier machines for NEA.

Computerization of NEA started under the SEPAP project which provided an Ohio Scientific, an Osborne portable, and two Hyperion portables between 1982 and 1983. These obsolete pieces of equipment are no longer in use. The evaluation of SEPAP indicated that the contractor had not prepared an evaluation of computer requirements, and that the computers purchased under the project were purchased arbitrarily without regard to NEA needs (A.D. Little, 1984, p.69). The report supported the decision to purchase an IBM PC (actually paid for by EPM funds) and recommended that the EPM project consider enhancement of the NEA computer center a high priority activity.

Despite the apparent success of the computer equipment purchases, there still have been problems. Soon after he arrived in June 1984, Ibrahim Hussein, NEA's Computer Unit Supervisor, noted that E/DI-specified computer equipment had not been properly matched or procured to meet either Sudanese voltage requirements or computer maintenance availability. He made NEA's management aware of the problem and prepared a written report for E/DI indicating NEA's specifications for desired equipment. He particularly requested additional Epson and NEC printers rather than IBMs because of the greater difficulty of having IBM printers maintained in Khartoum. (Epsons appear to be more reliable in Sudan than IBMs, regardless of spare parts.) Previously one Epson and two NEC printers had been procured by EPM. NEA wished to procure certain types of equipment based on a combined set of selection criterion that included technical performance, reliability, and maintainability in Sudan (particularly related to the ease of finding spare parts). Their desires could not be completely accommodated because of E/DI's concern that USAID funds could not be used to acquire non-U.S. origin equipment without a source origin waiver.

Between March and September 1985, NEA received 3 IBM/XT's, an IBM wheelprinter, a Genicom printer and a Compaq printer. The Genicom printer worked for only three months before malfunctioning, is no longer in use, and has not been repaired. Patricia Arnold, an E/DI Consultant, who conducted an 18-day evaluation of NEA's database management systems

Table 5.2: Computer Equipment at NEA

Microcomputer	Source	Acquired	Financed By	Value	Memory	Diskette	Hard Disc	Power Needs	Status	Support
Ohio Scientific	USA	1982	SSMFP/USAID		64K			220V-4.75A-150W	Obsolete	No
Osborne	USA	1982	SEPAF/USAID		64K				Obsolete	No
Hyperion Portable	USA	1983	EPM/USAID		256K			220V-4.75A-150W	Not Working	No
Hyperion Portable	USA	1983	EPM/USAID		256K	2 x 264K		220V-4.75A-150W	Under Repair in USA	No
IBM PC	USA	1984	EPM/USAID		512K	2 x 264K		120V-2.00A-200W	Operational	Yes
Aatek Video (used with PC)	USA	1984	EPM/USAID					120V-0.30A-30W	Operational	?
IBM II	USA	1984	EPM/USAID		640K	1 x 264K	10MB	120V-4.20A-400W	Operational	Yes
IBM Video (used with II)	USA	1984	EPM/USAID					120V-0.95A-100W	Operational	Yes
IBM II	USA	1985	EPM/USAID		640K	1 x 264K	10MB	120V-4.20A-400W	Operational	Yes
IBM Video (used with II)	USA	1985	EPM/USAID					120V-0.95A-100W	Operational	Yes
COMPAQ Portable	USA	1985	EPM/USAID		256K	1 x 264K	10MB	120V-2.00A-200W	Not Working	Maybe
IBM II	USA	1985	EPM/USAID		640K	1 x 264K	10MB	120V-4.20A-400W	Operational	Yes
IBM Video (used with II)	USA	1985	EPM/USAID					120V-0.95A-100W	Operational	Yes
<u>PRINTERS</u>										
NEC Dot Matrix (PC 8023)	USA	1982	EPM/USAID					120V-2.00A-400W	Not Working	Part
EPSON Dot Matrix (MX 100)	USA	1984	EPM/USAID					120V-1.00A-100W	Operational	Part
NEC Letter Quality (3550)	USA	1984	EPM/USAID					115V-2.50A-250W	Not Working	Part
HP Plotter (7470A 2-pen)	USA	1984	EPM/USAID					120V-0.30A-25W	Operational	No
GENIOM Dot Matrix (3014)	USA	1985	EPM/USAID					120/220V-1/.5A	Irregularly Working	No
IBM 142 Wheelprinter (5216)	USA	1985	EPM/USAID					120V-0.8A-0.1KVA	No Instructions	No
<u>BACKUP BATTERIES</u>										
Automatic Voltage Stabilizer	USA	1983	EPM/USAID					220V-3.00A-600W	Operational	?
Stepdown Autotransformer (220V-115V)	USA	1983	EPM/USAID					220V-10A-2KVA	Operational	Yes
Stepdown Autotransformer (220V-115V)	USA	1983	EPM/USAID					220V-5A-1KVA	Operational	Yes
TOPAC Backup Battery	USA	1984	EPM/USAID					120V-1000W	Not Working	No
Voltage Stabilizing Transformer	USA	1984	EPM/USAID					1000W	Operational	?
4 Datasavers	USA	1983-85	EPM/USAID					200W each	Partially Operational	No
<u>OTHER EQUIPMENT</u>										
Freidrich Air Conditioner								200V-15A-2900W	Operational	Yes

Table 5.3 Computer Software at NEA

SOFTWARE	COMPUTER	USE
Disc Operating System	IBM COMPAQ	System
LOTUS 1-2-3	HYPERION	Spreadsheet
LOTUS 1-2-3	IBM COMPAQ	Spreadsheet
LOTUS 1-2-3 Release 2	IBM COMPAQ	Spreadsheet
LOTUS Report Writer	IBM COMPAQ	Report Writer
STATPLAN	HYPERION	Statistics
STATPAC	HYPERION	Statistics
EXECUVISION	IBM COMPAQ	Graphics
CHARTMAN II	IBM COMPAQ	Graphics
OPTIMIZER	IBM COMPAQ	Linear programming
BASIC - Interpretive	IBM COMPAQ HYPERION	Language
DBASE II	IBM COMPAQ OSBORNE	Data Base
DBASE III	IBM COMPAQ	Data Base
ALADIN DB	HYPERION	Data Base
VOLKSWRITER	IBM COMPAQ	Word Processing
EASYWRITER	IBM COMPAQ	Word Processing
WORDSTAR	IBM COMPAQ	Word Processing
MULTIMATE	IBM COMPAQ	Word Processing
ARABSTAR	IBM COMPAQ	Word Processing
WORD PLUS	IBM COMPAQ	Dictionary
TYPING TUTOR	IBM COMPAQ	Typing Aid
IN:SCRIBE	HYPERION	Text Editor
IN:TOUCH	HYPERION	Communications
PFS:FILE	IBM COMPAQ	Filing
EEDO Energy Economics of Design Options (World Bank)	IBM COMPAQ	Analysis - no manual
ENERSTAT	IBM	Model - not used

in January 1986 suggests that problems with the Genicom printer may have been static-related (Arnold, 1986, p.17). She points out that static damages computer equipment, especially printers, that static increases with dryness, and that Khartoum's zero humidity for much of the year encourages static. These units are also rare in Khartoum and require experts to repair. She concludes, "this is an unreasonable situation for the long term when NEA takes over maintenance of their equipment. It would be advisable for NEA to be able to repair their equipment locally and to pay in local currency" (Arnold, 1986, p. 17).

Her concise and well-organized report, while presenting a good overview of the status and utilization of EPM acquired computer equipment, also presents a number of serious issues which do not seem to have been resolved at the time of the evaluation team's visit. For example, no provision of humidifiers, autostatic devices, or backup streamer tape equipment has been made. We understand that an additional procurement of four IBM/XT's is in progress, (2 with Minichrome screens for word processing), although NEA requested IBM/AT's. The specifications were for 220 V and 50 hz equipment suitable to Sudan, but E/DI has only received quotes on U.S. standard 120 V 60 hz equipment. The evaluation team thinks that a waiver to allow purchases of IBM equipment through IBM Europe may be the most expeditious way of resolving this problem. There is also a critical need for acquiring a magnetic streamer tape to provide backup data storage for NEA's hard disc storage.

Arnold's report recommends a series of steps to improve hardware utilization and longevity. These recommendations include: "train a NEA staff member in basic equipment repair; establish maintenance and repair schedules and alternatives for each piece of equipment; purchase only units that can be repaired locally and are compatible with lower power specifications; eliminate equipment that cannot be locally supported; purchase similar units (e.g., 3 identical dot matrix printers and 3 identical letter quality printers); acquire shop manuals for all equipment; humidify printer locations; and install anti-static devices." (Arnold, 1986, p.11.) She acknowledges that these recommendations will take some time to enact. However, she does not distinguish which actions are the responsibility of NEA and which are the responsibility of E/DI during the balance of the EPM project.

In the view of the evaluation team, while the NEA computer unit is a critical part of the organization which has done much to upgrade the performance and morale of NEA employees, it still needs considerable improvement, particularly in light of the additional equipment now in procurement. The condition of NEA's computer room leaves much to be desired and cannot easily accommodate additional equipment. It also raises basic questions about the lack of a firm, Mission-wide policy on computer equipment installation in Sudan. Given the relatively short-life of IBM PC, under Sudanese environmental conditions, it would appear to be valuable to require the recipient agency such as NEA to upgrade the physical premises where computer hardware will be installed to satisfy certain minimum conditions including power supply, air filtration or conditioning, dust control, humidification, anti-static devices, etc. While NEA has attempted to provide the project's computer hardware with a suitable environment, the evaluation team encountered conditions, which while an improvement over ambient

conditions, are still likely to degrade equipment performance rapidly, especially given NEA's relatively high utilization rates at present. The Mission should consider developing a firm policy on project computer acquisitions, similar to one in effect in Egypt, to secure longer operating lives for USAID-procured equipment. We also urge that E/DI attempt to rectify as many as possible of the hardware problems and incompatibilities in consultation with NEA's Computer Unit before the termination of the project.

Packaged software also has been acquired with project funds. Among the problems identified by Arnold with software of NEA include: software that does not operate on current equipment (e.g., STATPLAN and STATPAC); installed software that has not been analyzed to determine its usefulness; software used inappropriately (e.g., storing massive amounts of data within Lotus spreadsheets with no documentation); and lack of complete documentation with all software. She points out that knowledge of new software is limited at NEA and that software has been copied in an attempt to expose NEA to potentially more useful systems. However, she concludes that on balance the lack of manuals and incomplete nature of some of the copied programs rendered them less than useful to NEA. A number of recommendations are made by Arnold regarding software which do not seem to have been implemented by E/DI or NEA to date.

Arnold's report also provides an evaluation of other important areas related to NEA's information system. These include data considerations, users, documentation, and personnel and training. While these areas are not directly related to the equipment purchases per se, they do shed considerable light on the institutionalization of computer services at NEA and the many systems problems which that process faces. For example, she notes that although a principal mission of NEA is energy data acquisition in a central repository for analysis and tracking, "this does not happen" (Arnold, 1986, p.9). She concludes that this is due to limited data collection, no quality control of data, no appreciation of data needs or historical data and limited cooperation and reciprocal reporting between agencies. The result within NEA is "no definition of baseline data; no formal identification of data sources; no schedule of data collection; no organizational commitments to data sharing; and reluctance by NEA staff to pursue data collection" (Arnold, 1986, p. 11). She identifies significant problems encountered with data storage, including lack of data sharing due to problems endemic to PC's, problems of physical security of data, and data retrieval. NEC made at least one immediate modification in use of software at Arnold's suggestion to eliminate one source of data security vulnerability by creating a regular and secure back-up system for data files. She concludes, "the greatest danger is of data destruction through ignorance and negligence..., data that took much effort to assemble." (Arnold, 1986, p. 13).

From current utilization records maintained at the Computer Unit and made available to the evaluation team, it is obvious that the computer capability installed at NEA through EPM funds is consistently used. Although there are no automated logging-on or password procedures, the manual log records are well-kept and regularly analyzed. Fifty-seven percent of available hours of use during 1986 were utilized (3082 hours out of an annual total of 5382). No information on rates of equipment downtime was available

but it appears that performance of the IBM computers and at least one Compaq have been excellent, in contrast with the difficulties experienced with printers.

According to NEA's computer utilization figures, the Computer Unit accounted for 24% of system usage. This figure may be somewhat misleading as the Computer Unit's four staff members provide considerable assistance to other NEA staff in helping with accomplishment of computerized work. The next largest user is the Projects Group, which used nearly 17% (also accounting for 1600% of their reserved time). Information used 5.72%, E/DI 2.29% (10.85% of reserved time); the National Energy Plan used 1.73%; evening users (after 2 PM closing time) 1.06%; biomass 0.98%; marketing .61%; and conservation .06%. The analysis also provides a breakdown of work by type and by group, showing that database storage and training are the two largest system usages in the aggregate, followed by data analysis and word processing. This shows a gross misallocation of computer use to projects, which are largely outside the mission of NEA in the first place.

Analytically, the computing system has been misused. In addition to the usurpation of time by the projects, the data that have been assembled have been used to answer micro questions. They have not been used to create macro databases useful for national planning purposes, as was originally intended. The intellectually easier task has been settled for.

To date, nearly all NEA professional staff have been provided with a basic computer orientation and training course oriented to NEA's software provided by E/DI. Gregoire Genot of E/DI received high marks for his implementation of the six-month Information Project I started in March-April 1985. This consultancy also began work on an index filing system which is currently being continued. The Computer Unit now continues to give the course on its own, not only to NEA staff but to other interested ministries. To date, basic training has been provided to individuals from GPC, the Geological and Mineral Resources Department of MEM (GMRD), Census Department, Customs Department, Ministry of Labor, Ministry of Commerce and several components of the University of Khartoum.

At present, E/DI's 1986/1988 work plan calls for initiating an Information Project II beginning in June 1987, which will include a four week computer analysis course for six NEA staff, training of 6 NEA staff in improved data collection systems, and training of 4 NEA staff in energy survey design and primary data collection. They also propose a hardware acquisition task which includes procurement of the 4 additional IBM-XTs, 3 EPSON printers, 1 IBM wheelprinter, 1 20-MB streamer tape, 2 buffers, and 3 VPS backup batteries. It also calls for a review of photocopier specifications and acquisition of a high quality reproduction machine by August 30, 1987. A part of this task calls for 2 weeks of an office machine environment consultant to advise NEA on "specifications and conditions in preparing the new sites for computers and photocopiers."

The opinion of this evaluation team is that the computer acquisition and training activities conducted at NEA under EPM represent the most positive tangible project output. However, in order to ensure that USAID's investments

in equipment hardware and software are fully utilized, the tasks set out by E/DI in its 1986/1988 work plan concerning information systems (Tasks 1.1, 1.2, and 1.3) need to be considered the highest priority work remaining for E/DI.

There is also a need, in the team's opinion, for additional technical assistance to NEA's Computer Unit, the form of additional training in maintenance and repair (including provision of complete manuals and selected spare parts and enhancement boards), and a preliminary specification of likely future institutional needs so that continuity can be established by NEA in having its Computer Unit expanded, updated, and properly maintained over time. There is also a need to develop and implement a system maintenance plan. One possibility is to bill users of the system in order to establish a fund to procure needed maintenance and spare parts. Since the Computer Unit is a shared institutional resource, it would be useful for other donor-assisted projects to contribute user fees (possibly in hard currencies), which would help sustain the unit's operation.

For example, project budgets should include funds for computing time, and computing time for each project should be "purchased" from the computing facility at a given rate common to all projects. In such a manner, each project donates funds to computing system maintenance and operation in proportion to its use of the computing facilities. Such a system avoids the unhappy circumstance of having one project support the computing facilities, which in turn are used by all other projects, the first project in effect subsidizing all the other projects by paying for their computing.

The team is also concerned that the present system at NEA is now critically dependent on a few key individuals because of the lack of documented procedures and software. Compensation levels for computer professionals need to be set at market levels or these individuals will be lost to other organizations, a process which could set back NEA greatly in our opinion. We recognize that salary levels are set by civil service regulations, and that computing personnel get outside income from offering courses outside NEA. In the long run, this will be unworkable.

5.9. USAID'S PROJECT ADMINISTRATION

Throughout this chapter we have made a number of references to USAID's administration of the NEA component of the EPM Project. Rather than simply repeat them all here, we summarize and make some general evaluations.

The overall EPM Project Manager was also the Mission Energy Officer. In addition to overseeing the equally complex NEC portion of the EPM Project, he had responsibility for the Blue Nile Grid Rehabilitation II Project, the Roseires Dam Dredging Project, the Sudan Renewable Energy Project, and had a role in the Petroleum Initiative Commodity Import Program. He gave considerable moral support to both the NEA Component of EPM and to NEA, and was important in maintaining the institution-building spirit of the project. He has apparently been exposed to Mission criticism for administrative laxness in letting the local currency problem occur. However, it seems unreasonable

to the evaluation team that he should have been expected to undertake routine project tracking in addition to his other duties.

As we noted above, however, the project paper did not offer clear intellectual guidance to the NEA component of the EPM, and the Mission staff did not provide it. The Mission's attitude to the project stressed accounting problems at the expense of substantive implementation issues. More to the point, closer examination of some of the accounting issues involved in the project indicated that USAID management was responsible for many of the problems. For example, considerable local currency was spent on vehicle rentals because USAID failed to process the PIO/C for this purchase for two years. Nevertheless, USAID permitted the local currency problem in particular to create an adversarial relationship between the Mission and the NEA component of EPM, much to the detriment of the project's implementation.

6. NATIONAL ELECTRICITY CORPORATION

The National Electricity Corporation (NEC) component of the Energy Planning and Management project is evaluated in this chapter. Section 6.1 restates the goal of the EPM project and purpose of the NEC component. Section 6.2 describes the project inputs as found in the project paper. Section 6.3 explains the project progress and current status of the project outputs. The current status of NEC as an institution is summarized in Section 6.4. Section 6.5 evaluates the performance of the contractors providing technical assistance to NEC. The planned and completed training of NEC is presented in Section 6.6. The commodity purchases made by the contractors are described in Section 6.7. Finally, the administration of the project by USAID is summarized in Section 6.8.

6.1 GOAL AND PURPOSE

The goal of the EPM project is to ease energy-related constraints to economic recovery while contributing towards the long-term goal of meeting Sudanese energy requirements for domestic, agricultural and industrial uses in ways that are economical, efficient and environmentally sound. The purpose of the NEC component of the project is to increase the short-term reliability of the Blue Nile electric power grid and to improve the managerial and financial capability of the NEC to generate, transmit and distribute power.

6.2 INPUTS

Four types of project inputs are described in the project paper: funding from USAID and GOS, technical assistance, training, and commodities.

Funding - Three contracts have been funded to provide technical assistance to NEC. One contract is with Harza Engineering Company (Harza) for technical assistance, one with Arkel-Talab Cargo Services, LTD. for technical assistance in operation and maintenance (Arkel-Talab/O&M), and another contract with Arkel-Talab for computer services (Arkel-Talab/CS). The estimated costs and obligated amounts for each contract are shown below.

	Estimated Cost, <u>US dollars</u>	Obligated Amount, <u>BS dollars</u>	Local Currency, <u>LS</u>
Harza	1,981,400	1,505,100	950,000
Arkel-Talab/O&M	250,000	250,000	2,174,675
Arkel-Talab/CS	0	0	220,600
Total	<u>2,231,400</u>	<u>1,755,100</u>	<u>3,344,675</u>

Technical Assistance - The person-months of technical assistance being provided by the three contracts are shown below.
Harza

Long-Term Technical Assistance	
- Chief of Party	48.0
- Financial Controls and Planning	24.0
- Energy Efficiency and Load Management	12.0
- Computer Specialist	<u>24.0</u>
Total	108.0 Person-Months
Short-Term Specialists	
- Accounting System	3.5
- Financial System	2.0
- Tariff, Legal Analysis and Regions	1.0
- Stores Purchasing	1.0
- Stores Records	1.0
- Corporate Planning	2.0
- Man-Power Training	2.5
- Computer System	<u>2.0</u>
Total	15.0 Person-Months
Home Office Support	
- Project Management Administration	15.0
- Technical/Non-Technical Support	<u>10.0</u>
Total	25.0 Person-Months
Grand Total	148.0 Person-Months
Arkel-Talab/O&M	
Long-Term Technical Assistance	
- Hydraulic Controlled Equipment	24.0
- Heavy Power System Maintenance Equipment	24.0
- Vehicle Maintenance Center and Machine Workshop	24.0
- Telecommunications System Maintenance	<u>24.0</u>
Total	96.0 Person-Months
Short-Term Specialists	
- Professional Backstopping	<u>24.0</u>
Grand Total	120.0 Person-Months
Arkel-Talab/CS	
- Computer Programmers	27.0 Person-Months
Total NEC component	295.0 Person-Months

Training - Harza was to provide technical assistance to train NEC staff. Also, Harza was to provide 2 person-months to plan and coordinate training programs in the United States and other countries. The funding of these training programs is outside the budget of the Harza contract. Arkel-Talab is providing training with their technical assistance.

Commodities - A total of US\$66,400 was allocated in the Harza contract for commodity purchases to be determined at a later date. The Arkel-Talab budget had no allocation for commodities.

6.3 CURRENT STATUS OF OUTPUTS

The current status of the project outputs is described using the NEC project outputs as defined in the project paper (USAID/Khartoum, 1982a, pp 19-20, 66). Seven outputs are defined, and the following seven sections give their current statuses.

6.3.1 Increased Organization and Management Capabilities

The corporate organizational structure recommended by the Irish Electricity Supply Board is being implemented by the NEC. The purposes of this task were to implement the organizational structure and improve the management capabilities of NEC.

The World Bank prepared a study entitled "Staff Appraisal Report-Sudan Power Rehabilitation Project" in June 1985, as part of their proposed project assessment. The project would finance two additional diesel units at Burri, and rehabilitate two hydro units at Roseires Dam. As part of their assessment the performance of NEC was judged. The assessment as stated on page 28 was:

"NEC's institutional and operational performance is subject to a number of major problems. These are (a) poor financial performance; (b) inadequate system capacity; (c) low plant availability; (f) frequent power breakdowns; (e) excessive power losses; and (h) high cost of power supply.

These problems are caused by (i) shortage of trained staff; (ii) weak organization and management; (iii) lack of effective management information system; (iv) chronic delays in planning for expansion and resulting in costly reliance on development of thermal rather than hydro power; (v) shortage of spare parts and lack of systematic maintenance due to lack of foreign exchange; (vi) inadequate financial resources to meet NEC's requirements due to low tariffs and slow collection of electric bills; (vii) unmetered and unbilled consumption of electricity by a number of consumers; and (viii) siltation of water intakes at Roseires hydroelectric station."

Since the report was prepared, two of the problems cited have improved, inadequate system capacity and frequent power breakdowns. Considerable improvement still is needed to solve these problems.

During the EPM Project, the Director-General position has been held by several different individuals. Several key positions at the Senior Director level have remained vacant during the EPM project. These vacancies are severely impeding the proper management of corporate activities. The efforts of Harza to work with the Director-General and Senior Directors have not been successful because of the vacant positions and NEC lack of confidence in Harza Engineering Company. Harza has been successful at working with middle management at the director level.

6.3.2 Maintenance Procedures

This task was contracted to Arkel-Talab. The objective of the contracted activity was to improve the operation and maintenance of the telecommunications and mobile equipment provided to NEC under CIP. The contract has two tasks, one dealing with the Vehicle Maintenance Center and the other with the Telecommunications Center.

6.3.2.1 Vehicle Maintenance Center

The CIP procured a fleet of 152 vehicles, vans, busses, and specialized pieces of electrical construction equipment for the NEC, worth approximately US\$8,251,000. The equipment arrived in Khartoum between September 1983 and June 1984, and was placed into varying degrees of service. The overall benefit of the equipment was the availability of modern mechanized equipment to replace large labor crews. The Bechtel Final Report enumerated the benefits to system operation as follows:

- Improved distribution pole and pole-mounted equipment installation,
- Improved maintenance response to trouble calls,
- Greatly reduced "wait-time" for loading and off-loading of equipment at Central Stores with cranes,
- Reduced employee travel time to and from job sites using jeeps, vans, pick-ups and trucks,
- Reduced time to complete new distribution cable extensions with the excavator/cable trenchers, and
- Easier movement of materials in warehouse with forklift trucks, resulting in better handling, storage, and location of materials.

One of the conclusions and recommendations of the Bechtel Final Report (Table 4.2) is:

Conclusion - "Inadequate, and in some cases, destructive maintenance of mobile equipment by mechanics has led to the early failure, or violation of warranties, on some equipment."

Recommendation - "A program of operator and mechanic training and qualification must be installed and continued, initially using expatriate supervisory personnel."

Although the Bechtel Final report was dated September 1984, the problem with the proper care of the vehicles and construction equipment had been realized about a year before. As a result of meetings with USAID, NEC, and Bechtel in December 1983, the NEC Director-General formally requested technical assistance from USAID on February 17, 1984. The request was for two specialists for vehicle and telecommunications equipment maintenance for six months.

A USAID internal action memorandum to the mission director from the energy advisor, dated June 12, 1984, stated the problem as:

"Continuing experience since delivery of the equipment demonstrates a very serious and urgent need for immediate assistance in training NEC staff in proper operation and maintenance of the CIP-funded equipment."

Approval was given to procure technical assistance for a two-year period. Arkel-Talab Cargo Service, Inc. was awarded the contract.

Description of the Vehicle Maintenance Center - The Vehicle Maintenance Center is responsible for the maintenance and repair of the NEC vehicles and construction equipment and is located next to the Khartoum Central Warehouse Facility. Due to the quantity of U.S. equipment provided by the CIP, the majority of the effort is concentrated on the U.S. equipment. Another maintenance center located at the Khartoum Headquarters handles other equipment operated by NEC. There are limited maintenance facilities located in the field centers.

The center consists of three buildings: two garages and a repair shop. The first building was an existing structure which is an open sided garage with 7 bays used for battery and radiator repair. The temporary office facility has been partially constructed in this building.

The second building is a garage and is a pre-fabricated metal structure purchased by USAID. The NEC contracted with Steel Construction, a Sudanese company, to erect the building. Construction began in February 1985 and is 75% complete as of February 1987. The building has 7 garage bays on each side for vehicle repair. There is an open pit bay for under-vehicle maintenance and a front end alignment bay. Electric service has not yet been installed in the building, so the use of power tools and lighting has not been possible.

The third building, the Repair Shop, is also a pre-fabricated metal structure purchased by USAID and erected by Steel Construction. Construction began in February 1985, and is 75% complete as of February

1987. Electric service has been installed, but the interior is not finished. Safety barriers around the various pieces of equipment need to be built. The building is divided into three areas; a garage, a spare parts storage area, and a work shop area. The garage has 6 bays, with one bay containing a hydraulic lift. The parts area is complete and waiting for NEC to assign a clerk and the transfer of spare parts to the area. The Vehicle Maintenance workshop area contains the equipment listed below. This equipment has not been utilized, and no training has been provided, except where noted, because of the incomplete state of building construction.

1. Front End Alignment Machine
2. Engine Dynamometer
3. Boring Machine
4. Line Boring Machine (limited use in 1987)
5. Valve Grinding Machine
6. Boring-Honing Machine (limited use in 1987)
7. Brake Drum and Disk Turning Lathe
8. Fuel Pump Tester
9. Headwork Machine
10. Head Surfacar Machine (limited use in 1987)
11. Hydraulic Press (utilized - manual machine)
12. Electric System Analyzer
13. Bead Blasting Machine
14. Radiator Repair Equipment
15. Grinder and Drill Press
16. Truck Tire Machine
17. Crank Grinding Lathe (limited use in 1987)

The following maintenance procedures have been instituted: 1) the recording of accurate maintenance and repair records for all vehicles and equipment, 2) time keeping for workers, 3) a record of all vehicles and equipment that can be termed "Permanently Out of Service." (the records include descriptions and cause for said classification), and 4) a list of vehicles and equipment that are known to have unacceptable component failure rates. A record of causes and all relating facts is being kept for future reference should additional equipment be procured by USAID.

Training began in May 1985. Three advisors are providing technical assistance, and training has continued to date with the exception of one advisor being evacuated for 6 months. Training manuals from some equipment manufacturers have been acquired and are being translated into Arabic. The method of training is to provide hands-on, step-by-step physical repairs. The center should be staffed by approximately 20 NEC mechanics but is presently staffed by only 10 certified mechanics. The mechanics have received training in engine (benzine and diesel) repair, electric repair, and gear box repair.

Two problems require discussion. First, the procurement of parts and materials from outside Sudan has been the biggest bottleneck. There are instances when parts or materials are needed but are not available in Sudan. This is particularly a problem for the equipment procured by the

CIP, because it is U.S.-manufactured, and parts cannot be obtained locally. The equipment was procured with spare parts, but, operating experience and manufacturer design weaknesses have resulted in failures requiring spare parts not supplied. The two options for procuring spare parts are either directly from the United States, with U.S. dollars, or from a Sudanese dealer, with local currency. NEC has not allocated funds, either U.S. dollars or local currency, for the procurement of parts.

Second, the construction of the buildings has taken an abnormally long time, and the provision of technical assistance has been hindered because the center has been under construction. On November 19, 1985, a meeting was held with the NEC Director-General to review the slow construction progress of the buildings, but no action resulted.

The performance of the Vehicle Maintenance Center has been good; of the 152 vehicles procured, 92 are in service, 57 are out of service, and the conditions of 3 are unknown. Although the present situation with 38% of the vehicles out of service appears to be poor, the number of vehicles out of service at the beginning of the contract activity was greater. Of the 57 out of service, there are some spectacular examples of the equipment problems. All five forklift trucks are out of service because there are no spare tires available. The six pick-up trucks are all out of service with similar mechanical problems and no spare parts. Twelve of the fourteen vans are out of service. The pick-ups and vans parked at the maintenance center averaged 5,000 to 6,000 km on the odometers. Eight of the nine busses are out of service with engine failures and stress cracks in the frames. The 15 cable reel carriers/line pullers worth US\$ 462,790 have never been requested by NEC to be put in service, they sit unused.

About two years of training will be required to instruct the NEC mechanics on the proper use of the equipment at the Vehicle Maintenance Center. This, of course, assumes that construction has been completed on the buildings. A period of time is required for the equipment in service to experience enough daily usage to encounter the majority of service problems. During this time period, the most valuable training of the NEC mechanics can be achieved. After this training, the mechanics should be able to handle any new maintenance problems which may arise. If the technical assistance to the Vehicle Maintenance Center is not continued for a period of two additional years, then the majority of the vehicles will be out of service at the end of the two years because of the incomplete state of technical assistance at this time and lack of spare parts.

6.3.2.2 Machine Shop

Equipment has been procured by the CIP to equip a machine shop to assist in the repair of vehicles, construction equipment, and other equipment. The cost of the equipment was US\$ 181,613. The shop is to be located next to the Vehicle Maintenance Center in an area presently being used for storage of other materials. The equipment for the shop has not

been uncrated since its delivery in 1984. Several of the items are still in Port Sudan, awaiting release upon receipt of handling and storage charges. The U.S. firm supplying the equipment was to pay the charges but has gone bankrupt. Neither USAID or NEC has paid the charges. The NEC has plans to commission the shop but has not taken any action. The equipment to be housed in the shop is as follows:

1. Metal Saw
2. Two Drill Presses
3. Sheet Metal Forming Machine
4. Spot Welder
5. Vertical Milling Machine
6. Horizontal Milling Machine

The Evaluation Team inspected the location of the machine shop and the uncrated equipment. The sheet metal forming machine is stored outside and is being used as sleeping quarters and clothes line by someone.

6.3.2.3 Telecommunications Maintenance Center

The CIP procured four types of communications systems: 1) a high frequency (HF) radio system, 2) a very high frequency (VHF) radio system, 3) a microwave rural telephone system, and 4) an electronic private branch exchange (EPBX) telephone system. These systems were to replace and expand the voice communication capabilities of the NEC.

The HF radio system was designed to replace the existing Power Line Carrier (PLC) network. A power line carrier system uses the power carrying conductors as the communication path. The system has a cost advantage because additional cabling is not required, but the disadvantage of not being available when the transmission line is out of service. The PLC system used by NEC was reliable but subject to frequent interruptions from repeated transmission line outages. The HF radio system would provide a redundant communication route totally independent of the transmission system. The system would also expand the locations of communication service.

At the beginning of the contract, NEC was not utilizing the HF system except for the Khartoum Supply-to-Port Sudan link. About 90% of the system was not being used on a daily basis because station operators were not monitoring the transceivers. Most of the HF sites also had PLC facilities, and it appears that the station personnel rely on PLC, neglecting the HF radio system.

A VHF radio system has been installed at 37 operating centers throughout the BNG and Eastern Area. The VHF system provides base (fixed station) and mobile (vehicle and walkie talkie) communications to dispatch and control maintenance crews working out of those operating centers. During the contract, the system installation has been completed and is in very heavy daily usage.

The microwave rural telephone system has been used to communication to a few key locations. The voice cable which provided communications between the Khartoum Load Dispatch Center and the Burri Generating Station was in very poor condition and subject to frequent interruptions. To improve reliability, a microwave rural telephone system was used to replace the existing cable. This also avoided the replacement of existing cable and future maintenance problems. The Khartoum North Generating Station was under construction and needed communications and was also included in the system. The system was completed during the CIP project and was maintained during the present contract.

Two EPBXs telephone systems were installed and became operational during the CIP project to provide and improve internal company telephone service. The first was a 32-line system at the Burri Generating Station to provide telephone communication to key personnel in the operation of the station. The second was a 104-line system at the Khartoum Headquarters office intended to improve the existing internal communications within the offices at this location. During the contract, the third system was installed and placed into service at Damazine. The maintenance of all three systems was done by NEC personnel with the assistance of the Telecommunications Advisor.

The Telecommunications Advisor provided 15 person-months of technical assistance, from May 1985 to April 1986, and from October 1986 through February 1987. The training consisted of hands-on work of NEC personnel during the routine maintenance of the telecommunications equipment. Seven NEC staff have received training:

1. Mr. Emmanuel Duku - NEC Chief Telecoms Engineer trained in HF, VHF, EPBX, and Power Supplies,
2. Mr. Abdul Halam - trained in VHF,
3. Mr. George Atta - trained in VHF radio,
4. Mr. Seif - trained in HF radio,
5. Mr. Samia - trained in EPBX telephone,
6. Mr. Sala - trained in power supplies and batteries, and
7. Mr. Giffar - trained and left NEC.

On December 28, 1986, a request was made from the NEC Director-General to the mission director for the training of telecommunication personnel abroad. The training would be in EPBX and VHF systems and the estimated cost is US\$ 55,000.

A modest expansion of the telecommunications system is being planned. The preliminary cost is US\$ 150,000 and would complete the system as outlined in BNG Phase I, and expanded the system to obtain fuller coverage.

6.3.3 Purchasing and Stores Procedures

The purchasing and stores activities are funded under the Blue Nile Grid Rehabilitation - Phase II Project by a contract with EBASCO Overseas Corporation. The technical assistance is being provided to the Manager

of the Central Warehouse in Khartoum. Procedures for purchasing and stores are being reviewed, and a computerized tracking system is being proposed. Since the Ebasco work is outside the scope of the EPM project no further discussion will be provided. There has not been a need for coordination between Harza and EBASCO on this task.

6.3.4 Planning and Budgeting Procedures

Studies are performed each year to determine the budget projections for the following fiscal year. Budget amounts are based on projected kWh sales for the following year, but allowances for uncollectables are not evident. This uncollectible amount is roughly equivalent to the amount spent for fuel purchases shown in the NEC budget (NEC Joint Final Accounts for the Financial Year Ended 30th June 1986). It appears that this fuel is being paid for by GOS and added to the debt accumulated by NEC. The NEC budget comparison of June 30, 1986 shows about ten percent budget overrun; however, far less was spent on production and distribution items--fuel and power, operating materials and repair and maintenance--than expected. This was roughly offset by high expenditures for interest payments and another item shown as "net surplus/deficit" (NEC Joint Final Accounts for the Financial Year Ended 30th June 1986).

This proposed budget is reviewed by the Ministry of Finance and Economic Planning, and revised, if necessary. When adopted, these projections become the spending guidelines for the year's costs. Improvements have been observed in computer handling of budgetary items. The mechanisms are in place to provide a comparison of actual and budgeted expenditures. The only difficulty seems to be in getting accurate budget codes on input documents being used to update these records. This difficulty is being dealt with by returning an error to the user and having the corrections made by the person who reported the number incorrectly.

6.3.5 Financial and Billing Procedures

This section offers a detailed description of the meter reading, billing and collection system as it is currently practiced and notes and assesses changes being introduced.

6.3.5.1 Meter Reading

Meter readers are scheduled to read meters on a monthly basis, with reading dates to correspond roughly with working days of the month. Books containing meter cards for one day's work for each meter reader are used, but the books are in bad physical condition; pages fall out and are frequently lost. A new system has been designed and programmed however, which will provide a computer print-out to replace walk books. This system will be ready for implementation on March 1, 1987 and should improve the system by eliminating the lost meter card problem and removing the ability of meter readers to estimate reading on the basis of the previous (or an even earlier) reading. The reading system still needs considerable improvement, mostly involving general discipline of

the meter readers, but a major step will have been taken when the new system is implemented.

6.3.5.2 Electric Service Billing

Meter readings are brought to the computer center, where data entry is done. Readings are then processed and lists of questionably high or low usage accounts are printed out. These lists are forwarded to district offices where corrections are to be made, and the lists returned to the computer center, within ten days. This system has been in place for some time now, and procedures seem to be established regarding its use. After the lists are reviewed, corrections are made and bills are calculated and printed in the computer center. This high-low procedure has greatly improved the accuracy of computerized billing records because many errors can be corrected before the bill is created. This results in more credible statistical reporting. These bills are then delivered to customers by the meter readers when meters are read for the subsequent billing.

The billing process also produces reports for use by district offices and headquarters personnel. District personnel used the "bill register," which has been improved beginning November 1985, to determine the proper amount to collect or to resolve high billing complaints. The bill register is an excellent working document, which contains two years of billing history for each customer. New computer equipment is on order which will allow data entry to be done from terminals, eliminating some problems related to the use of cassettes, in addition to allowing other system enhancements. During the evacuation in 1986, billing fell behind schedule. The billing system had been reprogrammed to allow multiple months usage and billing to be averaged and distributed to proper months in computer history records. This change was made, in part, to improve the statistical usefulness of billing reports. The new billing system was put into production in February 1986 and was still in the de-bugging stage at the time of evacuation. A system of this complexity would ordinarily take several months before programs would run perfectly. The NEC programmers were relatively inexperienced at the time but were able to begin to recover lost time before Mr. Azri returned to Khartoum.

6.3.5.3 Electric Service Collections

The collection system is the most efficient of all areas reviewed. Bills are paid in district offices, where pertinent data are recorded with a cash register equipped with a cassette tape for data storage. At the end of the collecting day, totals are calculated from cash register tapes for balancing of posting records to bank deposit. Cassettes and other necessary audit information are then forwarded to data processing so that computer records can be updated. Totals are checked to assure proper posting. This system was installed early in 1985, and NEC programmers were instrumental in training the new cash register operators.

6.3.5.4 Delinquent Accounts

A special effort is now in progress to collect accounts in arrears. Customers are being notified by radio of the area of concentration of collection efforts and that disconnection will be made if past due bills are not paid. Also, temporary offices are being used in these areas, giving the customers more convenience in paying their bills. This process seems to be proceeding, but concern about accuracy of past billings causes great caution. Disconnection is made even more difficult by NEC's past failure to disconnect promptly, giving customers reason to believe that bills need not be paid.

Everything considered, the results are good, as shown in records of collections: July 1986, LS 3,100,000; August 1986, LS 2,100,000; September 1986, LS 5,500,000; October 1986 LS 5,500,000; November 1986 LS 4,250,000; and December 1986, LS 5,400,000 (NEC, December 1986).

6.3.5.5 Service Orders

Service orders are generated in the district offices when customers apply for service. At this time a check is made to be sure that service is available in the area, and confirmation by the technical department is required. If service is available, a deposit equal to an estimated three months billing is collected. In addition, the customer pays a service fee of LS 300 for three phase, or LS 100 for single phase connection. These seem to be appropriate amounts. At this point, a customer account number is acquired, a service order is prepared (in four parts), and documents are forwarded to proper departments. The NEC procedure here calls for an audit to be performed to assure that the document is properly recorded in computer records. From discussion with NEC employees, there appears to be failure to enforce this procedure strictly, possibly allowing errors to go undetected. A recent change in procedures is designed to allow a cross-check that should improve reliability of audits considerably.

6.3.5.6 Billing Corrections

Billing corrections are initiated when a high bill complaint is received and a determination is made that billing was incorrect. The correction process includes a computer transaction that updates the accounts receivable amount and corrects the previous reading. The procedure, unfortunately, does not include a correction of kWh consumption. This is significant in as much as these corrections can be for a very large number of kWh and over a period of time would distort any analytical process which used billing figures. Thus, economic planning on the basis of these figures could be dangerous. The audit procedures for corrected bills is inadequate or nonexistent. One of the new billing reports has significantly reduced the number of incorrect bills being issued and will, over time, result in better data for use in planning.

6.3.5.7 Payroll

Time cards originate from the supervisors and are sent to headquarters for processing. These documents contain information relating to type of pay (overtime etc.), work codes, and all types of allowances. A general review is done before sending time cards to the computer center, where they are entered and a computer edit produced. This edit indicates any irregularity in employee number provided on input documents and lists them for correction by the accounts department. Also, the number of hours is edited at this time. Corrections are made, and the list is returned to the computer center for final processing. A report is produced which is used by the accounts department to determine the proper amount of pay for pay envelopes and to write checks for those employees who have bank accounts (only 5% to 10% have bank accounts). This is a very bulky system, but, under prevailing conditions, it seems to be the best way to handle the payroll. Reprogramming of the payroll system was begun by the Arkel-Talab subcontractor, Sud Consult, Mr. M.I. Abusin, COP, but incomplete work was reported by Mr. Azri, who recommended that payment to the contractor be withheld until satisfactory completion of the assignment. The Mission reports that because of unsatisfactory performance, this contract has been closed without acceptance of the invoice for the last month's services. NCR is currently working on converting the payroll system to the COBOL computer language.

6.3.5.8 General Accounting

This is the area whose functioning is the most difficult to assess. In tracking reports, it is difficult to ascertain the origin of some of the figures. There seems to be great inconsistency of records that come from different sections within this area. Each report seems to be internally consistent but does not correspond with other reporting. Mr. Felix Young, accounting advisor for Haiza Engineering, completed a study of this area in November 1985. This study contains recommendations for improving work flow and enhancing the audit process, but no one at NEC was familiar with the report.

6.3.5.9 Summary

The progress made within the billing, meter reading, collecting, budgeting, and payroll systems has not been without difficulty. However, the projects taken on are of lasting value and will gradually help build a good foundation for NEC's financial soundness. Projects undertaken appear to have been selected so that the ones attempted first were the ones that would do the most good. Procedures were incorporated into the billing system that at least will make the user aware of the error conditions. For instance, meters showing high usage can now be examined before billing, preventing incorrect recording of information. Meter readers fail to read over 50% of the meters for each cycle of billing. Through computer programming, these accounts are being billed for zero usage, thus reducing revenues. This tactic should result in management's insistence on improving the meter reading program to make this balance

sheet look better. Much remains to be done before the desired results can be accomplished, but a great deal of headway can be made during the remainder of time Mr. Azri is scheduled to remain in Khartoum. Since Mr. Azri arrived as a computer specialist, project results pertaining to computer services have shown major improvement. Great care has been taken to assure that the user of each new document understands its function and is aware of handling requirements. There is a good possibility that if Mr. Azri were not to be allowed to finish his assignment in Khartoum, the improvements made to the system so far would be damaged. Plans were made in the beginning that should be followed through while the designer is still available to coordinate efforts.

6.3.6 Energy Efficiency Program

The purpose of this task was to provide technical assistance to NEC in planning, analyzing, and executing programs to improve the energy efficiency and losses of the distribution system.

Bechtel National, Inc. inspected NEC power system facilities in February 1982, to determine the equipment requirements for the CIP. Part of the inspection reviewed the 11-kV distribution system and found the general condition to be poor. The following conditions were cited in their August 1982 final report: 1) undersized conductors have been utilized, 2) feeders are over-extended, and 3) little power factor correction has been installed on either the primary feeders or on large secondary load.

Bechtel estimated the technical losses of the Blue Nile Grid system to be 15-17% with a potential improvement, or reduction of losses, of 6% possible with design changes. The largest single loss component was identified as the 11-kV distribution system. Two improvements suggested were the use of larger cable and overhead conductor sizes and the optimum location of capacitors to improve both voltage regulation and distribution losses.

The CIP procured 62.4 MVar of capacitors, worth US\$495,921, for installation by NEC. The capacitor sizes procured are shown below.

	Quantity	Size (kVar)	Type	Total (MVar)
1.	20	600	Switched	12.0
2.	12	1200	Switched	14.4
3.	20	600	Unswitched	12.0
4.	12	1200	Unswitched	14.4
5.	4	2400	Switched	9.6
Total	<u>68</u>			<u>62.4</u>

Twenty-one time controls, 21 temperature controls, cut-out fuses, and other miscellaneous parts required for installation were also procured. The Bechtel final report on the CIP shows 100 capacitors of

the 200-kVA size as being ordered, but the only place they are shown is on page 26 of Appendix C. This number does not tally with the list given above, but the reason for this 100-capacitor discrepancy could not be ascertained. The capacitors were delivered in Sudan during 1983.

The UNDP/World Bank report entitled "Power System Efficiency Study" reviewed the potential for efficiency improvement and loss reduction for the BNG (World Bank, June 1984). The following recommendations for loss reduction of the 11-kV distribution system were given: 1) installation of an estimated 40-50 MVar of static capacitors, 2) repair of substation voltage control equipment to improve voltage regulation, 3) reconductoring of overhead 11-kV lines, 4) reconductoring of secondary services, and 5) control of street lighting.

The Harza Energy Efficiency Advisor had a 1-year assignment in Khartoum from February 28, 1985 to March 1, 1986. A final report dated March 1986 and entitled "Power Factor Correction," was prepared by the advisor, documenting the year's work. The activities of the advisor were devoted to the areas of distribution system efficiency and industrial load improvement.

The distribution system efficiency was concerned with the installation of the capacitors procured by the CIP. The NEC had installed 11.4-MVar of capacitors in the fall of 1984. The advisor reinitiated the installation of capacitors in May 1985, and 18.0-MVar were installed during the remainder of that year. The advisor made comprehensive plans for the installation of the remaining capacitors during January and February 1986, and forwarded these plans to the NEC Director-General on January 2, 1986.

Appendix 5 of the Advisor's final report lists the 33 capacitor bank installations completed. Six of the banks are listed as being out of service, and one bank is listed as having one fuse element burned out. No explanation is made in the report why the banks were isolated or why the one fuse element was burned out.

As of February 7, 1987, the installation of the capacitors has not been completed by NEC because of the failures they have experienced. NEC updated their records, and in the last year, six more capacitor banks have failed and been isolated. No attempt has been made to repair the failed banks by replacing them with ones available in stores. The possible reason for the failures given by NEC was overvoltages caused by power surges. The units have been experiencing internal failures and blowing their protective fuses.

The summary of capacitor installations is shown below.

1. Capacitors in operation	19.2-MVar	30.8%
2. Capacitors isolated	<u>10.2-MVar</u>	16.4%
3. Total Capacitors installed	29.4-MVar	47.2%
4. Capacitors in stores	<u>35.4-MVar</u>	52.8%
5. Total capacitors procured	62.4-MVar	100.0%

6.3.7 Tariffs Reviewed

The long-run marginal cost tariff study took longer to complete than was anticipated. The draft report calculates a tariff rate in a 3-block structure for domestic consumers because NEC currently has a 3-block domestic structure and wanted the study done that way. NEC also specified that financial, i.e., subsidized, fuel prices be used in the calculations as well (Coopers & Lybrand, 1986). The overall tariff rate recommended by Coopers & Lybrand on the basis of these assumptions roughly doubles the pre-existing NEC domestic tariff rate, although NEC implemented a rate increase in January 1987, on its own. In the NEC rate change, the rate for the lowest block was reduced from 17 PT/kWh (piasters/kWh) to 15, the middle block remained the same at 19 PT/kWh, and the high block was raised 60% from 22 PT/kWh to 35. The marginal cost tariff recommended in the Coopers & Lybrand study left the first two blocks alone, according to NEC directives, but would raise the top block another 63% to 57 PT/kWh. The current blocks are 0-75 kWh/month, 76-200 kWh, and over 200 kWh, but Coopers & Lybrand notes that the marginal cost portion of the tariff applies only to the highest block (Coopers & Lybrand, 1986, p.V-11). They also recommend collapse of the 3-block domestic structure to 2 blocks, 0 to 25 kWh/month, and 26 kWh/month and above, and that the GOS discusses its policy of providing cheap electricity to domestic consumers.

Using NEC's actual fuel costs rather than economic costs (which would value the fuel at world prices or at least at full, local production and transportation costs) yields fuel cost inputs into the calculation exercise of only 73% of economic costs for 3500 s.e.c. fuel oil, 60% for 1500 s.e.c. fuel oil, and 152% for gasoil; NEC predominately uses 3500 fuel oil: in 1986, it used 66,560 metric tons of 1500 and 135,100 metric tons of 3500. Consequently, Coopers & Lybrand's marginal cost tariffs may be only about two-thirds of economic cost. An additional problem with the study is that the effect of theft of service is not assessed.

6.4 CURRENT STATUS OF NEC AS AN INSTITUTION

The current status of the NEC will be reviewed by discussion of the legislative responsibilities, institutional strengths, and weaknesses.

6.4.1 Legislative Responsibilities

The NEC came into being in May 1982, when it replaced the Public Electricity and Water Corporation in accordance with the National Electricity Corporation Act and the Khartoum Water Corporation act. That legislation made NEC responsible for:

1. Construction and management of the power facilities of the National grids and the Khartoum distribution area,

2. Generating and transmitting the electricity on the National electricity grids, its supply in bulk to regional administration, and the establishment of bulk supply tariffs for this purpose,
3. Establishing technical standards for electricity installations and operation to ensure uniformity throughout Sudan,
4. Providing consulting and technical services to regional electricity organizations on a commercial basis, and
5. Providing training for its own staff and for the staffs of regional organizations.

NEC is responsible for the supply of electricity where system voltage is 66 kilovolts or higher, and the regional organizations are responsible where the system voltage is 33 kilovolts or less. Consequently, NEC is responsible for the Blue Nile Grid, which has transmission voltages of 110 and 220 kilovolts, and the Eastern Grid with a voltage of 66 kilovolts. Elsewhere, the regional organizations are responsible for the supply.

6.4.2 Institutional Strengths

The institutional strengths described in this section are the improvements in electric systems reliability and GOS economic policy changes.

6.4.2.1 Short-Term Reliability Improvement

One of the purposes of the EPM project was to increase the short-term reliability of the BNG system. One measure of system reliability is a comparison of the amount of energy actually delivered with the total amount of energy which could have been delivered over a specified time. The ratio of these two quantities gives a measure of the probability that energy will be delivered to customers. This is the best measure that can be made with the available data. The specific expression is:

$$R = \frac{ED}{ET} = \frac{ED}{ED + EO}$$

Where: R - Reliability index,
 ED - Amount of energy actually delivered,
 ET - Total amount of energy which could have been delivered,
 EO - Amount of energy not delivered, and
 ET = ED + EO.

The amount of energy actually delivered, ED, is the energy customers receive and use. The amount of energy not delivered, EO, is the energy customers did not receive when there is a power outage. The total amount

of energy which could have been delivered, ET, is the sum of the energy delivered and energy not delivered.

The NEC records this information and prepares a quarterly "Summary of System Performance," which gives monthly statistics on the amount of energy generated and the amount of energy not delivered. The information is recorded by the system operators in the Khartoum Load Dispatch Center. When load shedding or an outage occurs, the operators keep track of the amount of load, in megawatts, which is shed (planned or otherwise) and the duration of the event. This information is used to calculate the amount of energy not served. An example of these quarterly statistics is shown in Table 6.1.

The quarterly statistics from 1980 through 1986 and the calculated reliability index are shown in Table 6.2. The amount of energy delivered, ED, is taken directly from the quarterly statistics. The amount of energy not delivered during generating outages, GO, and transmission and distribution outages, TO, are summed and equal to the amount of energy not delivered, EO. Figure 6.1 shows the graph of the reliability index, R, versus time and has an interesting shape. During August of each year the reliability takes a precipitous dip caused by reduced output of the Roseires Dam. The reliability continued to decrease during each August from 1980 to 1983, when the lowest reliability was 0.74. After 1983, the reliability has increased, and the lowest reliability during 1986 occurred in January 1986, when a transmission tower delivering power from Roseires Dam was down for 6 days.

Four factors can be cited in the improvement of the reliability of the Blue Nile Grid system since 1983: the implementation of a successful program for removal of silt and debris from the Roseires Dam; the commissioning of the Khartoum North Generating Station, which increased the system generating capacity; the commissioning of the second transmission line delivering power from the Roseires Dam; and the installation of 220-kV circuit breakers at Damazine Substation to increase the transmission system reliability.

6.4.2.2 GOS Economic Policy Changes

The GOS has made several economic policy changes during the past 2 years which have affected the financial operations of the NEC. The economic changes are being administered by the Ministry of Finance and Economic Planning. There have been two basic changes: 1) the requirement that NEC pay for the fuel consumed in its generating plants, and 2) the removal of subsidy payments for the operation of parastatal organizations such as NEC. The requirement for payment of fuel consumed by NEC to the Ministry of Finance and Economic Planning was instituted in 1985. The effect of this can be seen by examining Annual Balance Sheets, and observing the increase in the subsidy received by NEC. The removal of subsidy payments by the Ministry of Finance and Economic Planning to the NEC was effective July 1, 1986. This is one reason why the NEC has been interested in retaining the services of Harza in the improvement of the

Table 6.1 National Electricity Corporation
Blue Nile Grid
Summary of System Performances

	July 1986	August 1986	September 1986
- Peak power generation (MW) :	209.4	215.7	215.7
Energy generated (GWh) :	105.8	110.2	107.7
Roseires	68.5	64.0	68.0
Sennar	8.7	4.8	7.9
Khartoum North Steam	10.7	21.0	12.7
Burri Steam	9.4	11.5	7.7
Burri Diesel I & II	-	-	2.3
Burri Power III	5.9	7.1	7.4
Burri Gas Turbine	1.8	0.8	1.8
Kilo X Gas Turbine	0.4	0.4	0.4
Kuku Gas Turbines	0.3	0.5	0.4
Wad Medani	-	-	-
- Available power (MW) :	272.5	269.0	259.7
Roseires	130.0	130.0	122.0
Sennar	8.0	9.0	7.7
Khartoum North Steam	60.0	60.0	60.0
Burri Steam and Diesel	20.5	16.0	20.0
Burri Power III	24.0	24.0	24.0
Burri Gas Turbine	10.0	10.0	14.0
Kilo X Gas Turbine	10.0	10.0	10.0
Kuku Gas Turbines	10.0	10.0	10.0
Wad Medani	-	-	-
- Load Shedding (GWh) :			
Due to capacity shortage	-	0.1	0.0
Due to tr./distr. failures	-	0.3	1.0
- Fuel consumption (tons) :			
Furnace oil 3500 R	6759.0	8775.0	5739.0
Furnace oil 1500 R	3559.0	4762.0	3902.0
Diesel oil	875.0	908.0	1048.0
Gas oil	843.0	723.0	792.0
- Fuel cost (KLS) :			
Furnace oil 3500 R	2203.0	2850.0	1871.0
Furnace oil 1500 R	1213.0	1495.0	1225.0
Diesel oil	634.0	581.0	671.0
Gas oil	621.0	532.0	584.0
Total	4671.0	5458.0	4351.0

Table 6.2
ENERGY OUTAGES AND RELIABILITY INDEX
1980 - 1986

Month	Energy Delivered GWh	Gen. Outage GWh	T&D Outage GWh	Total Outage GWh	Total Energy GWh	Reliability Index
	ED	GO	TO	EO	ET=ED+EO	R=ED/ET
JAN 1980	61.177	0.077	0.258	0.335	61.512	0.99455
FEB	61.097	NA	0.030	NA	NA	NA
MAR	75.300	0.049	0.054	0.103	75.403	0.99863
APR	73.421	0.276	0.092	0.368	73.789	0.99501
MAY	76.513	0.620	0.038	0.658	77.171	0.99147
JUN	74.514	0.400	0.308	0.708	75.222	0.99059
JUL	68.405	1.703	0.489	2.192	70.597	0.96895
AUG	46.530	5.705	0.462	6.167	52.697	0.88297
SEP	63.224	0.398	0.515	0.913	64.137	0.98576
OCT	72.390	0.773	0.194	0.967	73.357	0.98682
NOV	70.390	0.435	0.188	0.623	71.013	0.99123
DEC	68.267	NA	0.092	NA	NA	NA
JAN 1981	63.744	0.010	0.075	0.085	63.829	0.99867
FEB	64.233	0.014	0.044	0.058	64.291	0.99910
MAR	75.510	0.265	0.490	0.755	76.265	0.99010
APR	72.269	0.160	0.130	0.290	72.559	0.99600
MAY	85.044	0.250	0.121	0.371	85.415	0.99566
JUN	85.720	0.400	0.480	0.880	86.600	0.98984
JUL	77.282	0.400	0.080	0.480	77.762	0.99383
AUG	63.584	9.200	0.100	9.300	72.884	0.87240
SEP	66.786	3.600	1.900	5.500	72.286	0.92391
OCT	77.684	0.737	0.600	1.337	79.021	0.98308
NOV	71.424	1.071	0.545	1.616	73.040	0.97788
DEC	74.592	0.330	0.190	0.520	75.112	0.99308
JAN 1982	67.900	0.350	0.100	0.450	68.350	0.99342
FEB	65.600	0.030	0.190	0.220	65.820	0.99566
MAR	79.500	0.480	0.130	0.610	80.110	0.99239
APR	78.600	2.060	1.055	3.116	81.716	0.96187
MAY	74.400	16.432	1.049	17.481	91.881	0.80974
JUN	74.000	12.433	0.997	13.430	87.430	0.84639
JUL	84.900	3.100	0.530	3.630	88.530	0.95900
AUG	66.200	3.600	0.140	3.740	69.940	0.94653
SEP	74.300	1.300	0.440	1.740	76.040	0.97712
OCT	86.930	1.300	0.500	1.800	88.730	0.97971
NOV	78.290	9.600	0.070	0.670	78.960	0.99151
DEC	81.900	0.900	0.100	1.000	82.900	0.98794

Table 6.2 - Continued

ENERGY OUTAGES AND RELIABILITY INDEX
1980 - 1986

Month	Energy Delivered GWh	Gen. Outage GWh	T&D Outage GWh	Total Outage GWh	Total Energy GWh	Reliability Index
	ED	GO	TO	EO	ET=ED+EO	R=ED/ET
JAN 1983	67.900	0.780	0.170	0.950	68.850	0.98620
FEB	65.600	1.520	0.500	2.020	67.620	0.97013
MAR	77.050	2.750	0.600	3.350	80.400	0.95833
APR	75.270	17.710	0.190	17.900	93.170	0.80788
MAY	86.670	9.679	0.235	9.914	96.584	0.89735
JUN	86.700	8.950	0.382	9.332	96.032	0.90282
JUL	90.230	6.990	0.320	7.310	97.540	0.96896
AUG	53.630	9.960	0.780	10.740	64.370	0.83315
SEP	66.600	22.740	0.630	23.370	89.970	0.74025
OCT	89.300	NA	NA	6.900	96.200	0.92827
NOV	86.700	NA	NA	5.100	91.800	0.94444
DEC	81.000	NA	NA	5.000	86.000	0.94186
JAN 1984	81.900	3.060	0.690	3.750	85.650	0.95622
FEB	81.080	3.040	0.310	3.350	84.430	0.96032
MAR	88.490	4.630	0.050	4.680	93.170	0.94977
APR	81.600	19.100	0.900	20.000	101.600	0.80315
MAY	82.800	20.000	0.800	20.800	103.600	0.79923
JUN	108.000	2.000	0.700	2.700	110.700	0.97561
JUL	107.200	8.500	0.900	9.400	116.600	0.91938
AUG	114.500	8.000	0.180	8.180	122.680	0.93332
SEP	100.200	9.500	0.250	9.750	109.950	0.91132
OCT	105.200	NA	0.690	NA	NA	NA
NOV	97.900	NA	0.310	NA	NA	NA
DEC	88.200	NA	0.300	NA	NA	NA
JAN 1985	104.000	2.600	0.300	2.900	106.900	0.97287
FEB	73.900	2.000	0.200	2.200	76.100	0.97109
MAR	75.600	1.000	0.400	1.400	77.000	0.98182
APR	98.700	3.900	0.400	4.300	103.000	0.95825
MAY	109.100	0.400	0.500	0.900	110.000	0.99182
JUN	105.000	0.500	0.600	1.100	106.100	0.98963
JUL	107.100	0.400	0.600	1.000	108.100	0.99075
AUG	92.400	3.600	0.200	3.800	96.200	0.96050
SEP	98.700	2.000	0.100	2.100	100.800	0.97917
OCT	112.900	0.100	0.100	0.200	113.100	0.99823
NOV	98.800	0.000	0.300	0.300	99.100	0.99697
DEC	95.200	0.000	0.500	0.500	95.700	0.99478

Table 6.2 - Continued

ENERGY OUTAGES AND RELIABILITY INDEX
1980 - 1986

Month	Energy Delivered GWh	Gen. Outage GWh	T&D Outage GWh	Total Outage GWh	Total Energy GWh	Reliability Index
	ED	GO	TO	EO	ET=ED+EO	R=ED/ET
JAN 1986	91.200	0.100	6.200	6.300	97.500	0.93538
FEB	89.500	0.100	0.100	0.200	89.700	0.99777
MAR	111.400	0.200	0.200	0.400	111.800	0.99642
APR	105.400	0.100	0.700	0.800	106.200	0.99247
MAY	112.100	6.400	0.500	6.900	119.000	0.94202
JUN	104.500	4.000	0.100	4.100	108.600	0.96225
JUL	105.800	NA	NA	NA	NA	NA
AUG	110.200	0.100	0.300	0.400	110.600	0.99638
SEP	107.700	0.000	1.000	1.000	108.700	0.99080
OCT	118.100	0.400	1.900	2.300	120.400	0.98090
NOV	106.000	0.700	1.000	1.700	107.700	0.98422
DEC	93.400	0.200	0.400	0.600	94.000	0.99362

SYSTEM RELIABILITY INDEX BLUE NILE GRID

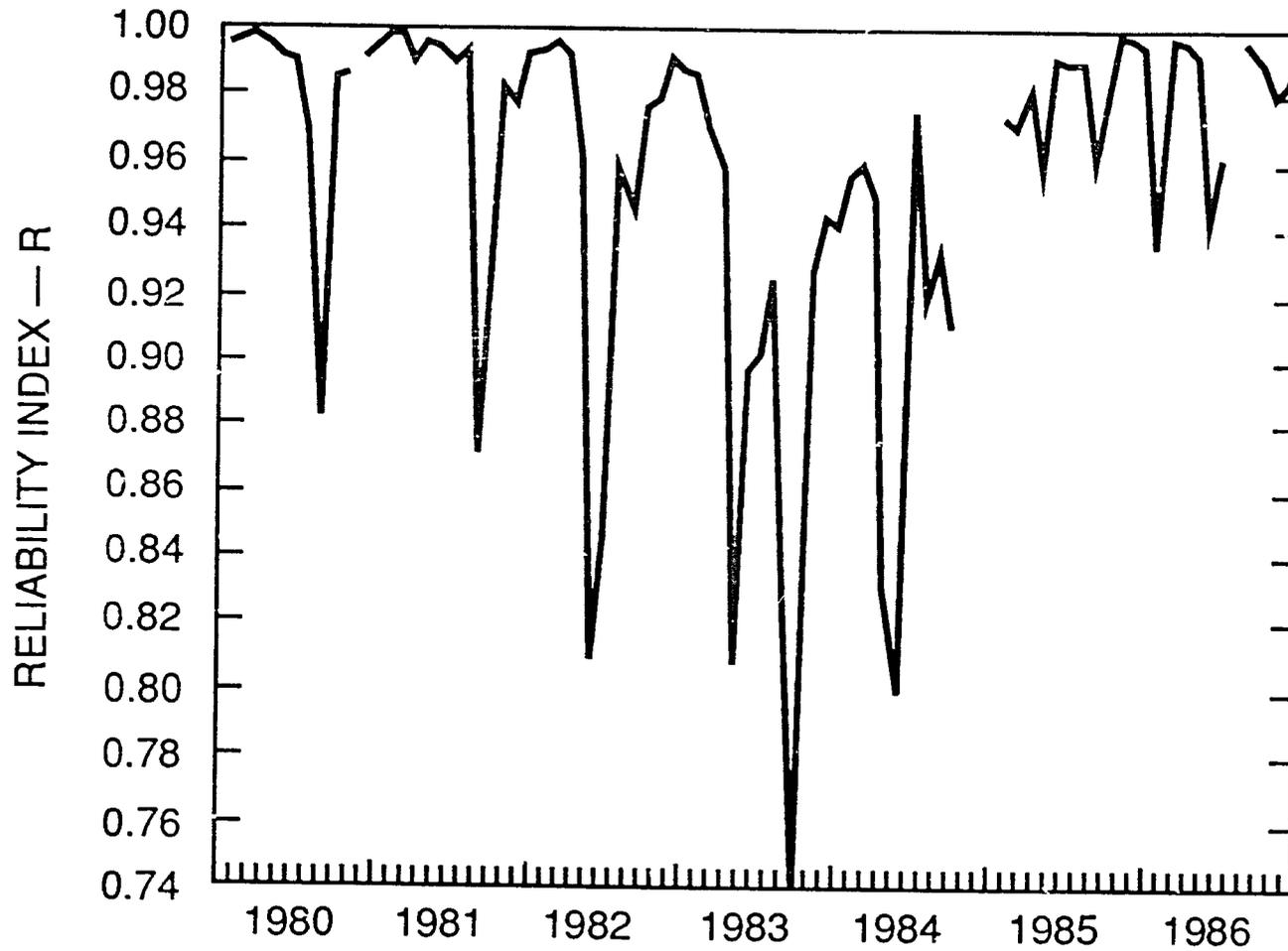


FIG. 6.1

billing and collection system. The effects of the subsidy removal are too early to determine. However, no requests for subsidy payments have been made to the Ministry of Finance and Economic Planning as of February 1987, seven months after the removal.

6.4.3 Institutional Weaknesses

The NEC is completely dependent upon foreign donor countries for its capital expansion programs. The history of power development in Sudan shows this dependence. From 1925 to 1955, the 30 years of power development by the Sudan Light and Power Company was done by an agreement between a group of British companies and the GOS. From 1962 to 1973, the Power I Project was financed by West Germany and the World Bank. The Power II Project from 1974 to 1978 was a short-term expansion program also financed by foreign donors. The Power III Project from 1979 to 1988 has an estimated cost of LS 388.0 million and is being financed by IDA, ODA, and Kfw. The Power IV Project, scheduled to begin in 1988, has been in the planning stages since 1983, and financing is currently being secured from Italy, IDA, EIB, the African Development Bank, Holland, Finland, Kuwait and the Arab Investment Bank. The estimated total is about US\$ 400 million.

The working relationship with foreign donors has drawn NEC into a mode of allowing foreign consulting firms to perform virtually all of the steps from project planning to plant commissioning. The result is that engineering and manufacturing expertise is not being built within NEC or the country to develop the power system. NEC relies upon the donor's consultants to perform the project planning, the donor's architecture and engineering firms for the detailed project designs: the equipment purchased is all of foreign manufacture, and the construction is managed by donor consultants. NEC participates in the projects by providing data, assisting with project planning, design, and construction of their power system. When new plant is placed in service, NEC assumes operating responsibility and must then learn the operation and maintenance. The Khartoum North Generating Station is a recent example of the working relationship with donors. The project was financed by the Overseas Development Administration; the consultant was Ewbank & Partners of the United Kingdom; the turn-key contractor was Northern Engineering Industries of the United Kingdom; and the project construction was managed by the Power III Project Staff which consists of NEC staff and the consultant Motor Columbus. The project staff is not located in the NEC Khartoum Headquarters, but is isolated and located in the Kuwait-Towers in downtown Khartoum. A review of the ten major components of the Power III Project repeats this pattern of dependence upon foreign power system expertise.

The provision of technical assistance for institutional building to the NEC is a new concept for them, and they are apparently having difficulty determining how to utilize effectively the expertise provided to them. The Irish Electricity Supply Board has provided assistance in the reorganization of NEC. USAID in the EPM Project has provided assistance for institution building in specific areas such as billing,

corporate planning, and energy efficiency. The most obvious example of the problems NEC is having with effective utilization of technical assistance is the lack of a person at NEC responsible for the daily activities of the EPM Project. The USAID contractors are responsible to the NEC Director General, but he cannot handle the daily activities required of such a project. Also, the assignment of NEC counterparts for the technical advisors has not been made in several instances. The result has been the loss of opportunity for NEC, as once again the foreign donor's consultant performs the work.

The need for technical assistance is great. For the reasons mentioned above, the building of engineering expertise has suffered in NEC. There is also a need for technical assistance in accounting, finance, and billing. There is expertise within NEC, but there is not a depth in expertise to sustain the organization. As a result, the time required to complete a project is lengthy. The installation of the El Bagier Substation is an example. Competent people are working on the project, but there is not a large enough pool of talent to make the project proceed at a quicker pace. Another indication of the shallowness of expertise is the inability to perform multiple projects concurrently. The installation of the remaining CIP circuit breakers is an example. The talent to design and install these breakers is occupied with the El Bagier Substation. The provision of technical assistance to the NEC should be a long term-commitment.

The NEC organization's most obvious hindrance is the long-standing problem with vacancies in higher management jobs. These vacancies cause not only the directly lost production from the absence of key personnel, but also difficulty with initiating new programs during the time of vacancy. NEC has had vacancies for quite some time in senior managerial positions. Of the five positions, three are vacant at this time, and as long as this situation continues the organization will be severely hampered. This is evidenced by the slowness with which new programs are implemented. Also, there seems to be an inability at this level to delegate authority, causing approval processes to be difficult.

Employee training programs within NEC are inadequate, resulting in more difficulty filling positions that become available from within the company. Also, no safety training is in place for employees who hold the more dangerous technical jobs. The planned completion in December 1987 of the World Bank-financed Technical Training Center located outside of Khartoum should be a good resource, if properly implemented.

Communication with employees on every level seems to be poor. The employees are not kept informed about company emphasis areas. Consequently, NEC receives much less support for these projects.

Because of the dependence upon foreign donors for capital expansion, the NEC management skills have been focused for many years upon the acquisition of new capital from donors. The efficient utilization of resources and operation of the company as a profit-making entity has been of secondary concern to the NEC management. The comparison of the very

successful courting of donors for the Power IV Project to the poor performance in collecting monthly bills is a prime example of the curious dichotomy of the NEC management performance.

6.5 CONTRACTOR PERFORMANCE

The performance of the Harza and Arkel-Talab contracts will be judged on a task-by-task basis using a 10-point rating scale. The following rating scale was used.

<u>Point Rating</u>	<u>Description</u>
10	Superior
7.5	Excellent
5	Average
2.5	Poor
0	Unsatisfactory

6.5.1 Harza Engineering Company

Harza has nine tasks defined in their statement of work, corresponding almost identically to the seven NEC project outputs defined in the project paper. The tasks and our evaluation ratings are shown below. A discussion of the rating for each task follows.

<u>Task</u>	<u>Description</u>	<u>Project Output</u>	<u>Score</u>	<u>Possible</u>
1a.	Organization and Management	1	2.5	10
1b.	Legislation and Standards	1	2.5	10
1c.	Maintenance Coordination	2	5	10
1d.	Purchasing and Stores	3	-	-
1e.	Planning and Budgeting	4	7.5	10
1f.	Financial System and Billing	5	10	10
1g.	Energy Efficiency	6	2.5	10
1h.	Tariff Review	7	5	10
1i.	NEC Microcomputers	-	-	-
Totals			35.0	70

Task 1a was judged poor for several reasons. Because of the poor recommendations that NEC had heard from a World Bank source about the qualifications of Harza as utility management specialists, the COP was never accepted by NEC. As a result, the COP efforts in this task were negated by NEC's attitude toward him. Part of the problem with NEC's initial use of Harza also came for the poor working relation between USAID and NEC in the selection of Harza. Task 1b was judged poor for the

same reasons. Also, NEC has not taken any initiative on legislative changes or drafting of standards. Task 1c was judged average. This is a coordinating task with Arkel-Talab, but there has been little need for much coordination. Task 1d was not rated because the task has been turned over to the BNG Rehabilitation - Phase II Project under the contract with EBASCO. Task 1e was judged excellent. The efforts in corporate planning were minimal, probably because of the unfavorable response by the NEC. However, the on-going efforts in improving the account to track the budget are excellent. Task 1f was judged superior. The efforts in financial forecasting were judged superior. The ongoing work in improving the billing procedures is excellent and is recognized by the NEC as extremely valuable. Task 1g was judged poor because the installation of capacitors was not completed and the causes of capacitor failures were not analyzed or reported. Task 1h was judged average because of the acceptance of the study by the NEC. However, the task consumed more contract personnel resources than was expected. Task 1i was not evaluated, because the task has been assigned to the BNG Rehabilitation - Phase II Project under the contract with EBASCO.

In summary, the overall performance of Harza is judged to be average: the work performed was either superior or poor. The performance was poor during the early stages of the contract activity and excellent thereafter. A review of the contract after completion should be very good on balance.

6.5.2 Arkel-Talab

The objective of the contract is to improve the operation and maintenance of the telecommunications and mobile equipment provided to NEC under the CIP. The contract is judged according to the areas of equipment expertise being provided to NEC.

	<u>Equipment</u>	<u>Score</u>	<u>Possible</u>
1	Vehicle Maintenance Center	7.5	10
2	Machine Shop	-	-
3	Telecommunications Center	<u>10.0</u>	<u>10</u>
	Score	17.5	20

The work being performed at the Vehicle Maintenance Center is judged to be excellent. Progress has been made in training operators and maintenance personnel despite the fact that the facilities have been under construction during the entire contract period and the power repair equipment has not been available. The building construction was not the responsibility of the contractor. Nonetheless, initiative was taken by the contractor to speed the completion.

The task of training for the machine shop has not been scored, because the shop has not been set up. Set-up was not the responsibility of the contractor and is beyond his control.

The task of training personnel for the telecommunications center is rated as superior. Six people have been trained and can carry on the activities independently.

6.6 TRAINING

The training completed and proposed by the contractors is described. The EPM project paper specified the training budget, in US\$1000, as:

Long-term	
NEA	51.40
Short-term	
NEC	229.50
NEA	336.70
Language	
NEC	22.50
NEA/GPC	22.50

Nine NEC employees were provided with some training under a centrally funded program. These sessions were attended during 1983. Dates range from May 4, 1983 to September 12, 1983, and all dealt with electrical engineering.

Harza COP Mr. John F. Sheehy, in a letter to Mr. Ahmed Khalil, Director of Training, outlined the NEC training guidelines as related to high level, middle level and basic training (Sheehy, 1985). Mr. Sheehy suggested in his letter that a detailed training program be prepared with the assistance of NEC officials.

Training experiences for NEC employees during the EPM project are as follows:

1. Khalid Mohamed El Hassan, 9-1-84 to 12-10-84, T.V.A.-utility engineering--Centrally funded by GETP;
2. Eight programmers currently are being trained in Cairo. Schooling includes: data communications concepts, VRX TRANSCO Programming, Combine Data Entry and Systems, and VRX TRANSCO Implementation. Funds are provided under the EPM project.

A request has been made for funding of training for NEC staff in accounting and financial management from American Electric Power Company. Training requested would consist of

1. Utility training: 40 sessions, 3 weeks;
2. University training: 60 sessions, 3 weeks;
3. Utility experience: 4 weeks.

This request would include eight participants at an estimated cost of US\$ 190,500.

6.7 EQUIPMENT/COMMODITY PURCHASES

Harza has purchased approximately US\$58 thousand worth of measuring and recording instruments, including maximum demand recorders, for use by NEC. These instruments are needed to determine NEC distribution network power factor improvements and power consumption data necessary to establish tariff rates for various consumer categories and to keep such data up-to-date. The equipment is in NEC stores. Harza has proposed using an instrumentation engineer on a short-term assignment to assist NEC in utilizing the equipment. Approval of the advisor has not been given as of February 1987.

6.8 USAID'S PROJECT ADMINISTRATION

The administration of the project by USAID is described by explaining the administration of the three contracts.

6.8.1 Harza Engineering Company

A Request for Proposal for "Technical Assistance to Sudan National Electricity Corporation" was issued by USAID on July 11, 1983. The closing date for the RFP was August 25, 1983. Six proposals were received and reviewed by an evaluation team in Sudan, from October 3-11, 1983. The five-member evaluation team was composed of three people from USAID, one from NEC, and one from the Ministry of Finance and Economic Planning. Three proposals were judged to be competitive and were given further consideration. The competitive proposals were ranked in the following order: 1) Stone and Webster, Inc., 2) Harza Engineering Company, and 3) Bechtel National, Inc./Coopers and Lybrand.

On December 4, 1983, three members of the evaluation team, two from USAID and one from the Ministry of Finance and Economic Planning, met and voted for Stone and Webster Inc. as the company most capable of implementing the NEC portion of the EPM project. The decision ultimately turned on the committee's judgement that Stone and Webster presented a much stronger chief of party than either Harza or Bechtel (Kranstover, December 1983).

Best and final offers were requested from the three competitive proposers by January 22, 1984. The Stone and Webster proposal, while being ranked first by the evaluation team, was by far the most expensive, the difference deriving from higher indirect costs. Given the technical closeness of the two top proposals, Harza Engineering Company was selected by USAID.

On February 15, 1984, the evaluation team leader wrote a memorandum to files describing a February 5, 1984 meeting with the NEC team member,

who was absent from the final voting and unaware of who had been selected as the contractor (Kranstover, February 1984). The NEC team member expressed his disappointment with the selection of Harza, the reasons given being that Harza was more of an engineering/construction firm than a management/consulting firm and the poor impression of the Harza chief of party.

On March 21, 1984, the evaluation team leader wrote a memorandum to the mission director to apprise him of recent developments regarding the reaction of the NEC to the Harza contract (Kranstover, March 1984). The NEC Director General was told by a World Bank official that Harza was not properly qualified to perform the technical assistance contract. The Director General also complained that he was not represented properly during the evaluation sessions.

The contract between Harza and USAID was signed on February 27, 1984 and March 12, 1984, respectively. The period of performance was 50 months beginning March 1, 1984 and ending April 30, 1988. The total estimated contract cost was US\$1,981,400, and the amount initially obligated was US\$379,000.

The Harza contract has been modified eight times in the 22 months between March 1, 1984 and December 31, 1986, an average of once every 3 months. Five of the modifications have been to incrementally fund the contract, one to correct mistakes in the statement of work, one to add a subcontract, and one to add a long term advisor and reduce the amount of short-term consultant work.

The first modification was completed on July 31, 1984, and corrected sections of the SOW which were in the RFP and bidder's proposal but left out of the original contract by mistake. The second modification, which replaced the proposed Harza financial advisor with a subcontract with Coopers & Lybrand to provide exactly the same expertise NEC would have received from Bechtel, was completed on December 27, 1984. There was no increase in estimated contract cost as a result of the subcontract, although, the subcontract was substantially more than the estimated costs Harza had allocated. The cost difference was taken up by a reduction in Harza's fixed fee. The originally proposed Harza financial advisor did not accept the long-term overseas assignment because of his wife's illness. It is interesting to note that the Coopers & Lybrand subcontract was originally contained in the Bechtel proposal, which was graded down during the proposal evaluation because the expertise of the financial advisor was not in-house but had to be subcontracted.

The third modification was completed on June 16, 1985, and added 24 person-months for a computer advisor to review, analyze, and assist in computer automation of the NEC billing process. The amount of short-term expert assistance was reduced from 39 person-months to 15. No increase in the estimated contract cost resulted from the changes in personnel allocation.

The fourth contract modification was completed on June 26, 1985, and increased the amount obligated by US\$285,000 from US\$379,000 to US\$664,000. The fifth contract modification was completed on November 28, 1985, and increased the obligation of the local currency funding by LS 600,000 from LS 360,000 to LS 950,000. The sixth contract modification was completed on February 18, 1986 and increased the amount obligated by US\$336,000 from US\$664,000 to US\$1,000,000. The seventh contract modification was completed on September 24, 1986 and increased the amount obligated by US\$330,100 from US\$1,000,000 to US\$1,330,100. The eighth contract modification was completed on December 27, 1986 and increased the amount obligated by US\$175,000 from US\$1,330,100 to US\$1,505,100. A ninth contract modification is being approved by USAID and NEC to obligate funds to allow contract work to continue until June 30, 1987.

A review of invoices submitted by Harza from March 1, 1984 to November 30, 1986 shows a total of US\$1,391,274.10 billed. The average invoice is US\$66,251.15 during this 21 month period. Total funds of US\$1,505,100 have been obligated in 5 increments, for an average increment of US\$301,020. The average amount of time between funding increments is 4.5 months. It is difficult to conceive how a contractor can successfully perform a 50-month effort with a 4.5-month time horizon.

6.8.2 Arkel-Talab/O&M

A Request for Proposal for "Operation and Maintenance Advisory Services for the National Electricity Corporation" was issued by the USAID Mission to the Sudan on August 26, 1984, with a closing date of September 30, 1984. The RFP sought proposals from United States (or U.S./Sudanese joint venture) firms or institutions interested in providing services. No qualified firm submitted a proposal, but a technically acceptable proposal was received from Arkel-Talab Cargo Services, Limited which is incorporated in the Sudan and is fifty percent beneficially owned by the U.S. firm of Arkel International and fifty percent by Sudanese nationals.

A contract was negotiated between Arkel-Talab and USAID and signed on December 30, 1984 and January 6, 1985, respectively. The period of performance was 26 months, beginning January 1, 1985 and ending February 28, 1987. The estimated contract cost was LS 3,002,175 and the total amount was obligated.

The first contract modification was signed on May 16, 1985 and obligated US\$250,000. The obligation of US dollars was due to a change by GOS in currency regulations, which prohibited the contractor from converting Sudanese pounds to US dollars. The budget was used to cover expenses from February 9, 1985 until October 31, 1985, anticipating a change in GOS regulations.

The second contract modification was signed on December 4, 1986. The modification revised the local currency budget to allow for the

payment of U.S. dollar direct costs in Sudanese pounds at the highest legal rate after the expenditure of the amount obligated in U.S. dollars.

A PIO/T was signed on January 4, 1987 to extend the contract from March 1, 1987 to June 30, 1987. The estimated contract costs was increased to LS 3,266,073. A review of the invoices shows LS 2,332,103 billed through December 31, 1986.

6.8.3 Arkel-Talab/CS

A contract for assistance in computer programming was signed on November 18, 1984 between Arkel-Talab and USAID. The contract specified twenty-four person months at a total of LS 200,000. The contract was comprised of computer support services to NEC for the purpose of converting computer programs to the COBOL language to provide more consistency. The first PIO/T was signed on September 27, 1984 obligating funds in the amount of LS 200,000. A second PIO/T of May 30, 1985 obligated an additional LS 8,000. This was to extend the time allotted for the project by 320 hours. A third PIO/T obligated LS 12,000 additional funds and added another three person-months to previous specifications. This project was subcontracted by Arkel-Talab to a local company called Sud Consult. Mr. M.I. Abusin, in his final report, cites difficulty due to intervals in which the original plan was abandoned (Abusin, December 1985). Mr. Shamshad Azri, COP for Harza who is directing the overall computerization of NEC procedures, felt that payment should not be made because the contractor's work was incomplete and retarded the overall effort. Final payment was not made, and NCR has now been contracted to complete the rewrite process.

7. THE ISTI CONTRACT

The EPM Project was amended to include a separate contract through the International Science and Technology Institute (ISTI) to place a long-term energy advisor within USAID. This advisor was to manage the EPM Project for the Mission, and to assist the Mission in any other energy-related question. This component of EPM has been perhaps the most successful, and deserves extension until the PACD.

The ISTI contract appears to have had an unrealistically large scope of work. The general scope of work was to "conduct organizational, technical, financial and social analyses of ongoing and proposed activities of the USAID/Sudan energy program. These analyses will define the costs, benefits and potential impact of GOS and USAID interventions in the energy sector." The scope of work follows with a list of fifteen "specific tasks" for which the contractor was to be responsible, on an "including, but not limited to" basis. It is a truly staggering list of tasks, including "... evaluation, on a national and regional basis, of the organizational and administrative capabilities of the GOS to carry out ongoing and proposed projects ...; analyses of past and probable future performance of Sudanese institutions in energy sector activities; draft sections of Country Development Strategy Statement ...; reviews of energy and engineering activities ...; designs for new energy/engineering activities and/or the energy/engineering components of other activities. The designs will include analyses of those activities' economic, social and administrative feasibility; Quarterly lists of analytical resources with Sudanese and American academic communities; Recommendations regarding all aspects of the implementation of existing and proposed energy projects; Assessments reviewing the current state ... and potential of the energy sector ...; biannual reports which identify the planning and programming activities to which other USAID resources might contribute ...; Assessments which examine potential renewable and nonrenewable energy resources in Sudan ...; two annual bibliographies (one each year) of publications and other data relevant to the Sudanese energy sector; ... Quarterly reports describing and analyzing GOS policies and programs in energy production and development with recommendations ...; Two annual reports which summarize contract activity for the preceding year ..." (USAID, April 1983, pp 2-4). The scope of work specified some forty-seven reports, reviews, and assessments, in addition to quarterly and annual reports in the initial two-year contract. The contract was amended six times to increase funding and extend the contract's completion date. PIO/T No. 650-000-3-30004, March 6, 1983, included a statement of work which assigned this contractor "primary monitoring and technical responsibility for the bilateral Rural Renewable Energy and the Energy Planning and Management Projects" (USAID/Khartoum, March 1983, Attachment 1), as well as six other major duties.

The Sudan Mission's substantial energy portfolio, including the bulk of the CIP program, required technical skills within the Mission. While the Mission could rely upon the Regional Economic Development Support

Office (REDSO) in Nairobi for some assistance, the scale and technical nature of the power component of EPM and the CIP Program demanded an in-country presence that could not have been filled without the hiring of an energy advisor.

The ISTI contract appears to have been a valid and effective mechanism, however, ensuring quality and continuity. If the energy advisor position had not been filled, or if someone without the technical qualifications or dedication of the present advisor had not been identified, there is a distinct possibility that the power system component of the Mission's portfolio would have been severely affected.

In hindsight, given the breadth and complexity of EPM, the Blue Nile Grid Rehabilitation, and SREP, the Mission should have developed an energy office, staffed with at least one local hire project assistant, to help the Energy Advisor in project implementation and oversight, as well as an economist to track NEA policy issues. In addition, more time of the PDO should have been allocated to the day-to-day management of the EPM, in particular during the critical time between long-term chiefs of party.

While records concerning the allocation of trust funds certainly have not been adequate, we believe that it is unrealistic to expect the Energy Advisor to undertake routine project tracking duties in addition to the daily technical oversight required for EPM, the Blue Nile Grid Rehabilitation, and the Roseires Dam dredging operation.

Energy is an intersectoral commodity, and cannot be overseen easily by one individual. This is particularly true for a Mission such as Sudan, where the portfolio includes power generation and transmission, tariff studies and public utility management, energy planning, renewable energy R&D, and forestry. The Energy Advisor has done an admirable job in the full range of topics.

The Energy Advisor has emphasized oversight in the power sector and has requested assistance in other areas from REDSO and elsewhere when needed. It may have been prudent for the Mission, however, to have requested more assistance from REDSO or the services of a local hire for oversight of the NEA portion of the EPM Project. We recommend that additional assistance be provided to the Energy Advisor through the hiring of a local specialist, whose task would be to assist the Advisor in the routine administration of the EPM, and coordinate with the PDO involved with EPM and SREP.

The Energy Advisor plays an important role in the Mission, beyond simple oversight of the EPM. This role is exemplified by the first rate oversight of the Roseires Dam dredging and mobilizing Mission response to short term crises (such as debris in the Roseires Dam, and the potentially severe power cuts in the Spring of 1987 due to drawdowns in the Roseires Reservoir), as well as longer term strategies (such as assistance in designing the Mission's petroleum initiative).

Even if the Mission proposes to withdraw from a major role in the power sector, the dominant role of energy in the Sudanese economy requires, in our opinion, the availability of expert advice within the Mission. The Energy Advisor position is a cost-effective way of providing this assistance.

8. DEVELOPMENT IMPACTS

The most tangible impacts of the EPM project will come from the NEC component, which has helped supervise installation of critically needed hardware for the Blue Nile Grid and is still working to install a computerized billing and collection system which is crucial to the financial viability of NEC and is important to Sudan's international indebtedness.

One measure of the immediate impact of the NEC component is the value of improved collections. In 1984/85 (July 1 - June 30), NEC collected 37% of its total billing, and in 1985/86 (July 1 - June 30), collected 44%. There is no reason to suspect that NEC's collection would have been better at all in 1985/86 without the project's intervention; i.e., we assume the difference between 37% and 44% is not simply attributable to random variations. We have no way of assessing this assumption statistically, but it seems circumstantially appropriate. The World Bank prompted NEC to begin disconnecting nonpaying customers, but that effort did not begin until July 1986. Shamshad Azri began work in the computerized billing and collection in 1984, and came to the project full-time in July 1985. Thus, the World Bank intervention occurred after the observed collection increase reported here, and the timing of the Harza contract under the EPM fits the observed pattern. Had NEC collected only 37% of the larger billing of 1985/86, it would have pulled in LS 8.8 million less revenue, or US\$2.9 million at an exchange rate of US\$1.0 = LS 3.0. We attribute roughly US\$170 thousand for one year of Azri's costs, which includes, salary, overhead, pay differential, and fee. If GOS funds to support people working with Azri matched the cost to USAID, which is a stringent assumption, USAID received an 853% rate of return on its investment in the first year of this activity. If GOS incurred no costs, USAID's first-year rate of return was 1,706%. For cost-benefit ratios, these are hard to beat. If similar or even improved collective rates persist into the future, this rate of return will increase. The benefits of the equipment installation, repair, and improvement maintenance from the NEC component are easily assessable in principle, but the evaluation team did not have the resources to obtain the relevant data.

From USAID's perspective, however, the important question is the permanence of these benefits. The improvement in collections seems the least sensitive to erosion after the end of the project. The benefits will be readily apparent to NEC, although without ministerial pressure, there may be little internal motivation to ensure that they continue; a concern for profitable operation may need to be enforced on NEC for a while. However, the World Bank is making its support contingent upon collection-related activities, and other donors may do the same, so enough incentives to maintain the improvements may exist for NEC to keep the new system operating. On the continuation of the vehicle and equipment maintenance activities after the end of USAID support, we are more agnostic.

On the NEA side of the Project, benefits from a strengthened energy planning institution which is able to contribute useful ideas for the development and implementation of national energy policies are elusive but potentially enormous. It is unnecessary for NEA to be the sole contributor to improved energy policies for the benefits from its contributions to have large pay-offs. After all, one-third of Sudan presently is desert or semi-desert, and approximately another quarter and a third is threatened with decertification from continued deforestation; the benefits from forestalling even part of this promise to be large.

9. LESSONS LEARNED

Most of the lessons we draw from the EPM Project probably have been drawn before, from experience with another project, perhaps many times from many projects. However, if the same problems are arising, the lessons may be worth repeating. With this humility about reinventing wheels, we discuss a few such lessons that may be worth considering in the design and execution of other projects.

1. Do not try to have one person oversee such technically diverse and internally complex projects as the EPM. Reasoning behind putting the NEC and NEA/GPC components together in one project may have been to secure coordination between the development of several institutions in the energy sector of a single country, institutions that ought to be coordinating activities among one another. This is not an unreasonable idea, but in fact, the coordination required and/or desired may be minimal, and even if it is important, it may be too complex to manage as a single project. Such coordination should be considered at the level of the Mission Energy Office, provided the Mission Energy Officer is not already managing both projects.
2. USAID should expect to have routine administrative matters handled uneasily at first by a young and/or ill-developed institution such as would be the appropriate recipient of an institution-building project. It is good to have administrative details go smoothly, but when the purpose of the project is to teach unfamiliar administrative and managerial principles, it is unreasonable to expect the pupil to get it right from the very beginning. Frustration at USAID is understandable but is probably counterproductive.
3. Do not prescribe as large a number of output-type tasks in the project paper of an institution-building project as were included in the NEA component of the EPM Project. There appears to be a tendency for a contractor/resident advisor for a host institution to focus on satisfying the tasks in a statement of work and forget what the overall project objectives were. Probably, the larger the number of specific tasks included in a project paper in the first place, the larger is the number of them that make marginal contributions to the success of the project. Nevertheless, it would take a bold contractor to ignore them, and it well may be less trouble to do them than to get them amended.
4. In an institution-building project, strive to get in the project paper, or the statement of work, or contractor proposals, or somewhere, a larger-scale, conceptual organization of the problems the host institution is supposed to deal with in its mission. Young organizations, in the energy sector at least, seem to have a tendency to rush off in all directions at once, with limited institutional effort devoted to thinking clearly about

national-level priorities in the energy sector. This may mirror the availability of hard-to-pass-up, donor funding for gadgets in a certain energy area, administrator's efforts to keep staff occupied, or other events that it seems reasonable to follow at the time, but when they are all put together, leave an incoherent institutional program. It would be very useful for USAID to help the contractor and the institution conceptualize the host institution's target problem -- not the institution's mission, but the general problem at which the mission is directed -- so that the institution, with the contractor's assistance can assign priorities to its own tasks. (For instance, NEA's mission includes studying energy technologies and energy policies and making recommendations regarding energy policies. NEA's target problem is energy in general in Sudan, including topics under the jurisdiction of GPC, NEC, the Ministry of Finance, the Renewable Energy Research Institute, and the Forestry Bureau of the Ministry of Agriculture. These energy topics, which are segmented bureaucratically, are much more interrelated in fact, and NEA should conceptualize Sudan's energy problems panoramically rather than along bureaucratically defined lines.) This can help the host institution take charge of its own house rather than be swung around in the winds of available donor funding for interesting work in tangentially-related areas of secondary importance to the host country. We recognize that prior conceptualization can cause serious problems if strongly held preconceptions are wrong and are not quickly revised. Consequently, earlier project planning phases such as the project paper or the statement of work may not be the best places to attempt comprehensive and specific conceptualization of problems, but without clear conceptualization at early stages, a project may miss its mark altogether. Consequently, we encourage early conceptualization by the project designers as well as continuing attention to conceptualization by implementors to ensure adequate fit between project and problem during execution.

5. Encourage the resident advisor contractor in an institution-building project, such as E/DI at NEA, to advertise its activities to all the members of the host institution, even -- even especially -- to staff not directly involved with the project. We were surprised at the misconceptions among staff members at NEA about what the EPM Project was trying to accomplish; who was being supported how much to do what, who was getting trained and thus primed for promotion, what the credentials of the contractors were (i.e., "Why should we listen to them?"), and general suspicions that when they were being told so little there must be something good they're getting left out of. These are not uncommon rumblings among staff of any institution with a morale problem, but many of them could be eliminated or redirected more productively with a little well-timed and friendly information. The project itself could actually benefit from the informed ideas of staff members not directly supported by it but interested or indirectly associated with topics of mutual interest.

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APPENDIX 1

List of Acronyms

BNG -	Blue Nile Grid
CIP -	Commodity Import Program
CFA -	Central Forestry Administration
COP -	Chief of Party
E/DI -	Energy/Development International
EPM -	Energy Planning and Management Project
ERC -	Energy Research Council
ESB -	Electricity Supply Board of Ireland
GOS -	Government of Sudan
GPC -	General Petroleum Corporation
IBRD -	World Bank
IES -	Institute for Environmental Studies
MEM -	Ministry of Energy and Mining
NEA -	National Energy Administration
NEC -	National Electricity Corporation
NRC -	National Research Council
PIO/C -	Project Implementation Order/Commodity
PIO/T -	Project Implementation Order/Technical Services

PPS -	Project Paper Supplement
REDSO -	Regional Economic Development Support Office
RERI -	Renewable Energy Institute
S&T/EY -	Office of Energy, Bureau for Science and Technology, USAID
SEPAP -	Sudan Energy Policy and Planning Project
SOW -	Statement of Work
SPDP -	Sudan Petroleum Development Project
SREP -	Sudan Renewable Energy Project
TA -	Technical Assistance
USAID -	U.S. Agency for International Development
WNPC -	White Nile Petroleum Co. Ltd.

APPENDIX 2

List of Persons Interviewed

USAID/W

Mr. John B. Slattery - Bureau of Africa/Sudan Office (AFR/EA) -
Mr. Weston A. Fisher - Bureau for Africa/Energy Advisor (AFR/TR/SDP)
Mr. Warren Rush - Bureau for Africa (AFR/GA)
Dr. David Jhirad - Office of Energy, Bureau for Science and Technology (S&T/EY)

USAID/Khartoum

Ms. Valerie Dickson-Horton, Associate Director, Project Operations Office
Mr. Blaine Jensen, Mission Evaluation Officer, Economic Policy and Planning Office
Mr. Jay Carter, Energy Advisor (ISTI)
Mr. Richard Macken, Assistant Project Development Officer
Mr. Dean Moody, Acting Chief, Engineering Office
Ms. Donna Stauffer, Project Design and Implementation Office
Mr. Azhari Karim, Project Design and Implementation Office
Ms. Ravindar Aulakh, Economic Policy and Planning Office
Ms. Annl W. Shugart, Chief Voucher Examiner, Controller's Office
Ms. Cecile E. Robles, Controller's Office

Ministry of Energy and Mines

Dr. Adam Mousa Madibu, Minister

National Energy Administration

Dr. Abdel Rahman Ali Shulhi, Director

Mr. Ismael El Gizouli, Associate Director, **Head of Planning Unit**

Ms. Maha Mohamed Ahmed, Information

Mr. Abdel Salaam, Information

Mr. Abdullah Osman, Regional Planning

Mr. Saleh Ali, Regional Planning

Mr. Ibhramin Hussein, Computer Unit

Mr. Mohamed Seleh Farah, Pricing

Mr. Gamal Osman, Pricing

Mr. Hyder Daoud, Pricing

Mr. Mohamed El Hakim, Conservation

Ms. Maha Ali El Sayed, Conservation

Mr. Ahmed Abdul Chader Abu Samm, Projects

Mr. Abdullah Mohamed Abdullah, Projects

Mr. Abdullah Mohamed El Hussein, Projects

Mr. Marun Osman Sar, Electrical Engineer

Mr. Bahri Osman Mamid, Techno-Economic Studies Division

Ms. Kawther Abdel Gadish, Techno-Economic Studies Division

Ms. Kawther Madani, Techno-Economic Studies Division

Energy/Development International (EDI), Contractor for NEA Component of EPM

Mr. David Pluth, Chief of Party

Dr. Mir Heydari, Senior Advisor

Mr. Sandy Hale, President

Mr. Paul Cough, Senior Economist

International Science and Technology Institute (ISTI)

Mr. Jay B. Carter, Energy Advisor, USAID/Khartoum

Harza Engineering Company, Contractor for NEC Component of EPM

Mr. Shamsad Azri, Chief of Party

Arkel-Talab

Mr. Terry Burrows, Vehicle Maintenance

Mr. Mike Rouse, Vehicle Maintenance

Mr. Tony Anagnostou, Telecommunications Workshop

Ebasco Service Company

Mr. Tom Jones

Mr. Ronald P. Isaacson

Chicci Inc.

Dr. William M. Bateson, Chief of Party, USAID Agricultural Planning and Statistics Project, Planning and Agricultural Economics Administration

Ministry of Finance and Economic Planning

Dr. Said Zaki, Undersecretary for Planning

Mr. Abdullah Omer, Deputy Undersecretary for Energy

Mr. Abd Elrahim El Sheik, Deputy Undersecretary, Public Corporation
Department

Renewable Energy Research Institute

Dr. El Tayeb Idriss Eisa
Mr. Gafaar El Faki

Management Development Center

Mr. Ali Ahmed Osman
Mr. Ali Abdel Karim

National Electricity Corporation

Dr. Abdel El Latif Ibrahim - Director General
Mr. Ahmed Khalil - Director of Training
Mr. Ahmed Babiker - Director of Public and Media Relations
Mr. Ahmed Zulfu - Director of Administrative Affairs
Dr. John Gindi - Director of Corporate Planning
Mr. Omar Fadalla - Director of Commercial
Mr. Ismael Babiker - Director of Finance and Administration/Khartoum
Mr. Kamal Natig - Senior Director of Finance and Adm.
Mr. Hamed El Mamoon - Senior Director of Khartoum Province
Mr. Al Gafaar - Manager of Transmission Division
Mr. Awad Ibrahim - Operation Manager, Computer Services Division
Mr. Al Sarrag - Burri Generating Station Manager
Supervisor of Maintenance, Khartoum North Generating Station
Mr. Mohamed Nasr - Khartoum North Area Manager
Mr. Khalil - Omdurman Area Manager
Ms. Bella Abdalla - Financial Management Division
Mr. Abdoullah Mohamed Ali - Accounts Division

Ms. Hameda - Cost Accounting and Budgets Division

Ms. Alawia - Statistical Accounting

Mahmoud Shrif - Distribution Standards

Khartoum Area Engineer

Mr. Mohamed Tineer and Mr. Mohamed Ahmed Mirgani - El Bagier Substation
Engineers

General Petroleum Corporation

Mr. Abdel Fatah Mohammed Saleh, Director General

Mr. F. I. Zaki, Director of Administration

Mr. Hassan Elzubei El Tahir, Refining, Distribution and Marketing

Mr. Salah M. Abdel Gadir, Training

Mr. Alam M. Abdel Bagi, Exploration and Production

Mr. Abdelmutool Osman, Refining, Distribution and Marketing

Mr. Ibrahım Mohamed El Nasr, Finance

Mr. Ahmed Hassan Ali, Planning

Mr. Omer Mohammed Ibrahim, Commercial Department

Mr. Abdul Rahman M. Eltilib, Pipeline Company

APPENDIX 3

NEC Facilities Visited

Billing Computer Center

Burri Generating Station

Burri Substation

Central Load Dispatch Center

Central Warehouse

El Bagier Substation

Khartoum North District Office

Khartoum North Generating Station

Kilo X Gas Turbine

Kilo X Substation

Kuku Gas Turbine

Kuku Substation

Meter Testing Shop

Omdurman District Office

Telecommunications Workshop

Vehicle Maintenance Shop

APPENDIX 4

STATEMENT OF WORK FOR MID-TERM EVALUATION OF SUDAN ENERGY PLANNING AND MANAGEMENT PROJECT

A. The Evaluation Team is to:

1. Review all project documentation, including reports, final evaluation and other materials from any related previous projects, such as the energy policy and planning project (936-5703)
2. Review project paper, grant agreement, contract, quarterly reports, project implementation letters, and other documentation related to EPM.
3. Interview all relevant personnel in the GOS, USAID, and the Contractor Teams.

B. The general approach incorporated in the PES Format will be followed. This would entail critical review of the goal, objectives, strategy, inputs and outputs of the EPM as a whole, as well as for each component. In addition, the team will consider the following specific issues and concerns:

C. General Consideration

Evaluate the structure of the project as originally designed. Was it useful to have different components under one project, but with different contractors? If not, what negative results have been experienced? Are there any changes in project structure which would improve the administration and implementation of the project?

Are the original objectives of the EPM still valid, given the present and potential economic and political environment in Sudan? How have the roles of the various agencies involved in the EPM evolved?

Has the project improved the viability of the various agencies? What has been the relationship between the contractors and their counterparts, and what, if any, changes are recommended? How could the contractors have been more effective in bringing about improved staffing and better management practices?

In addition, several general concerns identified in the project paper and the project paper supplement should be addressed:

- (1) The impact of the immediate short-term assistance.
- (2) The provision of advisory services and training by the contractors.
- (3) The extent of coordination by the contractors.
- (4) The appropriateness of the relative project contributions to the NEC, NEA, and the GPC.

D. NEA

Have the EPM and NEA made effective use of the previous Energy Policy and Planning Project? Is the NEA a viable institution at this time? Should the EPM role in meeting project objective be revised? Should the project objectives and strategy be altered to reflect the realities of the NEA?

What is the relationship between the contractor and the NEA, and how could their relationship be enhanced? How are NEA funding decisions made?

E. N.E.C.

To what extent has the EPM contractor been utilized by NEC? Is there sufficient coordination between the EPM and the Blue Nile Grid project? What changes in activities would most benefit NEC?

APPENDIX 5

CRITIQUE OF THE LOGICAL FRAMEWORK OF THE PROJECT PAPER

The program or sector goal and the two project purposes are appropriate to both the 1982 and present energy situation in Sudan. The project or sector goal is to ease energy-related constraints to development and to contribute to the satisfaction of longer-term energy requirements for development, i.e. looking to an orderly long-term development while recognizing the short-term exigencies Sudan is facing in energy. The project purposes were consistent with the program or sector goal: (1) to increase short-term reliability of the Blue Nile Grid and improve the managerial and financial capability of NEC to generate, transmit and distribute power; and (2) to improve the capability of NEA and GPC to plan for more efficient energy use in Sudan. However, at the project level, the outputs suffer problems of clarity, verifiability, plausibility, and arbitrariness.

The most critical problems with the logical framework involve the "important assumptions," from the program or sector goal level to the project component level. Many of the assumptions identified as required for success of the project were implausible at the time of writing of the project paper. The total effect of these assumptions is to largely assume away important causes of underdevelopment. Throughout the important assumptions and the project outputs are implicit and explicit assumptions that organizational restructuring will occur as smoothly as clockwork, that government agencies will cooperate with one another, and generally that Third World concepts of rationality are the same as the Western World's. Experience has shown these beliefs to be patently false. At less abstract levels, there are assumptions that are very specific technically but are simply false and were commonly known to be false at the time of composition of the project paper. For example, one of the "important assumptions" for success of the NEA component was that the demand for electricity on the Blue Nile Grid would either remain constant or grow proportionally to the grid capacity growth. The salient fact of electrification in developing countries is that demand growth almost immediately swamps new capacity and that grid extensions bring forth more demand than was anticipated. The problem is usually one of pricing, in which the demand for an underpriced good, physical access to which is difficult to restrict, both exceeds and erodes supply capacity. This is to be expected with typical Third World electricity pricing.

Many of the project outputs appear to be drawn from the contractor obligations specified in the work statements. It is not clear that these contractor duties are properly interpreted as project outputs, although some of them are relatively easily observable.

Overall, the higher level goals of the project were appropriate to Sudan's circumstances, but the specific project outputs were naively high and often assumed away the existence of the circumstances which the

project was implemented, if not designed, to change. The explicit "important assumptions" are not well conceived, and if they were seriously believed to be required for the success of this project, the project never should have been undertaken. To believe that these "important assumptions" really were necessary to the success of the project would involve one in a catch-22: the problem to be solved cannot exist if the project is to be successful. What these "important assumptions" appear to have done, however, is to raise the expectations of project outputs unrealistically and to encourage frustration of USAID with completely expectable implementation problems.

The following sections review the goals, outputs, objectively verifiable indicators (OVI's), means of verification, and important assumptions. Each item is paraphrased from the project paper (USAID/Khartoum, 1982, pp. 62-67) and is followed by a commentary phrase or sentence marked with an asterisk (*).

I. PROGRAM OR SECTOR GOAL

Program or Sector Goal

1. Ease energy-related constraints to development and contribute to longer term energy requirements.
* OK

Objectively Verifiable Indicators

1. Improved GNP in energy sensitive sectors.
* Not necessarily attributable to energy changes.
2. GNP/energy consumption increases.
* Measurement and attribution problems.
3. Energy allocations correspond to national and regional development priorities.
4. Types of energy consumed recognize environmental and economic constraints in Sudan.
* Vague. Fails to recognize tension between these 2 constraints.

Means of Verification

1. Energy supply/demand analysis.
* No clear relationship to anything.
2. Economic and energy statistics.
* OK.
3. GOS energy management plans and programs.
* Possibly.

Important Assumptions

1. Real oil prices stable for next 5 years.
* Possible to believe at time of Project Paper writing.
2. Sufficient foreign exchange available for oil purchases.
* Only marginally plausible.
3. Hydro and thermal electric power plant construction remains close to schedule.
* Not highly plausible.
4. MEM has authority to implement its plans and policy.
* Implausible if MEM ideas diverge from those of rest of GOS.

II. PROJECT PURPOSE

Project Purpose

- a. Increase short-term reliability of BNG and improve managerial and financial capability of NEC to generate, transmit and distribute bulk power.
* Fine.
- b. Improve capability of NEA and GPC to plan and prepare for more efficient energy use in Sudan.
* Fine.

OVIs: End of Project Status

1. NEC reliability improved by
 - a. Improved NEC organization and management structure.
* Hard to quantify.
 - b. Orderly maintenance and repair schedule.
* Measurable - good indicator.
 - c. Effective use of spare parts provided by CIP.
* Measurable - good indicator.
 - d. Improved cash flow from improved collections.
* Measurable - good indicator.
2. NEA to be capable of planning and advising on implementation of optional energy policies for Sudan.
* Hard to measure; excessively optimistic.
3. GPC to have reviewed planning techniques and policies to import, process and distribute petroleum products in an orderly fashion.
* Vague.
4. Public corporations, government institutions and large private companies will use energy supplies more efficiently.
* It is unlikely that adequate rewards to establish this would be available.
5. Commercial and financial arrangements for distribution, service and financing of cost-effect and energy-efficient equipment will have been strengthened.
* Hard to quantify.

Means of Verification

1. NEC and GPC operating and financial work.
 - * Plausible for a developed country but not in this case. "Before" data probably unavailable or unreliable. The improvement of data may actually make the situation look like it has deteriorated.
2. NEA data studies and recommendation.
 - * OK.
3. Project Evaluation.
 - * Possible.
4. Energy consumer needs of productive and energy use.
 - * Unclear but unlikely to exist if its meaning were clarified.
5. Contracts and agreements between oil companies and GOS.
 - * Relevance is unclear.

Important Assumptions

1. NEC able to generate and retain operating revenue to satisfaction of GOS.
 - * Unclear what is meant by "to the satisfaction of GOS". The satisfaction of GOS may have nothing positive to do with the financial viability of NEC.
2. Policy analysis and planning functions of NEA are accepted by GPC, NEC and other sections of MEM.
 - * Implausible for a new, resource-poor agency to exert major political influence soon after establishment.
3. GOS implementation of regional government programs conducted in a clear and timely manner to permit project to respond accordingly.
 - * The empirical grounds for such an assumption are highly questionable. If the governments were capable of doing this they probably wouldn't have the problems the project is trying to remedy.
4. Trained individuals return to their posts in MEM.
 - * Experience shows this is less than 100%, often far less.

III. PROJECT OUTPUTS

A. NEA

Outputs and OVIs

1. Adoption of and orderly transition to new organization structure.
No output magnitude.
* Assumes away the development problem.
2. National energy planning and evaluation functions consolidated at NEA. No output magnitude.
* Unclear.
3. Ten energy analysis and policy option papers prepared.
* Verifiable, but the number is arbitrary and does not appear to be based on either resources available or problems to be studied.
4. Detailed energy plans completed and reviewed annually. Once per year.
* No allowance for learning and coordination problems.
5. Recommended policies and plans implemented.
* The anticipated lack of interaction of policy implementation with politics is naive.
6. Capacity for computer-assisted data processing and analysis expanded. Magnitude of 5 people.
* Unclear whether the 5 people are supposed to know how to use a computer for word processing, games, or economic or engineering analysis.
7. Plan for regional energy allocation developed. One plan.
* Verifiable, but choice of number is not logically obvious.
8. Energy pricing and regulations in accordance of national development priorities implemented. Two reviews of pricing and regulation.
* Relationship between output and OVI is unclear. Otherwise politically naive.
9. Fuelwood and traditional energy sub-sector policy established and initial action taken. No OVI.
* This is a big sector in Sudan. With the 10 papers, 2 reviews, and 1 plan/year also due, this is possibly an excessively high goal.
10. Expanded use of appropriate energy-efficient equipment promoted. One study.
* A study has no clear relationship to expanded use of equipment.

11. Energy information needs to be prioritized and strategies implemented. One policy study and "100 publications acquired/developed distributed in quantity".
 - * Unclear.
12. Twenty reports on case studies of successful energy-efficiency operating experiences prepared and findings disseminated.
 - * Twenty sounds excessive.

Means of Verification

1. NEA records and accounts.
 - * OK.
2. Project records and evaluations.
 - * OK.
3. Review of NEA studies.
 - * OK
4. MEM and AID records.
 - * OK.
5. Project evaluation.
 - * Redundant with 2.
6. Contractor records.
 - * OK.
7. Observations.
 - * OK.

Important Assumptions: Assumptions for Achieving Outputs

1. Commercial users desire to improve energy efficiency.
 - * Without price assumptions, they may have no desire to improve energy efficiency.
2. Cooperation of GPC, NEC, and private sector is providing suitable information to NEA.
 - * Experience should suggest that developing country agencies often do not want to give information to one another.
3. Cooperation of public with NEA analysis.
 - * OK.
4. Demand for electricity generation from BNG remain constant or grows proportionally to capacity of BNG.
 - * This assumes away the common - really universal - problem found by electrifying developing countries: demand mushrooms.

5. NEC management endorses reorganization and adjusts functional duties among the several departments.
 - * Reasonable, but ignores the fact that the Director General could - and did - leave crucial posts vacant.
6. Private sector marketing companies assist GPC in data area and work with GPC for mutual benefit.
 - * Absolutely crazy.
7. Public and private professional skills are effectively tapped.
 - * Silly. Underdevelopment has two principal roots: insufficient skills and inability to unleash those that do exist.

B. NEC

Outputs, OVIs, and Means of Verification

1. New organizational structures and management procedures developed and implemented. No OVI. Verification: management structure diagram and corporate policies handbook.
 - * Output ok. Verification is inadequate. Does not address implementation.
2. Maintenance procedures reviewed. No OVI. Verification: maintenance schedules.
 - * Verification is inadequate. An OVI should have been equipment operation records - downtime, scrappage rates, etc.
3. Purchasing and stores procedures reviewed. No OVI. Verification: Purchasing and stores documents.
 - * Verification seems ok. Should have had an OVI such as inventory levels.
4. Planning and budgeting procedures and techniques reviewed. No OVI. Verification: Planning documents and budgeting systems.
 - * No account taken of implementation.
5. Financial controls system and billing procedures reviewed. Improve collection 25% by year 3 and 60% by year 4. Verification: financial control systems and accounts receivable reports.
 - * OK.
6. Energy efficiency and load management programs reviewed. No OVI. Verification: Energy efficiency and load management programs.
 - * Verification is vague.
7. Tariffs reviewed for NEC and regional governments. No OVI. Verification: revised tariff schedules.
 - * OK.

C. GPC

Outputs, OVIs and Means of Verification

1. Flexible oil products allocation designed. OVI: 1 system.
Verification: operational and financial records.
* Does not emphasize price-driven allocation system. The OVI is vague and the means of verification does not appear to match the OVI.
2. Improved distribution scheduling systems designed. OVI: 1 system. Verification: review of reports.
* OK.
3. Reduction in oil and refined products purchase costs. OVI: Average savings of 20 cents per barrel. Verification: contractor records and project evaluation.
* OK.
4. Improved financial management systems. No OVI. No means of verification.
* No specification is given for this indicator.

IV. PROJECT INPUTS

Inputs

1. Technical assistance.
* OK
2. Training
* OK.
3. Commodities.
* OK.
4. Local currency.
* OK.

No OVIs

Means of Verification

1. Technical assistance contract documents.
* OK.
2. Training schedule and plans.
* OK.
3. AID internal reports.
* OK.
4. Interim reports from contractor.
* OK.
5. GOS budget documents.
* OK.

Important Assumptions

1. Necessary GOS support is provided to the project.
* Vague.
2. AID funding is available on a timely basis through term of project.
* This implies that the project success is vulnerable to funding delays, i.e., that success hinges on a smooth flow of funding by AID rather than just finally getting the funds through the system.

APPENDIX 6

Status of Sudan General Petroleum Corporation as an Institution

Although the EPM project as originally planned called for the provision of technical assistance to the General Petroleum Corporation (GPC) in a number of areas, these activities were never funded due to a decision by Mission Director Brown in late 1983. Nevertheless, we wish to briefly review the current status of GPC as an institution so that USAID or other donors can make informed decisions about possible future project support.

The technical assistance planned for GPC was to mainly consist of activities which would "improve its capacity to make corporate planning decisions and to develop and implement planning and management strategies." Although the GPC activities were only to consume 6.4 percent of EPM project funds, they were extremely important given GPC's predominant role in Sudan's petroleum sector. The technical assistance was to cover: analysis of Sudan's petroleum products distribution system; review of procedures for procurement, importation and distribution of crude oil and refined oil products; development of improved financial terms and financing packages for crude oil purchases, development of improved techniques for management, financial controls, and strategic planning; training of GPC staff; and supply of computer hardware and software to GPC.

GPC was established in 1980 as an autonomous public corporation reporting to the Ministry of Energy and Mines with specific responsibilities for the procurement of crude oil and petroleum products, refining and shipping of petroleum products from Port Sudan to Khartoum, coordinating activities of the four oil marketing companies active in Sudan, and monitoring of the exploration and development activities of private oil companies. The separate Geological and Mineral Resources Department (GMRD) of the Ministry of Energy and Mines is responsible for entering into exploration and production-sharing contracts for oil and natural gas with private companies. The present organization of GPC is shown in the attached figure.

In addition to the planned USAID technical assistance, GPC has been the recipient of several other forms of technical assistance in recent years. Stone and Webster provided advisory services in financial systems and accounting from 1982 to 1985. Beginning in 1984, the World Bank provided a loan in the amount of \$12 million to GPC and GMRD to assist in the promotion of oil and gas exploration in Sudan, to provide technical assistance and training to GPC, and to fund an organization and management study and other specific oil and gas studies carried out by Robertson Research Associates (U.K.). More recently, the Sudan Academy of Administration has carried out the reorganization of GPC as shown in Fig. A.6.1.

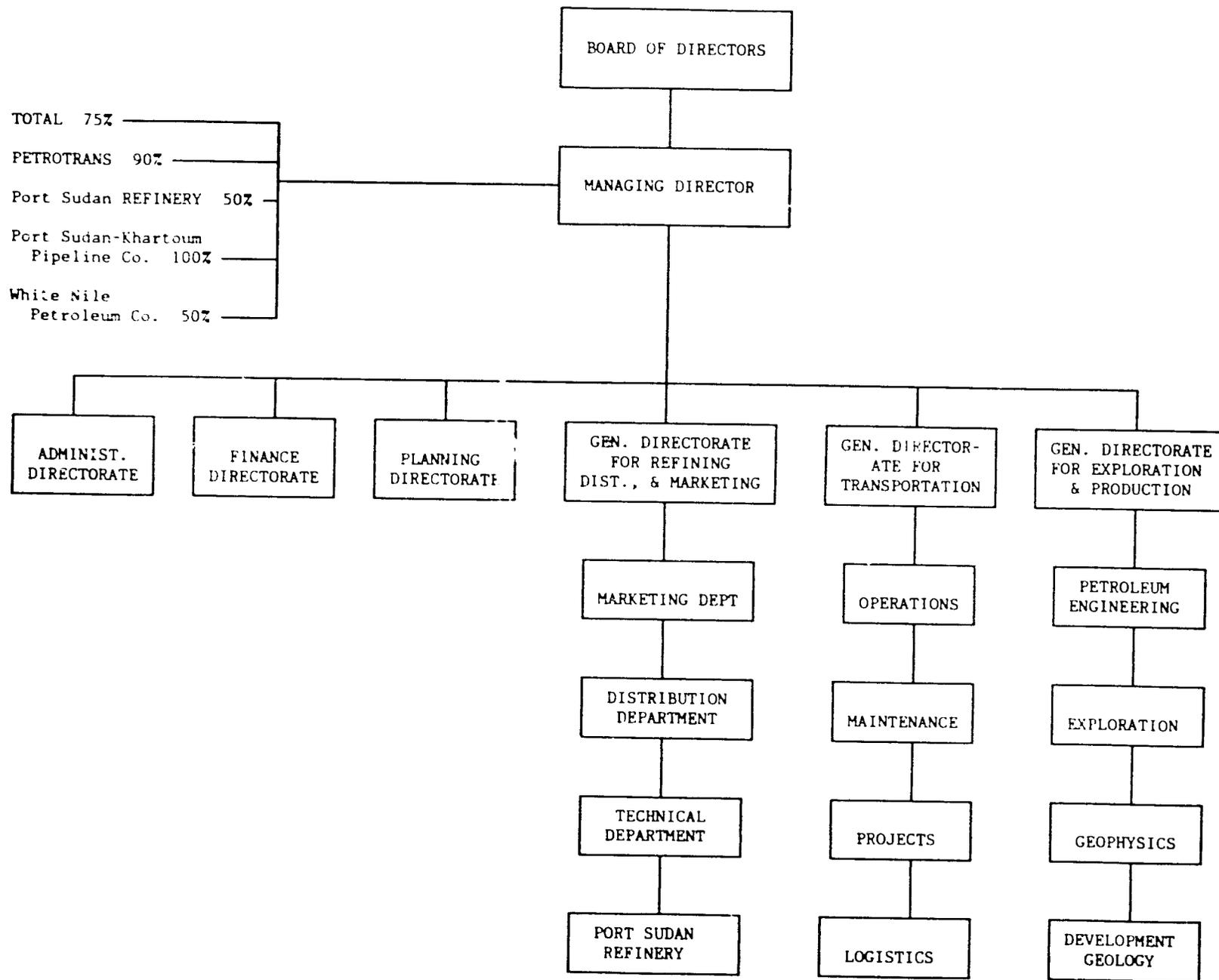


FIG. A.6.1. PRESENT ORGANIZATION OF GPC

GPC was also the beneficiary between 1984 and 1987 of \$10 million of CIP funds, out of an originally planned \$40 million total, contained in a special petroleum import facility. While the three years financing facility was never as successful as originally planned, it did contribute to lowering Sudan's financial burden for crude oil importation and achieving more favorable rates for crude purchases.

Based on a series of meetings with the GPC Managing Director, and key senior management officers, a limited assessment of GPC's institutional status is made. In general, GPC's current operations are vastly improved over those of three to five years ago. A new organization has been put in place and sweeping improvements have been made in GPC's management and staffing functions. The aging Port Sudan refinery, which is jointly operated with Royal Dutch Shell, has been thoroughly studied and a computer is being installed that will help GPC to optimize product imports in conjunction with refinery runs. Further study is planned of possible expansion and modernization of the refinery to add an asphalt/bitumen plant if it is economically feasible.

Operations of the Port Sudan-Khartoum Pipeline Company are being rationalized to increase the amount of refined products moved via the line from 50 percent to nearly 100 percent of capacity. Product distribution by its Petrotrans (90 percent GPC owned) subsidiary, block train shipments via the Sudan National Railway and shipments by private trucking companies are now being made on the basis of efficiency and economic comparisons. In addition to rationalizing modes of transport, and optimizing crude and product imports and refinery runs, GPC is seeking to take firm control of the long-standing but inefficient and corrupt product allocation system.

GPC instituted a new allocation and distribution system in 1985 which set up an open funding system for crude oil and product purchases. A committee is currently working to make further recommendations to reform the allocation system. It is instituting changes in coordination with the four major oil companies and provincial governments to ensure that minimum supplies of products are actually delivered to remote consumption centers rather than leaving this to private sector traders. It is also revising company margins to include dealers' managers in an effort to remove incentives for price-fixing. A national oil pricing committee has also been established with representatives from all major government agencies, major customers, transport and oil companies, and GPC staff to consider new pricing arrangements.

GPC's Planning, Finance, and Administration Directorates have instituted many operational improvements but are still in need of assistance regarding improved management information systems and financial accounting systems. There are still significant needs for computerization of many functions, although payroll systems were recently computerized. Training is also needed throughout GPC. The Exploration and Production Directorate also needs more training and computerization as well as equipment of various types. It still needs to undertake studies to better establish the geology of remote areas of Sudan as well

as assembly of petroleum exploration production packages. Also needed are exploration equipment and vehicles, remote communication systems, and navigation systems for precise positioning.

APPENDIX 7

Chronology of EPM

1977	Ministry of Energy and Mining Created
August 1982	Project Paper for EPM approved; Project Agreement between GOS and USAID signed
September 1983	PP Supplement approved
March 1984	E/DI COP arrives
July 1984	Harza COP arrives
April 1985	Nimiri overthrown, transitional military government in place
March 1986	New government elected
April 1986	All Americans evacuated from Sudan
August - October 1986	AID and Contractor personnel return to Sudan
January 1987	Mid-Term Evaluation begins

APPENDIX 8

NEA Chronology

May 1980	NEA created
August 1980	Agreement between MEM and USAID to initiate S&T/EY SEPAP
November 1980	PIO/T for Limited Scope Project Agreement
January 1981	SEPAP begins an 18-month project with ISTI/EDI contractor selection
August 1982	PP for EPM approved; Project Agreement signed
September 1982	National Energy Assessment completed under SEPAP
July 1983	Expiration of SEPAP as centrally-funded vehicle
September 1983	PP Supplement to extend SEPAP from August 1983 to January 1984, using EPM funds
March 1984	SEPAP evaluation conducted
April 1984	EPM contractor E/DI begins work
June 1984	GPC project component suspended
February 1985	E/DI COP departs
April 1985	Nimieri government overthrown, interim government installed
October 1985	New E/DI COP arrives
March 1986	New government elected
April 1986	U.S. project personnel evacuated
October 1986	U.S. project personnel resume activities

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